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PROPOSAL: AP Computer Science Essentials - JAVA.

TARGET AUDIENCE: Students interested in programming languages beyond Visual Basic. Grades 10-12

PURPOSE: Students enrolled in this course will become familiar with and gain proficiency in programming and problem solving as typically found in a Computer Science 1 course at an undergraduate level.

EXPENDITURES: Course materials and supplies will be purchased through vocational funds.

INDIVIDUALS TEACHING THE COURSE: Jeremy Willig

COURSE PREREQUISITE: Student must be grade 10-12. The course is the application course for the Programming strand of the career cluster pathway.

COURSE DESCRIPTION: Students enrolled in AP Computer Science Essentials – JAVA will be introduced to six major aspects of computing, including programming basics, object-oriented programming, data and information processing, software development life cycle, graphical user interfaces and event-driving programming and web basics. The A-level Advanced Placement Java topics test is required.

SCHEDULE/MEETING TIMES: AP Computer Science Essentials – JAVA is a year-long course and will fit within Campus High Schools block schedule.

Course	AP Computer Science Essentials - JAVA
Course Length	1 Year (1 Credit)
Prerequisites	Grades 10 – 12. Basic Programming
Textbooks, practice sets, and other published materials	Textbooks: Lamert, K.A., & Osborne, M. (2011). *Fundamentals of Java: AP Computer Science Essentials.* Boston: Course Technology, Cengage Learning.
Software	Windows 7: 64 bit, Microsoft Office 2010, Microsoft Visual Studio 2010 Professional
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Method of Teaching	Lecture, demonstration, hands-on projects and documents, quizzes, and tests
Pre-Test & Post-Test	Vocabulary competency
Grading Method	Daily Assignments, hands-on projects and documents, quizzes, and tests
Integration of Academics	These students will perform advanced mathematical calculations that would be found in business today. Instruction will include the use of the SQ3R method of reading comprehension that is a part of all school courses.

I. Getting Started With Java
   a. Background
      i. History of Computers
      ii. Computer Hardware and Software
      iii. Binary Representation of Information and Computer Memory
      iv. Programming Languages
      v. The Software Development Process
      vi. Basic Concepts of Object-Oriented Programming
   b. First Java Programs
      i. Why Java?
      ii. The Java Virtual Machine and Byte Code
      iii. Choosing a User Interface Style
      iv. Hello World
      v. Edit, Compile, and Execute
      vi. Temperature Conversion
      vii. Graphics and GUIs: Windows and Panels
   c. Syntax, Errors, and Debugging
      i. Language Elements

x. Design, Testing, and Debugging Hints

c. Improving the User Interface
   i. A Thermometer Class
   ii. Repeating Sets of Inputs
   iii. A Menu-Driven Conversion Program
   iv. Formatted Output with printf and format
   v. Handling Number Format Exceptions During Input
   vi. Graphics and GUIs

d. Introduction to HTML and Applets
   i. Hypertext, Hypermedia, and the World Wide Web
   ii. Overview of the Hypertext Markup Language
   iii. Simple Text Elements
   iv. Character-Level Formatting
   v. Lists
   vi. Linking to Other Documents
   vii. Multimedia
   viii. Tables
   ix. Applets

III. Arrays and Classes

a. Introduction to Arrays
   i. Conceptual Overview
   ii. Simple Array Manipulations
   iii. Looping Through Arrays
   iv. Declaring Arrays
   v. Working with Arrays That Are Not Full
   vi. Parallel Arrays
   vii. Using the Enhanced for Loop
   viii. Arrays and Methods
   ix. Arrays of Objects
   x. Graphics and GUIs: Changing the View of Student Test Scores

b. Classes Continued
   i. Class (static) Variables and Methods
   ii. Turtle Graphics
   iii. Java Interfaces – The Client Perspective
   iv. Java Interfaces – The Implementation Perspective
   v. Code Reuse Through Inheritance
   vi. Working with Arrays of Objects
   vii. Inheritance and Abstract Classes
   viii. Some Observations About Interfaces, Inheritance, and Relationships Among Classes
   ix. Acceptable Classes for Parameters and Return Values
   x. Error Handling with Classes

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      vii. Graphics and GUIs: Windows and Panels
   c. Syntax, Errors, and Debugging
      i. Language Elements
      ii. Basic Java Syntax and Semantics
      iii. Terminal I/O for Different Data Types
      iv. Comments
      v. Programming Errors
      vi. Debugging
      vii. Graphics and GUIs: Drawing Shapes and Text
   d. Introduction to Control Statements
      i. Additional Operators
      ii. Standard Classes and Methods
      iii. A Visit to the Farm
      iv. The if and if-else Statements
      v. The while Statement
      vi. The for Statement
      vii. Nested Control Statements and the break Statement
      viii. Using Loops with Text Files
      ix. Errors in Loops
      x. Graphics and GUIs: I/O Dialog Boxes and Loops
      xi. Design, Testing, and Debugging Hints
   e. Using Classes and Objects in Media Computing
      i. Introduction to Digital Image Processing
      ii. The images Package
      iii. Image-Processing Algorithms
      iv. Introduction to Digital Sound Processing
      v. The sounds Package

v. Working with Arrays That Are Not Full
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viii. Some Observations About Interfaces, Inheritance, and Relationships Among Classes
ix. Acceptable Classes for Parameters and Return Values
x. Error Handling with Classes
xi. Exceptions
xii. Reference Types, Equality, and Object Identity
xiii. Graphics and GUIs: Drawing Multiple Shapes

c. Arrays Continued
i. Searching
ii. Sorting
iii. Insertions and Removals
iv. Two-Dimensional Arrays
v. Applications of Two-Dimensional Arrays
vi. Graphics and GUIs: Menus

IV. Advanced Topics

a. Recursion, Complexity, and Searching and Sorting
i. Recursion
ii. Complexity Analysis
iii. Binary Search
iv. Quicksort
v. Merge Sort
vi. Graphics and GUIs: Drawing Recursive Patterns

b. Introduction to Collections
i. Overview of Collections
ii. Java Collection Resources
iii. Using Lists
iv. Using Stacks
v. Using Queues

AP Computer Science Essentials - Java

A. Brief Explanation and Purpose of the Proposed Initiative

a. Students enrolled in AP Computer Science Essentials – JAVA will be introduced to six major aspects of computing, including programming basics, object-oriented programming, data and information processing, software development life cycle, graphical user interfaces and event-driving programming and web basics. The A-level Advanced Placement Java topics test is required.

B. Justified Need:

a. Use of technology to accelerate improvement and performance
b. Integrated use of vocational and academic skills to increase student achievement and performance
c. Measurement of Objectives will include, but not limited to, student performance on daily assignments, hands-on projects, quizzes, tests, overall performance, and project based.

C. Outline of parties involved with the program

a. Jeremy Willig
b. Grades 10 - 12
c. Prerequisite: Basic Programming
d. Week by Week Calendar
   i. Week 1: Background
   ii. Week 2: First Java Programs
   iii. Week 3: Syntax, Errors, and Debugging
   iv. Week 4: Introduction to Control Statements
   v. Week 5: Using Classes and Objects in Media Computting
   vi. Week 6: Introduction to Defining Classes
   vii. Week 7: Control Statements Continued
   viii. Week 8: Improving the User Interface
   ix. Week 9: Introduction to HTML and Applets
   x. Week 10: Introduction to Arrays
   xi. Weeks 11: Classes Continued
   xii. Weeks 12 – 13: Arrays Continued
   xiii. Weeks 14 – 15: Recursion, Complexity, and Searching and Sorting
   xiv. Week 16: Introduction to Collections
   xv. Weeks 17 – 18: Multithreading, Networks, and Client/Server Programming

D. Curriculum Resources

a. Textbooks
   i. Lambert, K.A., & Osborne, M. (2011). *Fundamentals of Java: AP Computer Science Essentials.* Boston: Course Technology, Cengage Learning.

E. Materials

a. AP Testing Materials
b. Course Costs
   i. None

F. Training Necessary

a. Instructor will attend workshops sponsored by KBEA and other service vendors.

G. Budget and Funding Resources

a. This course will be submitted for Vocational Funding
b. Additional funding resources will come from business department funds

H. Research Base for the suggested program

a. Kansas Career Pipeline
b. Teaching the student to showcase themselves and their skills in a digital age

I. Evaluation process

a. Pre-Test

Kansas Information Technology Career Cluster **Programming & Software Development Pathway** **10157 AP Computer Science A**

Name _____ ID _____

Instructor Willig School Year _____

Enrollment Date ___/___/___ Completion Date ___/___/___ Credits Completed _____

I certify that the student received the training in the area indicated.

Student Signature _____ Date _____

Instructor Signature _____ Date _____

Competencies _____/39

RATING SCALE:
3: Skilled, works independently
2: Competent, may need assistance
1: Received instruction, skill undeveloped
0: No exposure, instruction or training

Measured Competencies listed should be seen as minimums (you can add)

I. AP Computer Science A

3 2 1 0 **1. Object-Oriented Program Design**

a. **Program design**
- Read and understand a problem description, purpose, and goals.
- Apply data abstraction and encapsulation.
- Read and understand class specifications and relationships among the classes "is-a," "has-a" relationships).
- Understand and implement a given class hierarchy.
- Identify reusable components from existing code using classes and class libraries.

b. **Class design**
- Design and implement a class.
- Choose appropriate data representation and algorithms.
- Apply functional decomposition.
- Extend a given class using inheritance.

3 2 1 0 **2. Program Implementation**

a. **Implementation techniques**
- Methodology
  - Object-oriented development
  - Top-down development
  - Encapsulation and information hiding
  - Procedural abstraction

b. **Programming constructs**
- Primitive types vs. objects
- Declaration
  - Constant declarations
  - Variable declarations
  - Class declarations
  - Interface declarations
  - Method declarations
  - Parameter declarations
- Console output (System.out.print/println)
- Control
  - Methods
  - Sequential
  - Conditional
  - Iteration
  - Understand and evaluate recursive methods

c. **Java library classes (included in the AP Java subset)**

3 2 1 0 **3. Program Analysis**

a. **Testing**
- Test classes and libraries in isolation.
- Identify boundary cases and generate appropriate test data.
- Perform integration testing.

b. **Debugging**
- Categorize errors: compile-time, run-time, logic.
- Identify and correct errors.
- Employ techniques such as using a debugger, adding extra output statements, or hand-tracing code.

c. **Understand and modify existing code**

d. **Extend existing code using inheritance**

e. **Understand error handling**
- Understand runtime exceptions.

f. **Reason about programs**
- Pre- and post-conditions
- Assertions

g. **Analysis of algorithms**
- Informal comparisons of running times
- Exact calculation of statement execution counts

h. **Numerical representations and limits**
- Representations of numbers in different bases
- Limitations of finite representations (e.g., integer bounds, imprecision of floating-point representations and round-off error)

3 2 1 0 **4. Standard Data Structures**

a. Simple data types (int, boolean, double)

b. Classes

c. Lists

d. Arrays

3 2 1 0 **5. Standard Algorithms**

a. **Operations on data structures previously listed**
- Traversals
- Insertions
- Deletions

b. **Searching**
- Sequential
- Binary

c. **Sorting**
- Selection
- Insertion
- Mergesort

Kansas Information Technology Career Cluster

3 2 1 0 **6. . Computing in Context**
- **a. System reliability**
- **b. Privacy**
- **c. Legal issues and intellectual property**
- **d. Social and ethical ramifications of computer use**

Foundation & 21st Century Competencies

lowercase letters are indicators to be considered)

II. Pathway Foundation
Problem Solving and Critical Thinking

3 2 1 0 **1. Demonstrate knowledge of the process required to evaluate and verify the nature of a problem.**
- a. Demonstrate knowledge of the underlying concepts of the information systems discipline.
- b. Demonstrate knowledge of methods for achieving productivity in knowledge work.
- c. Apply general systems theory to the analysis and development of an information system.
- d. Identify procedures for formal problem- solving.
- e. Demonstrate knowledge of the fundamental concept of information theory and organizational system processes.
- f. Identify the essential properties of information systems.

3 2 1 0 **2. Demonstrate knowledge of the process required to solve a problem.**
- a. Demonstrate knowledge of problem-solving steps and techniques.
- b. Summarize application planning, development, and risk management for information system.
- c. Identify potential problems in system implementation.
- d. Demonstrate knowledge of the information analysis process.
- e. Demonstrate knowledge of information technology solutions.

III. Cluster Foundation
Employability and Career Development

3 2 1 0 **1. Demonstrate ability to evaluate and compare employment opportunities and accept employment.**
- a. Identify job advantages and disadvantages.
- b. Compare job benefits to individual needs.
- c. Compare job opportunities and responsibilities to career plan.
- d. Make decision to accept or reject employment.
- e. Write acceptance or rejection letter without error.
- f. Complete employment forms upon acceptance.

3 2 1 0 **2. Demonstrate ability to seek and apply for employment.**
- a. Identify resources for finding employment.
- b. Analyze resources to determine those that are most appropriate for desired career.
- c. Compare job requirements with personal qualifications, interests, and aptitudes.
- d. Select job that matches personal qualifications, interests, and aptitudes.
- e. Identify prospective employer's submission requirements.
- f. Gather information and prepare rough draft of resume.
- g. Put resume in proper format.
- h. Write letter of application for specific job opening in correct format, without error.
- i. Gather information for application.
- j. Complete all questions on application with appropriate and honest answers.
- k. Sign and date application.
- l. Attach any supporting material required or requested.
- m. Submit full application package to employers.
- n. Dress appropriately for interview.
- o. Exhibit professional conduct before, during and after interview.
- p. Explain your qualifications and interests clearly and concisely.
- q. Answer all questions honestly and concisely.
- r. Write follow-up letter after the interview.

3 2 1 0 **3. Demonstrate knowledge of career development/progression patterns in the IT industry.**
- a. Identify education and training requirements for IT career pathways.
- b. Identify professional organizations in the area of information technology.
- c. Identify benefits derived from membership in specific professional organizations.

3 2 1 0 **4. Demonstrate knowledge of the relationship between lifelong learning and IT career development.**
- a. Identify present and future IT employment opportunities.
- b. Demonstrate knowledge of the potential impact of IT on future society.
- c. Identify the importance of lifelong learning in the IT field.
- d. Identify certification and/or degree requirements.
- e. Identify required knowledge and skills for career ladder.
- f. Research educational and training opportunities.
- g. Identify present and future IT education and training opportunities.
- h. Design a lifelong learning plan that ties in with career advancement plan.

3 2 1 0 **5. Develop a personal career plan to meet career goals and objectives.**
- a. Identify career that matches individual interests and aptitudes.
- b. Develop career goal with time frame.
- c. Identify goals and objectives for reaching and advancing in career.
- d. Write a list of strategies for achieving educational

Programming & Software Development Pathway

10157 AP Computer Science A

requirements.
- e. Identify strategies for obtaining employment experiences.
- f. Write a time line for achieving career goals and objectives.
- g. List alternatives and potential changes.

3 2 1 0 **6. Explain written organizational policies, rules and procedures to help employees perform their jobs.**
- a. Identify the contents of various organizational publications.
- b. Determine the appropriate document(s) for specific job responsibilities and work assignments.
- c. Locate and identify specific organizational policy, rule or procedure to assist with a given situation.
- d. Articulate how a specific organizational policy, rule or procedure will improve a given situation.

3 2 1 0 **7. Identify and demonstrate positive work behaviors and personal qualities.**
- a. Demonstrate regular attendance.
- b. Follow company dress and appearance standards.
- c. Exhibit pride in work.
- d. Demonstrate leadership and teamwork.
- e. Exhibit ability to handle stress.
- f. Display initiative and open-mindedness.
- g. Participate in company orientation and training programs with enthusiasm.
- h. Identify progressive strategies that will impact efficiency of job.
- i. Follow established rules, regulations and policies.
- j. Explain employer/management responsibilities.
- k. Demonstrate cost effectiveness.
- l. Demonstrate time management.
- m. Complete all tasks thoroughly.

3 2 1 0 **8. Identify and explore career opportunities in one or more career pathways.**
- a. Locate and interpret career information for at least one career cluster.
- b. Identify job requirements for three career pathways.
- c. Identify educational and credentialing requirements for three careers.
- d. Identify personal interests and aptitudes.
- e. Identify job requirements and characteristics of selected careers.
- f. Compare personal interests and aptitudes with job requirements and characteristics.
- g. Modify career goals based on results of personal interests and aptitudes with career requirements and characteristics.

3 2 1 0 **9. Provide examples of how IT is transforming business in various industries.**
- a. Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions.
- b. Demonstrate knowledge of the impact of computers on

career pathways in business/industry (e.g., how computers have eliminated and created jobs).

c. Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide.

d. Demonstrate knowledge of ethical issues that have surfaced in the information age.

Ethics and Legal Responsibilities

3 2 1 0 1. Demonstrate appropriate knowledge and behaviors of legal responsibilities and of positive cyber-citizenry.

a. Demonstrate knowledge of the legal issues that face information technology professionals.

b. Identify issues and trends affecting computers and information privacy.

3 2 1 0 2. Demonstrate knowledge of social, ethical, and legal issues in the information technology field.

a. Analyze the social implications of decisions made and actions taken as an information technology professional.

b. Demonstrate knowledge of the ethical issues that face information technology professionals.

c. Determine the practical implications of lawsuits in terms of good will, client relations, the bottom line, diversion of company resources, cash flow and accounts receivable.

d. Demonstrate knowledge of basic business law concepts.

3 2 1 0 3. Demonstrate knowledge of the rights and responsibilities of IT workers.

a. Identify generally accepted business ethics.

b. Demonstrate knowledge of federal laws governing discrimination and harassment.

c. Demonstrate knowledge of key concepts related to employment discrimination.

d. Demonstrate sensitivity to diversity, including differences in gender, culture, race, language, physical and mental challenges, and family structures.

e. Establish procedures for maintaining the confidentiality of client information.

Leadership and Teamwork

3 2 1 0 1. Build interpersonal skills with individuals and other team members.

a. Analyze the interdependence of empathetic listening, synergy, and consensus building.

b. Define roles within the group decision-making process.

c. Demonstrate knowledge of how to apply team methods to empower coworkers.

d. Apply knowledge of group dynamics.

e. Promote teamwork, leadership, and empowerment.

f. Identify strategies for fostering creativity.

3 2 1 0 2. Demonstrate knowledge of the skills needed for leadership in the IT environment.

a. Demonstrate knowledge of how to apply team methods to empower coworkers.

b. Establish goals and objectives for IS.

c. Define mission and critical success factors.

d. Identify desired group and team behavior in an IS context.

Safety, Health, and Environmental

3 2 1 0 1. Maintain a safe working environment.

a. Demonstrate knowledge of the relationship between health, safety, and productivity.

b. Identify health and safety standards established by government agencies.

c. Access needed safety information using company and manufacturers' references (e.g., procedural manuals, documentation, standards,

d. and flowcharts).

e. Ensure maintenance of a clean work area.

f. Solve safety problems using problem-solving, decision-making, and critical thinking strategies.

g. Demonstrate knowledge of ergonomics and repetitive strain injury.

Systems

3 2 1 0 1. Demonstrate knowledge of the nature of IT in business.

a. Determine how business activities interface with data processing functions.

b. Differentiate between the role of information systems within a company and their role in a global environment.

c. Measure increases in productivity realized by the implementation of information systems.

3 2 1 0 2. Demonstrate knowledge of the operation of cross-functional teams in achieving project goals.

a. Consider the benefits of using a cross-functional team in policy and procedure development.

b. Identify desired group and team behavior in an IS context.

3 2 1 0 3. Explain/discuss general strategies for maximizing organizational learning and productivity in a high tech environment.

a. Assess the importance of new technologies to future developments and to the future knowledge worker productivity.

b. Demonstrate knowledge of methods for achieving productivity in knowledge work.

c. Create/maintain an environment supportive of productivity.

IV. Academic Foundations

Language Arts Courses

3 2 1 0 1. Demonstrate language arts knowledge and skills required to pursue the full-range of career and post-secondary education opportunities within the IT career cluster.

a. Listen actively.

b. Adapt language (diction/structure, style) for audience, purpose, situation.

c. Collect/organize oral and written information.

d. Compose/edit (agenda, audio-visuals, bibliographies, drafts, forms/documents, notes, oral presentations, reports, technical terminology).

e. Comprehend oral and written information (cause/effect, comparisons/contrasts, conclusions, context, purpose, charts/tables/graphs, evaluation/critiques, mood, persuasive text, sequence, summaries, technical matter).

f. Evaluate oral and written information (accuracy, adequacy/sufficiency, appropriateness, clarity, conclusions/solutions, fact/opinion, propaganda, relevancy, validity, relationship of ideas).

g. Identify oral and written assumptions, purpose, outcomes/solutions, and propaganda techniques.

h. Predict outcomes/solutions from oral and written information trends.

i. Present formal and informal speech for the purposes of discussion, supplying/requesting information, interpretation, and persuasion.

j. Use library, text and Internet resources.

Communications Courses

3 2 1 0 2. Apply active listening skills to obtain and clarify information.

a. Determine familiarity of discussion.

b. Respond accordingly using appropriate verbal and nonverbal language.

c. Explain the message given in your own words.

d. Ask questions to seek or confirm understanding.

e. Paraphrase and/or repeat information.

f. Record and summarize information in written notes.

g. Follow directions and/or respond in a positive way with clear, concise comments.

3 2 1 0 2. Build customer relations.

a. Identify organizations' products and services (including own strengths as a sales agent).

b. Recognize the importance of all customers to the business.

c. Determine customers' individual needs.

d. Project a professional business image (e.g., appearance, voice, grammar, word usage, enunciation, nonverbal communication).

e. Interact with customers and colleagues in a professional (e.g., prompt, friendly, courteous, respectful, helpful, knowledgeable, and understandable) manner.

f. Comply with established business protocols and company policies.

g. Communicate company policies to customers.

h. Handle merchandise returns in accordance with customer service policy.

i. Handle customer complaints in accordance with customer

service policy.
j. Facilitate customer service through the maintenance of key information systems.
k. Follow through on commitments made to customers (e.g., special orders, delivery specifications, new items).

3 2 1 0 **3. Comprehend and use reading strategies to learn meaning, technical concepts, vocabulary, and follow instructions.**
a. Use reading strategy to achieve intended purpose.
b. Identify purpose of text.
c. Identify complexity of text.
d. Explain purpose of text.
e. Determine relevance, accuracy and appropriateness to purpose.
f. Identify complexities and discrepancies in information.
g. Analyze information presented in a variety of formats, such as tables, lists, figures.
h. Identify key technical concepts and vocabulary.
i. Follow all instructions as specifically given.
j. Explain meaning of new terms, vocabulary and concepts.
k. Interpret technical materials used.
l. Summarize overall meaning of text.
m. Write specific steps for applying information to task or new situation.
n. Write set of directions for others sharing information learned and applying that to task or new situation.

3 2 1 0 **4. Conduct meetings.**
a. Plan meeting.
b. Set agenda.
c. Schedule meeting.
d. Reserve meeting room.
e. Invite appropriate personnel.
f. Identify need for outside speakers.
g. Assign someone to take minutes.
h. Make introductions.
i. Invite questions, comments, and group participation.
j. Determine appropriate action, time frame, and person accountable for identified tasks.
k. Monitor time.
l. Publish minutes in timely manner.

3 2 1 0 **5. Demonstrate sensitivity in communicating with a diverse workforce.**
a. Identify factors (e.g., culture, ethnicity, equity, special/exceptional needs) that impact communication.
b. Identify strategies for successful communication with a diverse workforce.
c. Determine communication style appropriate for listener(s).
d. Bridge communication styles.
e. Establish guidelines for dealing with conflict.

3 2 1 0 **6. Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.**
a. Know subject matter well enough to be independent of written aids.
b. Identify characteristics of the audience and adjust to their ability to understand.
c. Use technical terms and concepts correctly.
d. Use proper organization and structure to achieve coherence of major points.
e. Identify media and visual aids appropriate to understanding of topic.
f. Prepare visual aids and support materials for easy viewing and without error.
g. Smoothly and efficiently operate any equipment used with support.
h. Deliver presentation without grammatical error.
i. Speak clearly with appropriate volume, rate and gestures while making and maintaining appropriate eye contact.
j. Use support materials in the presentation that enhance the understanding of the topic and the interest level of the audience.
k. Stay within presentation time parameters.
l. Evaluate listeners' interest and receptiveness.
m. Use verbal and nonverbal feedback strategies to engage discussion and adjust message and delivery.
n. Respond to questions and comments.

3 2 1 0 **7. Interpret and use tables, charts, and figures to support written and oral communications.**
a. Compile facts and arrange in an organized manner for a table, chart or figure.
b. Document sources of data.
c. Determine most appropriate way to display data for effective coherence.
d. Prepare table, chart, graph or figure for inclusion in publication or presentation.
e. Evaluate reference or source of data for authenticity and reliability.
f. Explain information presented in tables, charts and figures.
g. Prepare written summary of findings expressed in tables, charts and figures.

3 2 1 0 **8. Interpret verbal and nonverbal behaviors to enhance communication with co-workers and clients/participants.**
a. Identify verbal cues.
b. Observe voice speed, voice quality and tone.
c. Explain message conveyed by verbal behaviors.
d. Identify nonverbal cues.
e. Observe eye contact, facial expressions, posture, gestures and other body language.
f. Explain message conveyed by nonverbal behaviors.

3 2 1 0 **9. Locate, organize and reference written information from various sources to communicate with co- workers and clients/participants.**
a. Identify topic.
b. Conduct search of information using card catalog, keywords, and/or search engines.
c. Locate variety of resources such as books, journals, and magazines.
d. Locate information from electronic forms including the Internet.
e. Organize resources to use key information.
f. Read and take notes from selected resources.
g. Prepare outline that emphasizes major points with supporting data.
h. Present information in organized, easy-to-follow manner.
i. Prepare working bibliography according to MLA, APA, CBE, or Chicago, depending on the warranted language style.
j. Prepare a bibliography according to MLA, APA, CBE, or Chicago, depending on the warranted language style.
k. Use parenthetical, footnotes and endnotes text citations accurately.
l. Follow plagiarism and copyright rules and regulations.

3 2 1 0 **10. Use correct grammar, punctuation and terminology to write and edit documents.**
a. Organize and arrange information for effective coherence.
b. Report relevant information in order of occurrence.
c. Interpret information, data, and observations correctly.
d. Present main ideas and supporting facts.
e. Use technical terms and concepts.
f. Incorporate and use references effectively and accurately.
g. Report objective and/or subjective information.
h. Use correct grammar and sentence structure.
i. Use correct spelling.
j. Use correct punctuation and capitalization.
k. Use word processing software to develop text, charts, graphs or figures correctly.
l. Use presentation software to prepare visual support materials.
m. Format written documents with correct font and layout for easy reading.

Mathematics Courses

3 2 1 0 **1. Demonstrate mathematics knowledge and skills required to pursue the full range of career and post-secondary education opportunities within the IT career cluster.**
a. Identify whole numbers, decimals, fractions, complex numbers, polynomials, and geometrical figures.
b. Apply basic arithmetic (addition, subtraction, multiplication, and division) operations.
c. Apply relational (equal, not equal, greater than, less than, etc.) and logical operators in a logical expression.
d. Understand the relationship of data and measurements to the problem.
e. Produce mathematical formulae, expressions, and/or sequence of solution steps from problem statements.
f. Analyze problem statements for missing/irrelevant data,

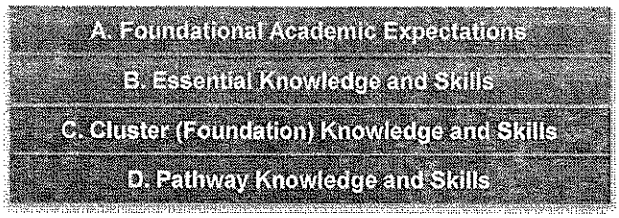
estimate/exact values, inconsistent parameters.
g. Construct charts/tables/graphs from functions and data.
h. Describe problem-solving techniques (e.g., successive approximation, trial and error).

Science Courses

3210 **1. Demonstrate science knowledge and skills required to pursue the full range of career and post-secondary education opportunities within the IT career cluster.**
a. Analyze/evaluate conclusions, conflicting data, controls, data, inferences, limitations, questions, sources of errors, and variables.
b. Use computers for information processing, mathematical applications and problem-solving.
c. Apply/use scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification.

S.HS.5.1.1

The Pathway Knowledge and Skills Chart describes what all/most learners/workers need to know and be able to do to demonstrate competence within a career pathway. Following the pathway description, there are four sets of knowledge and skill expectations:

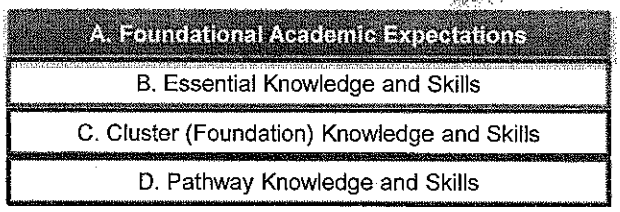


PATHWAY DESCRIPTION

Programming and Software Development: Careers in Programming and Software Development involve the design development implementation and maintenance of computer systems and software, requiring knowledge of computer operating systems, programming languages and software development. People with expertise in programming and software development work with cutting-edge technologies to develop tomorrow's products for use by businesses and consumers. While many of the career opportunities in this area are in software companies, large organizations of other types—such as Financial Services and Business—also offer many opportunities. People with expertise in programming and software development are in high demand, doing work such as creating the software that launches and runs NASA space shuttles.

A. FOUNDATIONAL ACADEMIC EXPECTATIONS

All secondary students should meet their state's academic standards. All Essential Cluster and Pathway Knowledge and Skills are predicated on the assumption that foundational academic skills have been attained. Some knowledge and skill statements will further define critical linkages and applications of academics in the cluster and/or pathway.



B. ESSENTIAL KNOWLEDGE AND SKILLS

The following Essential Knowledge and Skill statements apply to careers in all clusters and pathways. Persons preparing for careers in this pathway should be able to demonstrate these skills in the context of this cluster and pathway.

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Essential Topic ESS01	**ACADEMIC FOUNDATIONS:** ***Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.***
ESS01.01	**Complete required training, education, and certification to prepare for employment in a particular career field.**
ESS01.01.01	Identify training, education and certification requirements for occupational choice.
ESS01.01.02	Participate in career-related training and/or degree programs.
ESS01.01.03	Pass certification tests to qualify for licensure and/or certification in chosen occupational area.
ESS01.02	**Demonstrate language arts knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**
ESS01.02.01	Model behaviors that demonstrate active listening.
ESS01.02.02	Adapt language for audience, purpose, situation. (i.e. diction/structure, style).
ESS01.02.03	Organize oral and written information.
ESS01.02.04	Compose focused copy for a variety of written documents such as agendas, audio-visuals, bibliographies, drafts, forms/documents, notes, oral presentations, reports, and technical terminology.
ESS01.02.05	Edit copy to create focused written documents such as agendas, audio-visuals, bibliographies, drafts, forms/documents, notes, oral presentations, reports, and technical terminology.
ESS01.02.06	Comprehend key elements of oral and written information such as cause/effect, comparisons/contrasts, conclusions, context, purpose, charts/tables/graphs, evaluation/critiques, mood, persuasive text, sequence, summaries, and technical subject matter.
ESS01.02.07	Evaluate oral and written information for accuracy, adequacy/sufficiency, appropriateness, clarity, conclusions/solutions, fact/opinion, propaganda, relevancy, validity, and relationship of ideas.
ESS01.02.08	Identify assumptions, purpose, outcomes/solutions, and propaganda techniques.
ESS01.02.09	Predict potential outcomes and/or solutions based on oral and written information regarding trends.
ESS01.02.10	Present formal and informal speeches including discussion, information requests, interpretation, and persuasive arguments.

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ESS01.03	**Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**
ESS01.03.01	Identify whole numbers, decimals, and fractions.
ESS01.03.02	Demonstrate knowledge of basic arithmetic operations such as addition, subtraction, multiplication, and division.
ESS01.03.03	Demonstrate use of relational expressions such as equal to, not equal, greater than, less than, etc.
ESS01.03.04	Apply data and measurements to solve a problem.
ESS01.03.05	Analyze Mathematical problem statements for missing and/or irrelevant data.
ESS01.03.06	Construct charts/tables/graphs from functions and data.
ESS01.03.07	Analyze data when interpreting operational documents.
ESS01.04	**Demonstrate science knowledge and skills required to pursue the full range of post-secondary and career education opportunities.**
ESS01.04.01	Evaluate scientific constructs including conclusions, conflicting data, controls, data, inferences, limitations, questions, sources of errors, and variables.
ESS01.04.02	Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification.

Essential Topic ESS02	**COMMUNICATIONS:** ***Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.***
ESS02.01	**Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.**
ESS02.01.01	Determine the most appropriate reading strategy for identifying the overarching purpose of a text (i.e. skimming, reading for detail, reading for meaning or critical analysis).
ESS02.01.02	Demonstrate use of content, technical concepts and vocabulary when analyzing information and following directions.
ESS02.01.03	Select the reading strategy or strategies needed to fully comprehend the content within a written document (i.e., skimming, reading for detail, reading for meaning or critical analysis).
ESS02.01.04	Interpret information, data, and observations to apply information learned from reading to actual practice.
ESS02.01.05	Transcribe information, data, and observations to apply information learned from reading to actual practice.
ESS02.01.06	Communicate information, data, and observations to apply information learned from reading to actual practice.

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ESS02.02 **Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication in the workplace.**

- ESS02.02.01 Employ verbal skills when obtaining and conveying information.
- ESS02.02.02 Record information needed to present a report on a given topic or problem.
- ESS02.02.03 Write internal and external business correspondence that conveys and/or obtains information effectively.
- ESS02.02.04 Communicate with other employees to clarify workplace objectives.
- ESS02.02.05 Communicate effectively with customers and employees to foster positive relationships.

ESS02.03 **Locate, organize and reference written information from various sources to communicate with co-workers and clients/participants.**

- ESS02.03.01 Locate written information used to communicate with co-workers and customers.
- ESS02.03.02 Organize information to use in written and oral communications.
- ESS02.03.03 Reference the sources of information.

ESS02.04 **Evaluate and use information resources to accomplish specific occupational tasks.**

- ESS02.04.01 Use informational texts, Internet web sites, and/or technical materials to review and apply information sources for occupational tasks.
- ESS02.04.02 Evaluate the reliability of information from informational texts, Internet Web sites, and/or technical materials and resources.

ESS02.05 **Use correct grammar, punctuation and terminology to write and edit documents.**

- ESS02.05.01 Compose multi-paragraph documents clearly, succinctly, and accurately.
- ESS02.05.02 Use descriptions of audience and purpose when preparing and editing written documents.
- ESS02.05.03 Use correct grammar, spelling, punctuation, and capitalization when preparing written documents.

ESS02.06 **Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.**

- ESS02.06.01 Prepare oral presentations to provide information for specific purposes and audiences.
- ESS02.06.02 Identify support materials that will enhance an oral presentation.
- ESS02.06.03 Prepare support materials that will enhance an oral presentation.
- ESS02.06.04 Deliver an oral presentation that sustains listeners' attention and interest.
- ESS02.06.05 Align presentation strategies to the intended audience.
- ESS02.06.06 Implement multi-media strategies for presentations.

ESS02.07 **Interpret verbal and nonverbal cues/behaviors to enhance communication with co-workers and clients/participants.**

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ESS02.07.01	Interpret verbal behaviors when communicating with clients and co-workers.
ESS02.07.02	Interpret nonverbal behaviors when communicating with clients and co-workers.
ESS02.08	**Apply active listening skills to obtain and clarify information.**
ESS02.08.01	Interpret a given verbal message/information.
ESS02.08.02	Respond with restatement and clarification techniques to clarify information.
ESS02.09	**Develop and interpret tables, charts, and figures to support written and oral communications.**
ESS02.09.01	Create tables, charts, and figures to support written and oral communications.
ESS02.09.02	Interpret tables, charts, and figures used to support written and oral communication.
ESS02.10	**Listen to and speak with diverse individuals to enhance communication skills.**
ESS02.10.01	Apply factors and strategies for communicating with a diverse workforce.
ESS02.10.02	Demonstrate ability to communicate and resolve conflicts within a diverse workforce.
ESS02.11	**Exhibit public relations skills to increase internal and external customer/client satisfaction.**
ESS02.11.01	Communicate effectively when developing positive customer/client relationships.

Essential Topic ESS03	**PROBLEM-SOLVING AND CRITICAL THINKING:** ***Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.***
ESS03.01	**Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).**
ESS03.01.01	Identify common tasks that require employees to use problem-solving skills.
ESS03.01.02	Analyze elements of a problem to develop creative solutions.
ESS03.01.03	Describe the value of using problem-solving and critical thinking skills to improve a situation or process.
ESS03.01.04	Create ideas, proposals, and solutions to problems.
ESS03.01.05	Evaluate ideas, proposals, and solutions to problems.
ESS03.01.06	Use structured problem-solving methods when developing proposals and solutions.
ESS03.01.07	Generate new and creative ideas to solve problems by brainstorming possible solutions.
ESS03.01.08	Critically analyze information to determine value to the problem-solving task.

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ESS03.01.09	Guide individuals through the process of recognizing concerns and making informed decisions.
ESS03.01.10	Identify alternatives using a variety of problem-solving and critical thinking skills.
ESS03.01.11	Evaluate alternatives using a variety of problem-solving and critical thinking skills.
ESS03.02	**Employ critical thinking and interpersonal skills to resolve conflicts with staff and/or customers.**
ESS03.02.01	Analyze situations and behaviors that affect conflict management.
ESS03.02.02	Determine best options/outcomes for conflict resolution using critical thinking skills.
ESS03.02.03	Identify with others' feelings, needs, and concerns.
ESS03.02.04	Implement stress management techniques.
ESS03.02.05	Resolve conflicts with/for customers using conflict resolution skills.
ESS03.02.06	Implement conflict resolution skills to address staff issues/problems.
ESS03.03	**Identify, write and monitor workplace performance goals to guide progress in assigned areas of responsibility and accountability.**
ESS03.03.01	Write realistic performance goals, objectives and action plans.
ESS03.03.02	Monitor performance goals and adjust as necessary.
ESS03.03.03	Recognize goal achievement using appropriate rewards in the workplace.
ESS03.03.04	Communicate goal achievement with managers and co-workers.
ESS03.04	**Conduct technical research to gather information necessary for decision-making.**
ESS03.04.01	Align the information gathered to the needs of the audience.
ESS03.04.02	Gather technical information and data using a variety of resources.
ESS03.04.03	Analyze information and data for value to the research objectives.
ESS03.04.04	Evaluate information and data to determine value to research objectives.

Essential Topic ESS04	**INFORMATION TECHNOLOGY APPLICATIONS:** ***Use information technology tools specific to the career cluster to access, manage, integrate, and create information.***
ESS04.01	**Use Personal Information Management (PIM) applications to increase workplace efficiency.**
ESS04.01.01	Manage personal schedules and contact information.
ESS04.01.02	Create memos and notes.
ESS04.02	**Employ technological tools to expedite workflow.**
ESS04.02.01	Use information technology tools to manage and perform work responsibilities.
ESS04.03	**Operate electronic mail applications to communicate within a workplace.**
ESS04.03.01	Use email to share files and documents.

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ESS04.03.02	Identify the functions and purpose of email systems.
ESS04.03.03	Use email to communicate within and across organizations.
ESS04.04	**Operate Internet applications to perform workplace tasks.**
ESS04.04.01	Access and navigate Internet (e.g., use a web browser).
ESS04.04.02	Search for information and resources.
ESS04.04.03	Evaluate Internet resources for reliability and validity.
ESS04.05	**Operate writing and publishing applications to prepare business communications.**
ESS04.05.01	Prepare simple documents and other business communications.
ESS04.05.02	Prepare reports and other business communications by integrating graphics and other non-text elements.
ESS04.05.03	Prepare complex multi-media publications.
ESS04.06	**Operate presentation applications to prepare presentations.**
ESS04.06.01	Prepare presentations for training, sales and information sharing.
ESS04.06.02	Deliver presentations with supporting materials.
ESS04.07	**Employ spreadsheet applications to organize and manipulate data.**
ESS04.07.01	Create a spreadsheet.
ESS04.07.02	Perform calculations and analyses on data using a spreadsheet.
ESS04.08	**Employ database applications to manage data.**
ESS04.08.01	Manipulate data elements.
ESS04.08.02	Manage interrelated data elements.
ESS04.08.03	Analyze interrelated data elements.
ESS04.08.04	Generate reports showing interrelated data elements.
ESS04.09	**Employ collaborative/groupware applications to facilitate group work.**
ESS04.09.01	Facilitate group work through management of shared schedule and contact information.
ESS04.09.02	Facilitate group work through management of shared files and online information.
ESS04.09.03	Facilitate group work through instant messaging or virtual meetings.
ESS04.10	**Employ computer operations applications to manage work tasks.**
ESS04.10.01	Manage computer operations.
ESS04.10.02	Manage file storage.
ESS04.10.03	Compress or alter files.
ESS04.11	**Use computer-based equipment (containing embedded computers or processors) to control devices.**
ESS04.11.01	Operate computer driven equipment and machines.
ESS04.11.02	Use installation and operation manuals.
ESS04.11.03	Troubleshoot computer driven equipment and machines.
ESS04.11.04	Access support as needed to maintain operation of computer driven equipment and machines.

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Essential Topic ESS05	SYSTEMS: *Understand roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. Identify how key organizational systems affect organizational performance and the quality of products and services. Understand global context of industries and careers.*
ESS05.01	**Describe the nature and types of business organizations to build an understanding of the scope of organizations.**
ESS05.01.01	List the types and functions of businesses.
ESS05.01.02	Describe the types and functions of businesses.
ESS05.01.03	Explain the functions and interactions of common departments within a business.
ESS05.02	**Implement quality control systems and practices to ensure quality products and services.**
ESS05.02.01	Describe quality control standards and practices common to the workplace.

Essential Topic ESS06	SAFETY, HEALTH AND ENVIRONMENTAL: *Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. Follow organizational policies and procedures and contribute to continuous improvement in performance and compliance.*
ESS06.01	**Implement personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.**
ESS06.01.01	Assess workplace conditions with regard to safety and health.
ESS06.01.02	Align safety issues with appropriate safety standards to ensure a safe workplace/jobsite.
ESS06.01.03	Identify safety hazards common to workplaces.
ESS06.01.04	Identify safety precautions to maintain a safe worksite.
ESS06.01.05	Select appropriate personal protective equipment as needed for a safe workplace/jobsite.
ESS06.01.06	Inspect personal protective equipment commonly used for selected career pathway.
ESS06.01.07	Use personal protective equipment according to manufacturer rules and regulations.
ESS06.01.08	Employ a safety hierarchy and communication system within the workplace/jobsite.
ESS06.01.09	Implement safety precautions to maintain a safe worksite.
ESS06.02	**Complete work tasks in accordance with employee rights and responsibilities and employers obligations to maintain workplace safety and health.**
ESS06.02.01	Identify rules and laws designed to promote safety and health in the workplace.
ESS06.02.02	State the rationale of rules and laws designed to promote safety and health.

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ESS06.03	**Employ emergency procedures as necessary to provide aid in workplace accidents.**
ESS06.03.01	Use knowledge of First Aid procedures as necessary.
ESS06.03.02	Use knowledge of CPR procedures as necessary.
ESS06.03.03	Use safety equipment as necessary.
ESS06.04	**Employ knowledge of response techniques to create a disaster and/or emergency response plan.**
ESS06.04.01	Complete an assessment of an emergency and/or disaster situation.
ESS06.04.02	Create an emergency and/or disaster plan.

Essential Topic ESS07	**LEADERSHIP AND TEAMWORK:** ***Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.***
ESS07.01	**Employ leadership skills to accomplish organizational goals and objectives.**
ESS07.01.01	Analyze the various roles of leaders within organizations (e.g. contribute ideas; share in building an organization; act as role models to employees by adhering to company policies, procedures, and standards; promote the organization's vision; and mentor others).
ESS07.01.02	Exhibit traits such as empowerment, risk, communication, focusing on results, decision-making, problem solution, and investment in individuals when leading a group in solving a problem.
ESS07.01.03	Exhibit traits such as compassion, service, listening, coaching, developing others, team development, and understanding and appreciating others when acting as a manager of others in the workplace.
ESS07.01.04	Exhibit traits such as enthusiasm, creativity, conviction, mission, courage, concept, focus, principle-centered living, and change when interacting with others in general.
ESS07.01.05	Consider issues related to self, team, community, diversity, environment, and global awareness when leading others.
ESS07.01.06	Exhibit traits such as innovation, intuition, adaptation, life-long learning and coachability to develop leadership potential over time.
ESS07.01.07	Analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation.
ESS07.01.08	Describe observations of outstanding leaders using effective management styles.
ESS07.01.09	Participate in civic and community leadership and teamwork opportunities to enhance skills.
ESS07.02	**Employ organizational and staff development skills to foster positive working relationships and accomplish organizational goals.**
ESS07.02.01	Implement organizational skills when facilitating others' work efforts.

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ESS07.02.02	Explain how to manage a staff that satisfies work demands while adhering to budget constraints.
ESS07.02.03	Describe how staff growth and development to increase productivity and employee satisfaction.
ESS07.02.04	Organize team involvement within a group environment.
ESS07.02.05	Work with others to develop and gain commitment to team goals.
ESS07.02.06	Distribute responsibility and work load fairly.
ESS07.02.07	Model leadership and teamwork qualities to aid in employee morale.
ESS07.02.08	Identify best practices for successful team functioning.
ESS07.02.09	Explain best practices for successful team functioning.
ESS07.03	**Employ teamwork skills to achieve collective goals and use team members' talents effectively.**
ESS07.03.01	Work with others to achieve objectives in a timely manner.
ESS07.03.02	Promote the full involvement and use of team members' individual talents and skills.
ESS07.03.03	Employ conflict-management skills to facilitate solutions.
ESS07.03.04	Demonstrate teamwork skills through working cooperatively with co-workers, supervisory staff, and others, both in and out of the organization, to achieve particular tasks.
ESS07.03.05	Demonstrate teamwork processes that provide team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution.
ESS07.03.06	Develop plans to improve team performance.
ESS07.03.07	Demonstrate commitment to and a positive attitude toward team goals.
ESS07.03.08	Take responsibility for shared group and individual work tasks.
ESS07.03.09	Assist team members in completing their work.
ESS07.03.10	Adapt effectively to changes in projects and work activities.
ESS07.03.11	Negotiate effectively to arrive at decisions.
ESS07.04	**Establish and maintain effective working relationships with all levels of personnel and other departments in order to accomplish objectives and tasks.**
ESS07.04.01	Build effective working relationships using interpersonal skills.
ESS07.04.02	Use positive interpersonal skills to work cooperatively with co-workers representing different cultures, genders and backgrounds.
ESS07.04.03	Manage personal skills to accomplish assignments.
ESS07.04.04	Treat people with respect.
ESS07.04.05	Provide constructive praise and criticism.
ESS07.04.06	Demonstrate sensitivity to and value for diversity.
ESS07.04.07	Manage stress and control emotions.
ESS07.05	**Conduct and participate in meetings to accomplish work tasks.**
ESS07.05.01	Develop meeting goals, objectives and agenda.
ESS07.05.02	Assign responsibilities for preparing materials and leading discussions.
ESS07.05.03	Prepare materials for leading discussion.
ESS07.05.04	Assemble and distribute meeting materials.
ESS07.05.05	Conduct meeting to achieve objectives within scheduled time.

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ESS07.05.06	Demonstrate effective communication skills in meetings.
ESS07.05.07	Produce meeting minutes including decisions and next steps.
ESS07.05.08	Use parliamentary procedure, as needed, to conduct meetings.
ESS07.06	**Employ mentoring skills to inspire and teach others.**
ESS07.06.01	Use motivational techniques to enhance performance in others.
ESS07.06.02	Provide guidance to enhance performance in others.

Essential Topic ESS08	**ETHICS AND LEGAL RESPONSIBILITIES:** ***Know and understand the importance of professional ethics and legal responsibilities.***
ESS08.01	**Apply ethical reasoning to a variety of workplace situations in order to make ethical decisions.**
ESS08.01.01	Evaluate alternative responses to workplace situations based on legal responsibilities and employer policies.
ESS08.01.02	Evaluate alternative responses to workplace situations based on personal or professional ethical responsibilities.
ESS08.01.03	Identify personal and long-term workplace consequences of unethical or illegal behaviors.
ESS08.01.04	Explain personal and long-term workplace consequences of unethical or illegal behaviors.
ESS08.01.05	Determine the most appropriate response to workplace situations based on legal and ethical considerations.
ESS08.01.06	Explain the most appropriate response to workplace situations based on legal and ethical considerations.
ESS08.02	**Interpret and explain written organizational policies and procedures to help employees perform their jobs according to employer rules and expectations.**
ESS08.02.01	Locate information on organizational policies in handbooks and manuals.
ESS08.02.02	Discuss how specific organizational policies and procedures influence a specific work situation.

Essential Topic ESS09	**EMPLOYABILITY AND CAREER DEVELOPMENT:** ***Know and understand the importance of employability skills. Explore, plan, and effectively manage careers. Know and understand the importance of entrepreneurship skills.***
ESS09.01	**Identify and demonstrate positive work behaviors and personal qualities needed to be employable.**
ESS09.01.01	Demonstrate self-discipline, self-worth, positive attitude, and integrity in a work situation.
ESS09.01.02	Demonstrate flexibility and willingness to learn new knowledge and skills.
ESS09.01.03	Exhibit commitment to the organization.

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ESS09.01.04	Identify how work varies with regard to site, from indoor confined spaces to outdoor areas, including aerial space and a variety of climatic and physical conditions.
ESS09.01.05	Apply communication strategies when adapting to a culturally diverse environment.
ESS09.01.06	Manage resources in relation to the position (i.e. budget, supplies, computer, etc).
ESS09.01.07	Identify positive work-qualities typically desired in each of the career cluster's pathways.
ESS09.01.08	Manage work roles and responsibilities to balance them with other life roles and responsibilities.
ESS09.02	**Develop a personal career plan to meet career goals and objectives.**
ESS09.02.01	Develop career goals and objectives as part of a plan for future career direction.
ESS09.02.02	Develop strategies to reach career objectives.
ESS09.03	**Demonstrate skills related to seeking and applying for employment to find and obtain a desired job.**
ESS09.03.01	Use multiple resources to locate job opportunities.
ESS09.03.02	Prepare a résumé.
ESS09.03.03	Prepare a letter of application.
ESS09.03.04	Complete an employment application.
ESS09.03.05	Interview for employment.
ESS09.03.06	List the standards and qualifications that must be met in order to enter a given industry.
ESS09.03.07	Employ critical thinking and decision-making skills to exhibit qualifications to a potential employer.
ESS09.04	**Maintain a career portfolio to document knowledge, skills and experience in a career field.**
ESS09.04.01	Select educational and work history highlights to include in a career portfolio.
ESS09.04.02	Produce a record of work experiences, licenses, certifications and products.
ESS09.04.03	Organize electronic or physical portfolio for use in demonstrating knowledge, skills and experiences.
ESS09.05	**Demonstrate skills in evaluating and comparing employment opportunities in order to accept employment positions that match career goals.**
ESS09.05.01	Compare employment opportunities to individual needs and career plan objectives.
ESS09.05.02	Evaluate employment opportunities based upon individual needs and career plan objectives.
ESS09.05.03	Demonstrate appropriate methods for accepting or rejecting employment offers.

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ESS09.06 **Identify and exhibit traits for retaining employment to maintain employment once secured.**

- ESS09.06.01 Model behaviors that demonstrate reliability and dependability.
- ESS09.06.02 Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite.
- ESS09.06.03 Complete required employment forms and documentation such as I-9 form, work visa, W-4 and licensures to meet employment requirements.
- ESS09.06.04 Summarize key activities necessary to retain a job in the industry.
- ESS09.06.05 Identify positive work behaviors and personal qualities necessary to retain employment.

ESS09.07 **Identify and explore career opportunities in one or more career pathways to build an understanding of the opportunities available in the cluster.**

- ESS09.07.01 Locate and identify career opportunities that appeal to personal career goals.
- ESS09.07.02 Match personal interest and aptitudes to selected careers.

ESS09.08 **Recognize and act upon requirements for career advancement to plan for continuing education and training.**

- ESS09.08.01 Identify opportunities for career advancement.
- ESS09.08.02 Pursue education and training opportunities to acquire skills necessary for career advancement.
- ESS09.08.03 Examine the organization and structure of various segments of the industry to prepare for career advancement.
- ESS09.08.04 Research local and regional labor (workforce) market and job growth information to project potential for advancement.
- ESS09.08.05 Manage employment relations to make career advancements.

ESS09.09 **Continue professional development to keep current on relevant trends and information within the industry.**

- ESS09.09.01 Use self assessment, organizational priorities, journals, Internet sites, professional associations, peers and other resources to develop goals that address training, education and self-improvement issues.
- ESS09.09.02 Read trade magazines and journals, manufacturers' catalogues, industry publications and Internet sites to keep current on industry trends.
- ESS09.09.03 Participate in relevant conferences, workshops, mentoring activities and in-service training to stay current with recent changes in the field.

ESS09.10 **Examine licensing, certification and credentialing requirements at the national, state and local levels to maintain compliance with industry requirements.**

- ESS09.10.01 Examine continuing education requirements related to licensing, certification, and credentialing requirements at the local, state and national levels for chosen occupation.

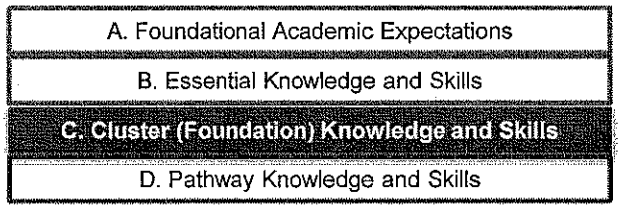
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ESS09.10.02	Examine the procedures and paperwork involved in maintaining and updating licensure, certification and credentials for chosen occupation.
ESS09.10.03	Align ongoing licensing, certification and credentialing requirements to career plans and goals.
ESS09.11	**Examine employment opportunities in entrepreneurship to consider entrepreneurship as an option for career planning.**
ESS09.11.01	Describe the opportunities for entrepreneurship in a given industry.

Essential Topic ESS10	TECHNICAL SKILLS: *Use of technical knowledge and skills required to pursue careers in all career cluster, including knowledge of design, operation, and maintenance of technological systems critical to the career cluster.*
ESS10.01	**Employ information management techniques and strategies in the workplace to assist in decision-making.**
ESS10.01.01	Use information literacy skills when accessing, evaluating and disseminating information.
ESS10.01.02	Describe the nature and scope of information management.
ESS10.01.03	Maintain records to facilitate ongoing business operations.
ESS10.02	**Employ planning and time management skills and tools to enhance results and complete work tasks.**
ESS10.02.01	Develop goals and objectives.
ESS10.02.02	Prioritize tasks to be completed.
ESS10.02.03	Develop timelines using time management knowledge and skills.
ESS10.02.04	Use project-management skills to improve workflow and minimize costs.

C. CLUSTER (FOUNDATION) KNOWLEDGE AND SKILLS

The following Cluster (Foundation) Knowledge and Skill statements apply to all careers in the Information Technology Cluster. Persons preparing for careers in the Information Technology Cluster should be able to demonstrate these skills in addition to those found on the Essential Knowledge and Skills Chart.



Cluster Topic ITC01	ACADEMIC FOUNDATIONS: *Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.*

No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

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Cluster Topic ITC02	COMMUNICATIONS: *Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.*
ITC02.01	**Develop positive customer relations to build and maintain a customer base in the IT industry.**
ITC02.01.01	Demonstrate knowledge of organization's offerings and of customers' importance to the organization.
Sample Indicators	Identify organization's products and services (including own strengths as an agent of the company). Recognize the importance of all customers to the business.
ITC02.01.02	Demonstrate ability to assist customers in a professional manner.
Sample Indicators	Determine customers' individual needs. Project a professional business image (e.g., appearance, voice, grammar, word usage, enunciation, nonverbal communication). Interact with customers and colleagues in a professional manner (e.g., prompt, friendly, courteous, respectful, helpful, knowledgeable, understandable). Ensure that your assistance promotes the best interests of the company.
ITC02.01.03	Effectively use organizational protocols and systems to fulfill customer service requirements.
Sample Indicators	Comply with established business protocols and company policies. Communicate company policies to customers. Handle merchandise returns in accordance with customer service policy. Handle customer complaints in accordance with customer service policy. Facilitate customer service through the maintenance of key information systems.
ITC02.01.04	Ensure that customers' needs are met to maintain a customer base.
Sample Indicators	Follow through on commitments made to customers(e.g., special orders, delivery specifications, new items). Maintain customer base.
ITC02.02	**Perform scheduling functions to meet customer needs.**
ITC02.02.01	Schedule customer appointments.
Sample Indicators	Create calendars/schedules. Maintain appointment calendars. Process requests for appointments. Verify appointments. Notify customers of changes in schedule. Manage scheduling conflicts.
ITC02.02.02	Document results of customer appointments.
Sample Indicators	Document results.

Cluster Topic ITC03	PROBLEM-SOLVING AND CRITICAL THINKING: *Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.*
ITC03.01	**Use product/service design processes and guidelines to produce a quality IT product/service.**
ITC03.01.01	Summarize the process of IT product/service design.
Sample Indicators	Test products for reliability. Initiate predictive maintenance procedures.

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Document a Quality Assurance (QA) program (includes creating a plan and evaluating effectiveness of the program).

ITC03.01.02 Plan for products/services using reliability factors.

ITC03.01.03 Create products/services using reliability factors.

ITC03.01.04 Test new products/services for reliability.

ITC03.01.05 Maintain the reliability of new products/services.

ITC03.02 Implement problem-solving processes to evaluate and verify the nature of problems in the IT industry.

ITC03.02.01 Explain information systems theory and practice.

Sample Indicators

Demonstrate knowledge of the underlying concepts of the information systems discipline.

Demonstrate knowledge of methods for achieving productivity in knowledge work.
Apply general systems theory to the analysis and development of an information system.
Identify procedures for formal problem-solving.
Demonstrate knowledge of the fundamental concept of information theory and organizational system processes.
Identify the essential properties of information systems.

ITC03.02.02 Explain information systems problem-solving techniques and approaches.

ITC03.02.03 Evaluate information systems problem-solving techniques and approaches.

ITC03.03 Employ organization and design principles to sort and group information used in the IT industry.

ITC03.03.01 Demonstrate the use of information organization principles.

Sample Indicators

Demonstrate knowledge of group support technology for common knowledge requirements.
Demonstrate knowledge of the information analysis process.
Demonstrate knowledge of Information Technology solutions.

Demonstrate knowledge of methods for achieving productivity in knowledge work.

ITC03.03.02 Demonstrate the use of design and color principles.

Cluster Topic ITC04 INFORMATION TECHNOLOGY APPLICATIONS: ***Use information technology tools specific to the career cluster to access, manage, integrate, and create information.***

No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

Cluster Topic ITC05 SYSTEMS: ***Understand roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. Identify how key organizational systems affect organizational performance and the quality of products and services. Understand global context of industries and careers.***

ITC05.01 Analyze and summarize the use of IT in business to enhance effectiveness.

ITC05.01.01 Integrate IT into various types of business models.

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Sample Indicators

Determine how business activities interface with data processing functions.
Differentiate between the role of information systems within a company and their role in a global environment.

Measure increases in productivity realized by the implementation of information systems.

ITC05.02 Implement cross-functional teams to achieve IT project goals.

ITC05.02.01 Summarize the importance of cross-functional teams in achieving IT project goals.

Sample Indicators

Consider the benefits of using a cross-functional team in policy and procedure development.
Identify desired group and team behavior in an IT context.
Explain technical concepts to various audiences in non-technical terms.

ITC05.02.02 Describe strategies for maximizing productivity in a high tech environment.

ITC05.03 Employ project management knowledge to oversee IT projects.

ITC05.03.01 Implement project methodologies to manage information system projects.

Sample Indicators

Define the project's contribution to business needs.
Define the scope of the project.
Identify stakeholders and decision makers.
Identify escalation procedures.
Develop task list (work breakdown structures).
Evaluate project requirements.
Identify required resources and budget.
Estimate time requirements.
Develop initial project management flowchart.
Identify interdependencies.
Identify critical milestones.
Evaluate risks.
Prepare contingency plan.
Manage the change control process.
Track critical milestones.
Participate in project phase review.
Report project status.
Utilize project management software.
Develop a method of evaluation.

ITC05.03.02 Define scope of work to achieve individual and group goals.

Sample Indicators

Assess the task's contribution to overall business needs.
Identify size and specifics of the task.
Formulate task sequence.
Plan multiple tasks simultaneously.
Identify potential problems.
Develop contingency plans.

ITC05.03.03 Develop time and activity plans to achieve objectives.

Sample Indicators

Coordinate plan with team, cross-functional groups, or individuals.
Formulate a task strategy.
Prioritize tasks according to business needs.
Manage multiple tasks simultaneously.
Devise plan of action.

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Cluster Topic ITC06 — **SAFETY, HEALTH AND ENVIRONMENTAL:** ***Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. Follow organizational policies and procedures and contribute to continuous improvement in performance and compliance.***

No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

Cluster Topic ITC07 — **LEADERSHIP AND TEAMWORK:** ***Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.***

No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

Cluster Topic ITC08 — **ETHICS AND LEGAL RESPONSIBILITIES:** ***Know and understand the importance of professional ethics and legal responsibilities.***

ITC08.01 Apply standard practices and behaviors that meet legal and ethical responsibilities and exhibit positive cyber-citizenry to understand legal issues faced by IT professionals.

ITC08.01.01 Explain legal issues faced by IT professionals.

Sample Indicators

- Demonstrate knowledge of the legal issues that face Information Technology professionals.
- Identify issues and trends affecting computers and information privacy.
- Explain legal issues involved in a company security policy.
- Identify legal issues involved concerning a security breach.

ITC08.01.02 Summarize the rights and responsibilities of IT workers.

ITC08.01.03 Identify ethical issues common to the IT field.

Cluster Topic ITC09 — **EMPLOYABILITY AND CAREER DEVELOPMENT:** ***Know and understand the importance of employability skills. Explore, plan, and effectively manage careers. Know and understand the importance of entrepreneurship skills.***

ITC09.01 Identify and explain the implications IT has on business transformation and development to demonstrate an understanding of the impact on business.

ITC09.01.01 Demonstrate understanding of the impact of IT on businesses.

Sample Indicators

- Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions.
- Demonstrate knowledge of the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs).
- Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide.
- Demonstrate knowledge of ethical issues that have surfaced in the information age.

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Cluster Topic ITC10	TECHNICAL SKILLS: *Use the technical knowledge and skills required to pursue the targeted careers for all pathways in the career cluster, including knowledge of design, operation, and maintenance of technological systems critical to the career cluster.*
ITC10.01	**Demonstrate knowledge of the hardware components associated with information systems.**
ITC10.01.01	Explain the fundamentals of operating systems.
Sample Indicators	Identify major operating system fundamentals and components.
ITC10.01.02	Explain the role of number systems in information systems.
Sample Indicators	Identify the role the binary and hexadecimal system in information systems. Demonstrate knowledge of number systems and internal data representation.
ITC10.01.03	Identify computer classifications and hardware.
Sample Indicators	Identify major hardware components and their functions. Identify the hardware associated with telecommunications functions. Identify types of computer storage devices.
ITC10.01.04	Describe elements and types of information processing.
Sample Indicators	Identify the elements of the information processing cycle (i.e., input, process, output, and storage). Identify types of processing (e.g., batch, interactive, event-driven, object-oriented).
ITC10.01.05	Use available reference tools as appropriate.
Sample Indicators	Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts).
ITC10.01.06	Describe the function of CPUs.
ITC10.02	**Compare classes of software associated with the development and maintenance information systems to develop software and maintain computer systems.**
ITC10.02.01	Explain the key functions and applications of software.
Sample Indicators	Demonstrate knowledge of the key functions of systems software. Demonstrate knowledge of widely used software applications (e.g., word processing, database management, spreadsheet development). Demonstrate knowledge of the function and operation of compilers and interpreters.
ITC10.02.02	Describe the range of languages used in software development.
Sample Indicators	Demonstrate knowledge of the range of languages used in software development.
ITC10.02.03	Summarize how data is organized in software development.
Sample Indicators	Demonstrate knowledge of how data is organized in software development.
ITC10.02.04	Explain new and emerging classes of software.
Sample Indicators	Identify new and emerging classes of software.
ITC10.03	**Identify and compare new IT trends and technologies to build an understanding of their potential influence on IT practices.**
ITC10.03.01	Explain measurement techniques for increased productivity due to information support implementation.
Sample Indicators	Measure increases in productivity realized by the implementation of information systems.
ITC10.03.02	Identify new IT technologies.
Sample Indicators	Identify new technologies relevant to information technology.

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Assess the importance of new technologies to future developments and to future knowledge worker productivity.

Identify new and emerging drivers and inhibitors of Information Technology change.

ITC10.03.03 Assess the potential importance and impact of new IT technologies in the future.

ITC10.04 Summarize basic data communications components and trends to maintain and update IT systems.

ITC10.04.01 Explain data communications procedures, equipment and media.

Sample Indicators
- Demonstrate knowledge of key communications procedures.
- Demonstrate knowledge of the uses of data communication equipment.
- Demonstrate knowledge of types of communications media.

ITC10.04.02 Explain data transmission codes and protocols.

Sample Indicators
- Demonstrate knowledge of data transmission codes and protocols.

ITC10.04.03 Explain the differences between local and wide area networks.

Sample Indicators
- Distinguish between local area networks and wide-area networks.

ITC10.04.04 Summarize data communication trends and issues.

Sample Indicators
- Identify data communication trends.
- Identify major current issues in data communications.

ITC10.05 Demonstrate technical knowledge of the Internet to develop and maintain IT systems.

ITC10.05.01 Describe Internet protocols.

Sample Indicators
- Demonstrate knowledge of the Transmission Control Protocol/Internet Protocol (TCP/IP) suite.
- Demonstrate knowledge of management protocols, applications and procedures (e.g., SNMP, intrusion detection, and reporting issues).
- Explain the concept of routing.

ITC10.05.02 Explain Domain Name Server (DNS).

Sample Indicators
- Demonstrate knowledge of the Domain Name System (DNS).
- Explain the DNS hierarchy.
- Identify elements of DNS (e.g., zones, server types).

ITC10.05.03 Summarize Internet security issues and systems available for addressing them.

Sample Indicators
- Demonstrate knowledge of the Domain Name System (DNS).
- Explain the DNS hierarchy.
- Identify elements of DNS (e.g., zones, server types).

ITC10.06 Access and use Internet services when completing IT related tasks to service and update IT systems.

ITC10.06.01 Demonstrate the use of an Internet connection.

Sample Indicators
- Configure a small home office Internet connection using cable, DSL, wireless or satellite connection.
- Test Internet connection using tools such as ping, trace route, net stat, host, dig, and nslookup.

ITC10.06.02 Troubleshoot Internet connection problems.

ITC10.06.03 Explain the components of Internet software.

Sample Indicators
- Demonstrate knowledge of the components of Internet software.

ITC10.06.04 Install Internet software for use on an operating system.

Sample Indicators
- Identify common browser features.

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Install Internet software.
Differentiate between Web-based applications and applications installed on a local computer.
Download software upgrades and shareware from the Internet.
Unpack files using compression software.

ITC10.06.05 Describe virus protection procedures.

Sample Indicators
Demonstrate acute awareness of virus protection techniques.
Identify types and capabilities of popular virus protection software.
Explain spyware, adware, and malware.
Identify how to avoid spyware, adware, and malware and how to recover from infection.

ITC10.06.06 Explain cookies and adware on an internet connected computer system.

Sample Indicators
Demonstrate knowledge of cookies and their use on an internet-connected computer system.
Identify types and consequences of pop-ups and ad-ware.

ITC10.07 Install and configure software programs to maintain and update IT systems.

ITC10.07.01 Verify that hardware and software system components are compatible prior to performing installation.

Sample Indicators
Identify hardware requirements (e.g., processor, memory, disk space, communications, printers, monitors).
Determine compatibility of hardware and software.

ITC10.07.02 Verify that software to be installed is licensed prior to performing installation.

Sample Indicators
Verify conformance to licensing agreement.
Understand the concept of an End User License Agreement (EULA).
Differentiate between open source and proprietary licenses.
Explain the concept of open source.
Identify common characteristics of open source licensing agreements, including the GNU General Public License (GPL).

ITC10.07.03 Perform installation accurately and completely, using available resources as needed.

Sample Indicators
Install given application/system software on various platforms in accordance with manufacturer's procedures.
Disable/uninstall software that may interfere with installation of new software.
Differentiate between procedures for an upgrade and for a new installation.
Differentiate between stand-alone and network installation procedures.
Select appropriate installation options (e.g., default, customized).
Configure software to appropriate operating system settings.
Configure macros, tools, and packages to accomplish simple organizational and personal tasks.
Convert data files if required.
Verify software installation and operation.

ITC10.07.04 Resolve problems with installation if they occur.

Sample Indicators
Troubleshoot unexpected results.
Access needed help using manufacturers' technical help lines or Internet sites.
Formulate new installation procedure if needed.

ITC10.07.05 Perform customization as requested.

Sample Indicators
Customize software to meet user preferences.

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ITC10.07.06 Document procedures, using clear and effective notes, for future use.

Sample Indicators
- Document step-by-step installation and configuration procedures.

ITC10.08 Demonstrate knowledge of Web page basics to build an understanding of Web page design and functioning.

ITC10.08.01 Explain the features and functions of Web browsing software.

Sample Indicators
- Demonstrate knowledge of the role of browsers in reading files on the World Wide Web (text-only, hypertext).
- Identify how different browsers affect the look of a web page.
- Demonstrate knowledge of the characteristics and uses of plug-ins.

ITC10.08.02 Explain the features and functions of Web page design software.

Sample Indicators
- Compare/contrast the features and functions of software editors available for designing web pages.

ITC10.08.03 Compare and contrast clients and servers.

Sample Indicators
- Differentiate between a client and a server.
- Explain how traditional and modern Internet clients exploit the client/server relationship.

ITC10.08.04 Describe how bandwidth affects data transmission and on-screen image.

Sample Indicators
- Demonstrate knowledge of how bandwidths affect data transmission and on-screen image.

ITC10.08.05 Compare the benefits of internal and external Web hosting.

Sample Indicators
- Compare the advantages and disadvantages of internal external web hosting.

ITC10.09 Employ IT knowledge and procedures when configuring or modifying an operating system to ensure optimal system functioning.

ITC10.09.01 Configure/modify system as needed.

Sample Indicators
- Secure needed supplies and resources.
- Review automated scheduling software.
- Identify data requirements.
- Identify scheduling priority in programming.
- Build system software command structures using operating system macro facilities for computer systems.

ITC10.09.02 Use operating system principles to ensure optimal system function.

Sample Indicators
- Apply basic commands of operating system software.
- Apply appropriate file and disk management techniques.
- Employ desktop operating skills.
- Handle materials and equipment in a responsible manner.
- Follow power-up and log-on procedures.
- Interact with/respond to system messages using console device.
- Run applications/jobs in accordance with processing procedures.
- Follow log-off and power-down procedure(s).

ITC10.09.03 Use available reference tools as appropriate.

Sample Indicators
- Access needed information using appropriate reference materials.

ITC10.09.04 Document procedures and actions.

Sample Indicators
- Develop audit trails.

ITC10.09.05 Configure systems to provide optimal system interfaces.

ITC10.10 Perform standard computer backup procedures to protect IT information.

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ITC10.10.01 Explain the need for regular backup procedures.

Sample Indicators
- Recognize the need for regular backup procedures.

ITC10.10.02 Configure, perform and maintain backup procedures.

Sample Indicators
- Load backup software.
- Load compression drive backup software.
- Install surge suppression protection.
- Identify battery backup equipment.
- Maintain battery backup system.
- Identify hot and warm site backup concepts.

ITC10.11 Recognize and analyze potential IT security threats to develop and maintain security requirements.

ITC10.11.01 Describe potential security threats to information systems.

ITC10.11.02 Identify the range of security needs and the problems that can occur due to security lapses.

ITC10.11.03 Assess security threats.

Sample Indicators
- Maximize threat reduction.
- Assess exposure to security issues.
- Implement countermeasures.
- Ensure compliance with security rules, regulations, and codes.
- Demonstrate knowledge of virus protection strategy.
- Implement security procedures in accordance with business ethics.

ITC10.11.04 Develop plans to address security threats.

ITC10.11.05 Implement plans to address security procedures.

Sample Indicators
- Maintain confidentiality.
- Load virus detection and protection software.
- Identify sources of virus infections.
- Remove viruses.
- Report viruses in compliance with company standards.
- Implement backup and recovery procedures.
- Follow disaster plan.
- Provide for user authentication and restricted access (e.g., assign passwords, access level).

ITC10.11.06 Document security procedures.

ITC10.12 Maintain computer systems to ensure optimal IT system functioning.

ITC10.12.01 Implement queries and reports to provide access to critical system information.

Sample Indicators
- Create a query to extract information from a file.
- Create a query to extract information from multiple files.
- Create reports from queries.
- Create and use logical files.
- Develop a display screen for use with high-level language program.
- Access needed information using appropriate reference materials.

ITC10.12.02 Ensure that system is functioning optimally.

Sample Indicators
- Monitor system status and performance.
- Run diagnostics.
- Respond to system messages.

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Perform preventive maintenance procedures on computer and peripheral devices.
Handle materials and equipment in a responsible manner.
Optimize windows environment to maximize performance of desktop resources.
Review automated scheduling software.

ITC10.12.03 Fix and document system problems.

Sample Indicators
Fix recoverable problems.
Restore system.
Document computer system malfunction(s).
Document software malfunction(s).

ITC10.12.04 Configure systems to provide optimal system interfaces.

Sample Indicators
Define hardware-software interface issues for a computer system.

Identify standards and issues related to I/O programming and design of I/O interfaces.

Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts, exceptions, Direct Memory Addressing [DMA], bus structures).
Apply concepts of privileged instructions and protected mode programming.
Configure peripheral device drivers (e.g., disk, display, printer, modem, keyboard, mouse, network).
Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic disk/CD-ROM storage and formats).
Allocate disk space, non-sharable resources, and I/O devices.

ITC10.13 Provide IT support and training to maintain proper network functioning.

ITC10.13.01 Provide Help Desk service to computer users within the organization.

Sample Indicators
Operate help desk.
Employ desktop productivity tools.
Support computer users.

ITC10.13.02 Provide training for basic computer use within the organization.

Sample Indicators
Train computer users.

ITC10.14 Identify and describe quality assurance concepts to develop an understanding of the requirements for quality IT products/services.

ITC10.14.01 Explain the history and standards of key quality management initiatives.

Sample Indicators
Demonstrate knowledge of the historical evolution of quality assurance/total quality management (e.g., Deming, ISO 9000).

Demonstrate knowledge of changes brought about by quality leaders in the world.
Demonstrate knowledge of the ISO 9000 process.

Demonstrate knowledge of the standards/requirements for the Baldridge award.
Demonstrate knowledge of successful efforts by industry to improve quality and/or reduce costs.

ITC10.14.02 Explain the terminology, role and benefits of quality within an organization.

Sample Indicators
Demonstrate knowledge of quality management terminology.
Identify the role of quality within the organization.
Identify the features and benefits of quality planning.

ITC10.14.03 Summarize the elements of a quality management system.

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Sample Indicators

- Demonstrate knowledge of the control devices used in functional areas (e.g., SPC, equipment).
- Demonstrate knowledge of the relationship among organizational structures, policies, procedures, and quality assurance.
- Identify internal and external customers.
- Differentiate between prevention and detection.
- Differentiate between variable and attribute data.
- Identify types of control charts.
- Demonstrate knowledge of how statistical techniques used to control quality (e.g., SPC, DOE, CR).

ITC10.15 Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.

ITC10.15.01 Describe the role of computer forensic investigators.

Sample Indicators

- Define computer forensics.
- List some of the basic skills and knowledge a computer forensics specialist should possess.
- Identify the circumstances under which computer forensics evidence is typically used, who typically uses such evidence, and how it is used.

ITC10.15.02 Demonstrate the effective use of basic computer applications relating to forensics investigations.

Sample Indicators

- Identify and attempt to retrieve possible evidence that may exist on a computer system.
- List what should and should not be done with the computer and evidence during an investigation.

ITC10.15.03 Identify criminal activity in relationship to cyber crime, the Internet, and Internet trafficking.

Sample Indicators

- List common internet crimes.
- List some prevention actions related to cyber crime.
- Describe techniques to identify criminal activity.
- Identify how one files a complaint if a cyber crime is suspected or has occurred.

D. PATHWAY KNOWLEDGE AND SKILLS

The following knowledge and skill statements apply to all careers in the Programming and Software Development Pathway.

- A. Foundational Academic Expectations
- B. Essential Knowledge and Skills
- C. Cluster (Foundation) Knowledge and Skills
- **D. Pathway Knowledge and Skills**

Pathway Topic ITPD01 PROGRAMMING AND SOFTWARE DEVELOPMENT

ITPD01.01 Identify and analyze customer software needs and requirements to guide programming and software development.

ITPD01.01.01 Gather data to identify customer requirements.

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Sample Indicators
- Gather information using interviewing strategies.
- Identify input and output requirements.
- Identify system processing requirements.
- Clarify specifications using questioning techniques.
- Identify hardware, networking, and software system functional requirements.
- Demonstrate knowledge of nonfunctional requirements (e.g., security, integrity response time, reliability, support, and documentation).

ITPD01.01.02 Conduct needs analysis.

Sample Indicators
- Gather information on problems from users.
- Perform workflow analysis to determine user needs.
- Analyze existing procedures.
- Define business problem to be solved by the application.

ITPD01.01.03 Develop software requirements and specifications.

Sample Indicators
- Demonstrate knowledge of the use, structure, and contents of a requirements specification document.
- Define system and software requirements.
- Develop informal specifications.
- Develop formal specification.
- Resolve conflicting requirements.
- Review and verify specification with customer.

ITPD01.01.04 Analyze requirements/specifications using current approaches.

Sample Indicators
- Demonstrate knowledge of how to use software methodologies to analyze a real-world problem.
- Identify constraints.
- Demonstrate knowledge of modeling and analyzing functional requirements (e.g., dataflow diagrams, process specifications, and a data dictionary).
- Demonstrate knowledge of modeling and analyzing data requirements (e.g., Jackson diagrams, entity relationship diagrams, and relations).

ITPD01.01.05 Use available reference tools as appropriate.

Sample Indicators
- Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts).

ITPD01.02 Create and use IT-based strategies and project plans when solving specific problems to deliver a product that meets customer specifications.

ITPD01.02.01 Define scope of work for the programming project.

Sample Indicators
- Define scope of work to meet customer needs.
- Demonstrate knowledge of the key functions and subsystems of the software product.
- Demonstrate knowledge of software development process and issues.
- Demonstrate knowledge of the system life-cycle approach.

ITPD01.02.02 Utilize interpersonal skills necessary to work on a software development team.

Sample Indicators
- Identify resources and risks.
- Demonstrate knowledge of cross-functional team structures and team members' roles.

ITPD01.02.03 Design project plan.

Sample Indicators
- Demonstrate knowledge of project budgeting, scheduling, and control issues related to software development.
- Demonstrate knowledge of software development methodology.
- Develop implementation plan.

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ITPD01.03 **Identify and analyze system and software requirements to ensure maximum operating efficiency.**

ITPD01.03.01 Identify the potential importance and impact of new IT technologies.

Sample Indicators
- Identify new technologies relevant to information technology.
- Assess the importance of new technologies to future developments.
- Identify system processing requirements.
- Identify data communication trends and major current issues.

ITPD01.03.02 Assess the potential importance and impact of new IT technologies.

ITPD01.03.03 Explain new and emerging classes of software.

Sample Indicators
- Identify new and emerging classes of software.
- Determine compatibility of hardware and software.

ITPD01.03.04 Summarize elements and types of information processing.

Sample Indicators
- Identify the elements of the information processing cycle (i.e., input, process, output, and storage).

ITPD01.03.05 Explain measurement techniques for increased productivity due to information systems implementation.

Sample Indicators
- Identify metrics for measurements.
- Measure increases in productivity realized by the implementation of information systems.
- Identify new and emerging drivers and inhibitors of information technology change.

ITPD01.04 **Demonstrate the effective use of tools for software development to develop software applications.**

ITPD01.04.01 Employ tools in developing software applications.

Sample Indicators
- Demonstrate knowledge of software development environment.
- Use prototyping techniques.
- Use appropriate Configuration Management tools.
- Use appropriate issues tracking tools.
- Demonstrate knowledge of reuse and components.

ITPD01.04.02 Apply language specific programming tools/techniques.

Sample Indicators
- Develop programs using appropriate language.
- Use appropriate development environment for the selected language (e.g., compilers, debuggers, test generation, static analyzer, etc.).
- Use user interface development tools.

ITPD01.04.03 Demonstrate use of computer-aided software engineering (CASE) tools.

Sample Indicators
- Use appropriate requirement analysis tools.
- Use appropriate modeling and analysis tools.
- Use requirement tracking tools.
- Demonstrate knowledge of software reuse, design pattern, and components.

ITPD01.05 **Design a software application using the software development process to deliver a product to the customer.**

ITPD01.05.01 Describe software development processes and methodology.

Sample Indicators
- Demonstrate knowledge of the information system life cycle.
- Demonstrate knowledge of system analysis issues related to design, testing, implementation, and maintenance.
- Record and analyze process.
- Identify the use of program design tools in a software development process.

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Identify roles on team members/customers in the software development process.
Identify current information life cycle models.

ITPD01.05.02 Create design specifications for a computer application.

ITPD01.05.03 Describe trade-offs involved in design choices.

ITPD01.05.04 Summarize the use of the principles of effective information management, information organization and information-retrieval skills when designing a software application.

ITPD01.05.05 Explain computing/networking hardware and software architecture.

ITPD01.06 Produce (code) a computer application to demonstrate proficiency in developing an application using the appropriate programming language.

ITPD01.06.01 Explain programming language concepts.

Sample Indicators

Demonstrate knowledge of the hardware-software connections.

Demonstrate knowledge of the concepts of data and procedural representations.

Demonstrate knowledge of the basic principles for analyzing a programming language.
Demonstrate knowledge of the basics of structured, object-oriented language.
Demonstrate knowledge of how a programming language can support multitasking and exception-handling.

ITPD01.06.02 Demonstrate proficiency in developing an application using an appropriate programming language.

Sample Indicators

Demonstrate knowledge of current key programming languages and the environment they are used in.

Translate data structure and program design into code in an appropriate language.

Demonstrate knowledge of key constructs and commands specific to a language.

ITPD01.06.03 Describe the range of languages used in software development.

Sample Indicators

Demonstrate knowledge of the range of languages used in software development.

ITPD01.06.04 Summarize program development methodology.

Sample Indicators

Demonstrate knowledge of how to resolve program implementation issues (e.g., debugging, documentation, auditing).
Demonstrate knowledge of software development issues (e.g., audit ability, correctness, reliability, and productivity).
Demonstrate knowledge of code analysis issues related to design, testing, implementation, and maintenance.
Demonstrate knowledge of how to design and implement programs in a top-down manner.
Demonstrate knowledge of how to translate algorithmic and modular designs to develop a program.
Demonstrate knowledge of structured/modular programming.
Demonstrate knowledge of how programming control structures are used to verify correctness.

Use code development tools (e.g. debugger, integrated development environments).

ITPD01.06.05 Explain basic software systems implementation.

Sample Indicators

Use appropriate programming language.

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Analyze and prepare logic using program flowchart.
Analyze and prepare logic using at least one alternative to flowcharting such as pseudocoding.
Review design (e.g., peer and/or user walkthrough).
Compile and debug code.
Prepare code documentation.
Prepare unit testing plan.
Conduct unit testing and bug fixes.

ITPD01.06.06 Develop software requirements/specifications.

Sample Indicators
Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, word flowcharts).
Divide design specifications into logical process blocks.
Identify parameters.
Follow specifications or drawings.
Record process (e.g., using flowchart, step-by-step narrative).
Record data.

ITPD01.06.07 Resolve problems with integration.

Sample Indicators
Troubleshoot unexpected results.
Fix code.

ITPD01.07 Implement software testing procedures to ensure quality products.

ITPD01.07.01 Develop a software test plan.

Sample Indicators
Access needed information using appropriate reference materials.
Define test procedures.
Analyze requirement and design specifications.
Development test cases using requirements and design specification.

ITPD01.07.02 Perform testing and validation.

Sample Indicators
Perform integration testing.
Perform regression testing.
Help with user-acceptance test.
Validate user documentation.

ITPD01.07.03 Document test results.

Sample Indicators
Document errors discovered.
Perform defect tracking.
Document discovered errors.

ITPD01.07.04 Develop software testing audit trails.

Sample Indicators
Record error correction procedures and actions.

ITPD01.08 Perform quality assurance tasks to produce quality products.

ITPD01.08.01 Summarize software quality assurance (QA) procedures.

Sample Indicators
Demonstrate knowledge of Software QA process.
Demonstrate knowledge of the standards/requirements for Software QA.
Develop team relationships to support Software QA tasks.

ITPD01.08.02 Perform software quality assurance tasks to produce a quality software product.

Sample Indicators
Identify standards and issues related to I/O programming and design of I/O interfaces.
Use customer satisfaction in determining product characteristics (e.g., cost, user-friendliness).

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Recognize the relationship between dependability, functionality, ease of use, etc.
Conduct code walkthrough and/or inspection.

Follow established procedures for testing, identifying problems, and tracking resolutions.

ITPD01.09 Perform maintenance and customer support functions to maintain software applications.

ITPD01.09.01 Analyze software technical support needs.

Sample Indicators

Identify maintenance and support requirements.
Apply information and data analysis techniques.
Define scope of work to meet customer support needs.

ITPD01.09.02 Perform customer service.

Sample Indicators

Access needed information using appropriate reference materials.
Provide help to first line user-support personnel to answer user questions.
Provide troubleshooting for software.
Perform system-tuning function.
Diagnose problems within system.
Perform technical functions required by customer/user.
Communicate and document technical support provided.

ITPD01.09.03 Perform software maintenance activities.

Sample Indicators

Following organizational procedural to communicate and document maintenance tasks.
Identify and analyze problem.
Analyze and propose solutions.
Implement solutions in code and documentation.
Release software and documentation updates according to procedures.

ITPD01.10 Develop and maintain a database to store information.

ITPD01.10.01 Explain database development processes.

Sample Indicators

Identify appropriate database type based on customer requirements, availability of software and hardware resources, and distribution specifications, etc.
Apply information and data analysis specifications to create a database model using techniques such as (e.g. -Entity Relationship Diagramming).
Analyze and normalize the developed database model looking for and resolving potential problems.
Analyze the security needs for the database.

ITPD01.10.02 Create, populate, and maintain a database.

Sample Indicators

Create a database from model specifications using both program code and Graphic User Interface (GUI) processes when provided by the database software.
Verify that all possible security safeguards are in place.
Populate the database created with test data.

Perform database queries to analyze database functionality and diagnose problems.
Perform database troubleshooting and system-tuning functions.
Perform technical functions required by customer/user.
Communicate and document technical support provided.
Perform standard maintenance on the database.
Release software and documentation updates according to procedures.

ITPD01.10.03 Perform database interfacing with web applications.

Sample Indicators

Develop scripts and forms that permit access via websites to the database.

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Identify and analyze potential security problems for web access to the database.
Propose security solutions to web-based security problems.
Implement solutions in code and documentation.

Information Technology Cluster Statements (Knowledge and Skill and Performance Elements); Information Technology Career Cluster Cluster Knowledge and Skill Statements (Foundation); Information Technology Cluster Information Support and Services Pathway Knowledge and Skill Statements; Information Technology Cluster Network Systems Pathway Knowledge and Skill Statements; Information Technology Cluster Web and Digital Communication Pathway Knowledge and Skill Statements; Information Technology Cluster Programming and Software Development Pathway Knowledge and Skill Statements are based in part on skill statements developed by Education Development Center, Inc., ITWorks! Ohio, the National Workforce Center for Emerging Technologies (formerly the Northwest Center for Emerging Technologies) and the World Organization of Webmasters (WOW).

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Name: Jeremy Willig

Subject: AP Computer Science Essentials - Java

Subject: Chapter 5 Lesson Plan

Objectives:

Students will have mastered the material in Chapter 5 when they can:

- Use the concepts of object-based programming --- classes, objects, and methods --- to solve a problem.
- Write a loop to visit a sequence of data values.
- Write a nested loop to visit positions in a two-dimensional grid of data values.
- Develop algorithms to perform simple transformations of images, such as the conversion of color to gray scale.
- Develop algorithms to perform simple transformations of sound clips, such as adjusting a sound clip's volume.

Standard: S_____ B_____ I_____

Marzano	Lesson Component
Highlight Strategy Used 1. Similarities & Differences 2. Reinforcing Effort & Provide Recognition 3. Summarizing / Note Taking 4. Homework & Practice 5. Nonlinguistic Representations 6. Cooperative Learning 7. Setting Objectives & Providing Feedback 8. Generating & Testing Hypothesis 9. Cues, Questions & Advanced Organizers	APK (Assess/Activating Prior Knowledge) – 20% of Instructional Time 1. Review Objectives and ask students what related programming experience they have, if any. 2. Review the vocabulary list at the beginning of the chapter, and ask students to identify any terms they are already familiar with. 3. Discussion about digital image processing and how images are digitized, represented, and stored. TIP (Teacher Input) – 20% of Instructional Time 1. Focus students' attention of the objectives for the chapter. 2. Show PowerPoint presentation for the chapter and discuss. 3. Guided instruction, as needed, on class and individual basis SAP (Student Active Participation) – 45% of Instructional Time 1. In Project 5-1, students will write an algorithm that converts an image to two random colors (instead of black and white), and another that asks for an image filename for the colored image. 2. In Project 5-2, students will write an algorithm that converts a color image to grayscale, weighting the RGB values to more accurately reflect how images are viewed by the human eye. 3. In Project 5-3, students will write a program that inverts a grayscale image so that it looks like a photographic negative. 4. In Project 5-4, students will write a program that converts an image to sepia. 5. In Project 5-5, students will write a program that applies a color filter to an image. 6. In Project 5-6, students will write a program that detects edges, and brightens or darkens the pixels to enhance the outlines of objects. 7. In Project 5-7, students will write a program that blurs an entire image. 8. In Project 5-8, students will write a program that reduces the size of an image by a given factor. 9. In Project 5-9, students will write a program that enlarges an image. 10. In Project 5-10, students will write a program that rotates an image counterclockwise by 90 degrees. 11. In Project 5-11, students will modify the sample program that adjusts the volume of a sound clip so that it avoids exceeding the limits on the size of a sample. 12. In Project 5-12, students will write a program that splices two sound clips. 13. In Project 5-13, students will write a program that composes two sound clips. 14. In Project 5-14, students will write a program that introduces echo into a sound clip. 15. In Project 5-15, students will write a program that accepts the name of a sound clip as input and creates a new file that is the inverse of the clip. 16. In the Critical Thinking Activity, students will evaluate a suggestion that a more accurate black-and-white image can be created by first converting the image to grayscale, then converting the grayscale image to black and white.

	ISS (Identify Student Success) – 15% of Instructional Time 1. Grading rubrics on every project for instant feedback 2. Periodic completion check throughout class period 3. Quick Quizzes (Exit Tickets) 4. Chapter 5 Quiz
Homebase	Reading Objective: 1. Determine relevance, accuracy and appropriateness to purpose 2. Analyze information presented in a variety of formats, such as tables, lists, and figures 3. Identify key technical concepts and vocabulary 4. Explain meaning of new terms, vocabulary and concepts 5. Write specific steps for applying information to task or new situation 6. Use correct grammar and sentence structure 7. Use correct spelling 8. Use correct punctuation and capitalization
	Math Objective: 1. Apply basic arithmetic operations 2. Apply relational and logical operators in a logical expression 3. Understand the relationship of data and measurements to the problem 4. Construct charts/tables/graphs from functions of data 5. Describe problem solving techniques
Planning	
Team Planning	

AP Central Collegeboard

AP® Computer Science A
Syllabus 2

Course Overview

AP® Computer Science A is both a college-prep course for potential computer science majors and a foundation course for students planning to study in other technical fields such as engineering, physics, chemistry, and geology. The course emphasizes programming methodology, procedural abstraction, and in-depth study of algorithms, data structures, and data abstractions, as well as a detailed examination of a large case study program. Instruction includes preparation for the AP Computer Science A Exam. In teaching this course, my reward comes when students can apply the programming tools they have learned to real-life examples on their own. Computer science is more than just programming. Students should leave my class with a clear understanding of Java and the ability to adapt to any new programming language that they are taught in college. I want them to have the confidence to tackle any problem-solving obstacles they encounter.

Major Texts

Bergin, Joseph et al. *Karel J Robot: A Gentle Introduction to the Art of Object-Oriented Programming in Java*. Redwood City, Calif.: Dreamsongs Press, 2005.
http://csis.pace.edu/~bergin/KarelJava2ed/Karel%2B%2BJavaEdition.html

College Board. *AP GridWorld Case Study.* New York: College Entrance Examination Board, 2006.

Horstmann, Cay. *Big Java*. Hoboken, N.J.: Wiley, 2002.

Lambert, Ken, and Martin Osborne. *Fundamentals of Java, Comprehensive Course.* 2nd ed. Boston: Course Technology, 2002.

Course Planner [C2]

The resources list includes the following text references: *Karel J. Robot* (KJR), *GridWorld Case Study* (MBS), *Big Java* (BJ), and *Fundamentals of Java* (FJ).

Unit (Weeks)	Title, Topics, and Student Objectives	Resources, Assessments, and Strategies
1 (0–3)	**Karel J. Robot** *(Introduces objects and inheritance)* **Topics:** [C3] • Objects • Classes • Looping • Conditionals **Objectives:** • Write and use simple classes with Karel J Robot • Learn the basics of conditionals and looping	**Resource:** 2 KJR **Assessments:** • Program-specific tasks for Karel • Create a SmartRobot Class to teach Karel more commands: turnRight(), turnAround(), climbStair() • Clear a field of beepers (using loops). • Redistribute a field of beepers (using loops and conditionals) • Run a hurdle race: o same height and equally spaced; o same height and unequally spaced; o different heights and unequally spaced.
2 (4)	**Java Basics** **Topics:** [C3] [C8] [C9] • Computer basics • Java basics • Using the compiler • Input and output **Objectives:** • Understand terminology: CPU, system and application software, primary and secondary memory, LAN, WAN, hard disk, CD-ROM • Understand computer ethics such as acceptable use policies, copyright, intellectual property, freeware, shareware, downloading music • Understand how all the different parts of the computer work together • Understand terminology: compiler, IDE, JVM • Edit, compile, and run a simple program in Java • Understand the different compile time errors, runtime errors, and logic errors • Use BufferedReader for input • Use output with System.out using print and println and format output to look nice	**Resource:** • FJ: lesson 3, Critical thinking • FJ: Project 1-1, Critical thinking **Assessments**: • Labs: Triangle, rectangle, square: area, and perimeter program • Get input for the registrar's office program • Label the parts of the computer **Strategies**: • To discuss computer ethics, begin by looking at the school's acceptable use policy, then go to the Web and look at the ACM's code of ethics. Students will write a small paper in favor of or against something related to computer ethics such as making copies of a copyrighted program and giving it away for free. • Assign a lot of small programs that illustrate different types of input and output—make sure students have used every type of input and displayed it in different ways.

C2—The course includes all of the topics listed in the "Computer Science A" column of the Topic Outline in the AP Computer Science Course Description

C3—The course teaches students to design and implement computer-based solutions to problems in a variety of application areas.

C8—The course teaches students to identify the major hardware and software components of a computer system, their relationship to one another, and the roles of these components within the system.

C9—The course teaches students to recognize the ethical and social implications of computer use.

3 (5)	**Defining Variables, Arithmetic Expressions** **Topics:** [C3] [C4] [C5] [C6] • Using and understanding variables • Comments • Arithmetic expressions in Java programs • Representing numbers in different bases **Objectives:** • Understand terminology: comments, variables, constants, reserved words, literals • Declare and initialize variables and constants in Java • Understand mathematical expressions in Java and their precedence • Understand how to change bases of numbers • Use casting to make their data more accurate • Understand limitations of finite representations of numbers such as the range of integers, real and float • Use the assignment operator correctly	**Resource:** • FJ: lesson 3, Projects **Assessments:** Labs: • Paycheck program; have employee information entered and calculate pay • Modify the paycheck program to also include any overtime hours in the calculations **Strategies:** • Students need practice with how the different types, double and int, relate when they are used in mathematical operations • Present a lot of small program examples in which they have to find the errors
4 (6–7)	**Introduction to Classes and OOP** **Topics:** [C4] [C5] [C6] • Creating and using classes **Objective:** • Understand terminology: constructor, accessor, mutator, instance variable, encapsulation, information hiding, procedural abstraction • Understand the difference between public and private access in a class • Use and comprehend the DecimalFormat class and the Random class • Write classes from scratch, choosing appropriate data representation • Understand how to declare a method and declare parameters in that method • Understand the use of preconditions, postconditions and assertions when designing methods	**Resource:** • BJ: chapter 3 **Assessments:** Labs: Purse class and StampMachine class **Strategies:** • Give students classes to complete, in which they are given a description and they must choose appropriate representation for that class

C3—The course teaches students to design and implement computer-based solutions to problems in a variety of application areas.

C4—The course teaches students to use and implement commonly used algorithms and data structures.

C5—The course teaches students to develop and select appropriate algorithms and data structures to solve problems.

C6 - The course teaches students to code fluently in an object-oriented paradigm using the programming language Java. The course teaches students to use standard Java library classes from the AP Java subset delineated in Appendices A and B of the *AP Computer Science Course Description*. (Note: Students who study a language other than Java in AP Computer Science must also be taught to use Java, as specified in the AP Java subset.)

	• Understand the difference between OOP development and top-down development	
5 (8–12)	**Conditionals and Looping** **Topics:** • if, if else, while, for **Objectives:** [C3] [C6] • Understand terminology: control statements, counter, infinite loop, iteration, nested loops, logical operators, truth tables • Construct syntactically correct loops and conditional statements • Understand the different errors that may occur with loops and employ helpful debugging techniques such as hand-tracing and extra print statements to figure out errors • Use logical operators to make programs more robust • Construct truth tables • Be able to calculate statement execution counts, e.g., how many times did the loop execute?	**Resources:** • FJ: lessons 4 and 6, Projects **Assessments:** Labs: • Approximate PI using Leibniz's method • Base Conversion: Convert from base 10 to base 2 • Guess My Number game • Euclidean algorithm program • Perimeter and area of rectangles using all combinations of certain range **Strategies:** • Students need practice writing different types of loops and conditionals
6 (13–14)	**The String Class** **Topic:** [C6] • String class **Objectives:** • Instantiate String objects • Understand that Strings are immutable • Use appropriate String methods to solve problems	**Resource:** • FJ: lesson 10.1 **Assessments:** • FJ: exercise 10.1 • Lab: LineEditor Class (*AP CS Course Description*) **Strategies**: • Work several examples using the substring method
7 (15–17)	**ArrayList** **Topic:** [C6] • Using ArrayList class **Objective:** • Use the ArrayList methods	**Resources:** • FJ: lesson 10.7 • BJ: 13.1 and 13.2 **Assessments:** • BJ: exercise p.13.1 • WordList (2004 AP CS A Exam, Free-Response Question 1, AP Central®) **Strategies:** • Stress the difference between add and set • Draw pictures of the ArrayList after add, set, and remove have been performed

C3—The course teaches students to design and implement computer-based solutions to problems in a variety of application areas.

C6 - The course teaches students to code fluently in an object-oriented paradigm using the programming language Java. The course teaches students to use standard Java library classes from the AP Java subset delineated in Appendices A and B of the *AP Computer Science Course Description*. (Note: Students who study a language other than Java in AP Computer Science must also be taught to use Java, as specified in the AP Java subset.)

8 (18)	**Arrays** **Topics:** [C4] [C5] [C6] • Declaring and initializing arrays • Manipulating arrays with loops • Creating parallel arrays **Objectives:** • Understand terminology: array, element, index, logical size, physical size, parallel arrays • Declare one-dimensional arrays in Java • Use initializer lists when declaring arrays • Manipulate arrays using loops and array indices • Use the physical and logical size of an array together to guarantee they do not go beyond the bounds of their array by identifying the boundary cases and using test data to verify results • Understand how parallel arrays can be useful when processing certain types of data • Work with arrays of primitive data types as well as arrays of objects while understanding the difference between the two types of data • Understand when to choose an array to represent data instead of an ArrayList	**Resource:** • FJ: lesson 8, Projects **Assessments:** Lab: • For one-dimensional arrays, read in numbers and place each one in an even, odd, and/or negative list **Strategies:** • Students need practice manipulating loops that work with arrays • Students also need to be reminded about the indexing of arrays beginning at zero
9 (19–21)	**Searching and Sorting Arrays** **Topics:** • Bubble, Selection, Insertion sorts • Sequential and Binary searches **Objectives:** [C4] [C5] [C6] • Write a method for searching an array • Perform insertions and deletions at given positions in arrays • Trace through sorting and searching algorithms and understand time constraints of each • Understand the algorithms behind each of the following searching and sorting techniques: bubble, selection, and insertion sorts; sequential search and binary search • Understand the time efficiency	**Resource:** • FJ: lesson 10 **Assessments:** Lab: • Students make their own "utility" class that includes all of these sorts and searches **Strategies:** • Students need practice tracing through sorts and searches and determining the runtime of each • Students also do well with a worksheet that addresses the efficiency of each of the strategies they have learned, efficiency for a sorted versus unsorted list, and "best," "worst," and "average" efficiency

C4—The course teaches students to use and implement commonly used algorithms and data structures.

C5—The course teaches students to develop and select appropriate algorithms and data structures to solve problems.

C6 - The course teaches students to code fluently in an object-oriented paradigm using the programming language Java. The course teaches students to use standard Java library classes from the AP Java subset delineated in Appendices A and B of the *AP Computer Science Course Description*. (Note: Students who study a language other than Java in AP Computer Science must also be taught to use Java, as specified in the AP Java subset.)

	of each sort and search and when it is desirable to use each one • Identify reusable components from existing code using classes and class libraries • Given different scenarios, students should be able to choose the most appropriate sort or search	
10 (22–24)	**GridWorld (Parts 1–3)** **Topics:** [C6] [C7] • Experimenting with a large program • Using classes • Modifying classes **Objectives:** • Run the case study and analyze output • Understand how the development of a large program came about by reading the chapters of the case study • Observe and experiment with the GridWorld case study • Understand the Bug class, Runner class, Grid Interface • Extend the Bug class by creating a specialized bug to meet some new type of bug requirement	**Resource:** • GridWorld: Parts 1–3 **Assessments:** • Exercises from within the case study **Strategies**: • Read the manual for the case study thoroughly • Be familiar with all the classes and interfaces discussed
11 (25–27)	**More on Classes, Inheritance, Interfaces** **Topics:** [C5] [C6] • Classes • Inheritance • Abstract classes • Interfaces **Objectives:** • Demonstrate inheritance by extending a class • Understand polymorphism and know when it is appropriate to override methods in a super class • Create and extend an abstract class • Create and extend a class given class specifications with the relationships among the classes described • Implement an interface	**Resources:** • BJ: chapter 11 • FJ: lessons 9.5 & 9.6 **Assessments:** • Create an abstract Shape class. • Pet Parade (2004 AP CS A Exam: Free-Response Question 2, on AP Central) **Strategies**: • Draw pictures of the inheritance hierarchy • Note: This unit could be moved to after unit 12 to use the GridWorld Case Study to introduce inheritance

C5—The course teaches students to develop and select appropriate algorithms and data structures to solve problems.

C6 - The course teaches students to code fluently in an object-oriented paradigm using the programming language Java. The course teaches students to use standard Java library classes from the AP Java subset delineated in Appendices A and B of the *AP Computer Science Course Description*. (Note: Students who study a language other than Java in AP Computer Science must also be taught to use Java, as specified in the AP Java subset.)

C7—The course teaches students to read and understand a large program consisting of several classes and interacting objects, and enables students to read and understand the current *AP Computer Science Case Study* posted on AP Central®.

12 (28–29)	**GridWorld (Part 4)** **Topic:** [C4] [C5] [C6] • Inheritance **Objective**: • Use inheritance to extend the Critter Class by making new types of Critters	**Resource:** • MBS: chapter 4 **Assessments:** • Exercises from the text **Strategies**: • Have fun with this chapter • Allow the students to be creative after working through the exercises and analysis • Create different kinds Critters
13 (30–31)	**Recursion (and Merge Sort)** **Topics:** [C4] [C5] [C6] • Recursion • Merge Sort **Objectives:** • Create a recursive method to solve a problem • Understand the difference between recursive and iterative solutions to a problem • Understand and use the Merge Sort • Understand how to calculate the informal runtime of merge sort and compare it's running time to the other sorts already learned	**Resources:** • FJ: lesson 11.1 • BJ: section 18.4 **Assessments:** • Factorial program • Rewrite loop programs with recursion **Strategies**: • Ask, "What is returned by this method?"
14 (32–36)	**Review** **Topics:** • Review AP Computer Science A topics. **Objective:** • Prepare for the AP CS A Exam by reviewing material and taking practice exams	**Resources:** • Previous free-response questions from AP Central **Assessments:** • Practice exams

C4—The course teaches students to use and implement commonly used algorithms and data structures.

C5—The course teaches students to develop and select appropriate algorithms and data structures to solve problems.

C6 - The course teaches students to code fluently in an object-oriented paradigm using the programming language Java. The course teaches students to use standard Java library classes from the AP Java subset delineated in Appendices A and B of the *AP Computer Science Course Description*. (Note: Students who study a language other than Java in AP Computer Science must also be taught to use Java, as specified in the AP Java subset.)

Teaching Strategies

I strive to create a learning environment that is comfortable for all students. Those who have never touched a computer should be as at ease in my class as those who have taught themselves how to program. I aim to foster critical thinking, a lifelong skill, and I accomplish this by giving challenging, yet not impossible, assignments. When new topics are introduced, I use a hands-on approach of having students see and run examples. While the novices ask questions, more experienced students can make changes to the examples and experiment with different outcomes.

Experienced programmers help the novices in a mentoring program after school. This promotes student leadership and propels in-class learning.

Lab Component

I give at least two programs per unit, and students work on programs about 70 percent of the time. They can also come in before or after school for extra

programming time and help. All computers have *JCreator LE* installed, and students have access to information on how to download it at home.

Prince George County

AP Computer Science A Syllabus

Course Description:

The AP Computer Science course is the Third course in the series of computer science courses offered in Prince Georges County. Because the development of computer programs to solve problems is a skill fundamental to the study of computer science, a large part of the course is built around the development of computer programs or parts of programs that correctly solve a given problem. The course also emphasizes the design issues that make programs understandable, adaptable, and, when appropriate, reusable. At the same time, the development of useful computer programs and classes is used as a context for developing other important concepts in computer science, including the development and analysis of algorithms, the development and use of fundamental data structures, and the study of standard algorithms and typical application. In addition, an understanding of the basic hardware and software components of computer systems and the responsible use of these systems are integral parts of the course. This course will prepare the student for the AP Computer Science A exam.

Course Resources:

Java Software Solutions for AP Computer Science A, J.Lewis, W.Loftus, and C.Cocking, 2nd Edition, 2007, Prentice Hall.

Be Prepared for the AP Computer Science Exam In Java, M. Litvin, 3rd Edition, 2008, Skylit Publishing.

AP GridWorld Case Study.

Web sites:

http://www.allstudentscanlearn.org – Mrs. White's website. This website should be checked daily for updates. Homework and assessments will be announced here as well as in class.

http://java.sun.com/javase/downloads/index/jsp
Sun's website to download latest version of the JAVA compiler.

www.aw-bc.com/cssupport/LewisLoftusCocking.htm
Source code and case studies provided by the textbook authors.

www.acm.org/serving/se/code.htm
ACM/IEE-CS Joint Task Force on Software Engineering Ethics and Professional Practices.

Note: A chart is available at the end of the syllabus to show correlation between the "Computer Science A" column of the Topic Outline in the AP Computer Science Course Description and each unit of this syllabus.

Grading Policy:

Labs – 10%
Classwork/Homework/Warmups – 20%
Assessments – 40%
Seasonal Packets and Projects – 30%

Unit Information:

Unit 1: Introduction to Computer Systems & Ethics
The student will learn about the components of a computer system, hardware and software. The code of ethics provided by the ACM will be explored. The students will download and install the latest JAVA compiler and the GridWorld Case Study, as well as the support material provided by Lewis,Loftus,Cocking.

Unit 2: Key Elements of a Program
This unit explores the key elements of a program. The use of primitive data types and the use of pre-defined objects are introduced. Students are also introduced to design techniques including pseudocode, flowcharting, and structure charts. Students create their first programs. Students will also work through Part One of the GridWorld Case Study.

Unit 3: Flow Control Structures
This unit covers the two basic flow control structures. Students will learn to use both selection and repetition statements to control the flow through a program. The students will also learn about boolean expressions and truth tables.

Unit 4: Writing Classes
This unit covers how to create a class. Proper method structure and class composition is enforced. This unit also explores interfaces and how to use them to create a class.

Unit 5: Arrays
This unit covers the design and use of one dimensional arrays, including using arrays as parameters, and searching and sorting arrays. The use of the ArrayList class and the use of ListIterator will be introduced. Multidimensional arrays will also be explored.

Unit 6: Advanced Classes
This unit covers the concepts of inheritance, class hierarchies, and polymorphism. Abstract classes will be explored. Polymorphism will be explored using both inheritance and interfaces.

Unit 7: Recursion
This unit covers recursion, including what recursion is and when it should be used. Concepts of recursion in searching and sorting are explored.

Unit 8: GridWorld Case Study
Students will complete parts two, three, and four of the GridWorld Case Study.

Unit 9: Exam Preparation
The students will review materials to prepare for the exam. An exam review book will be used, as well as, previous year's exams.

Unit 10: Final Project
Using previously created classes, the student will create a program to solve a specific situational problem. The students may work in a partnership with another student, or work alone.
Sample projects:
Create the game of 21 using the deck of cards created in Chapter 6 of Lewis,Loftus,Cocking
Create the game of dice poker using the die class provided in Chapter 4 of Lewis,Loftus,Cocking.

Additional Information:

Requirement: Minimum of three hours of computer access a week.

Students will have access to the classroom computer lab during class time. Students will also have access to the school computer lab at least 2 days a week after school for up to an hour. Students will be responsible for keeping a log of lab hours and having it signed by the appropriate supervisor.

Correlation to AP Topic Outline [C2]

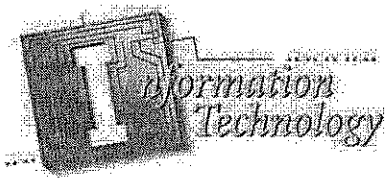
I. Object-Oriented Program Design The overall goal for designing a piece of software (a computer program) is to correctly solve the given problem. At the same time, this goal should encompass specifying and designing a program that is understandable, can be adapted to changing circumstances, and has the potential to be reused in whole or in part. The design process needs to be based on a thorough understanding of the problem to be solved.	
A. Program design	
1. Read and understand a problem description, purpose, and goals.	Units 1 and 3
2. Apply data abstraction and encapsulation.	Units 2 and 4
3. Read and understand class specifications and relationships among the classes (''is-a,'' ''has-a'' relationships).	Unit 4 and 6
4. Understand and implement a given class hierarchy.	Unit 4
5. Identify reusable components from existing code using classes and class libraries.	Unit 4
B. Class design	
1. Design and implement a class.	Unit 4
3. Choose appropriate data representation and algorithms.	Units 3 and 4
4. Apply functional decomposition.	Units 4
5. Extend a given class using inheritance.	Units 6
II. Program Implementation The overall goals of program implementation parallel those of program design. Classes that fill common needs should be built so that they can be reused easily in other programs. Object-oriented design is an important part of program implementation.	
A. Implementation techniques	
1. Methodology	
a. Object-oriented development	Unit 2
b. Top-down development	Unit 3
c. Encapsulation and information hiding	Unit 4 and 6
d. Procedural abstraction	Unit 4 and 6
B. Programming constructs	
1. Primitive types vs. objects	Unit 2
2. Declaration	
a. Constant declarations	Unit 2
b. Variable declarations	Unit 2
c. Class declarations	Unit 4
d. Interface declarations	Unit 4
e. Method declarations	Unit 4
f. Parameter declarations	Unit 4

3. Console output (System.out.print/println)	Unit 2
4. Control	
a. Methods	Unit 4
b. Sequential	Unit 3
c. Conditional	Unit 3
d. Iteration	Unit 3
e. Recursion	Unit 7
C. Java library classes (included in the A-level (AP Java Subset)	Units 2, 4, 5, and 6

III. Program Analysis The analysis of programs includes examining and testing programs to determine whether they correctly meet their specifications. It also includes the analysis of programs or algorithms in order to understand their time and space requirements when applied to different data sets.	
A. Testing	
1. Test classes and libraries in isolation.	Unit 4
2. Identify boundary cases and generate appropriate test data.	Unit 4
3. Perform integration testing.	Unit 4
B. Debugging	
1. Categorize errors: compile-time, run-time, logic.	Units 1, 2, 4 and 5
2. Identify and correct errors.	Units 1, 2, 4 and 5
3. Employ techniques such as using a debugger, adding extra output statements, or hand-tracing code.	Units 1, 2, 4 and 5
C. Understand and modify existing code	Units 1, 2, 3, 4, 5, 6, 7, 8, and 10
D. Extend existing code using inheritance	Units 6
E. Understand error handling	
1. Understand runtime exceptions.	Units 4
F. Reason about programs	
1. Pre- and post-conditions	Units 4
2. Assertions	Unit 4
G. Analysis of algorithms	
1. Informal comparisons of running times	Unit 5
2. Exact calculation of statement execution counts	Unit 5
H. Numerical representations and limits	
1. Representations of numbers in different bases	Unit 1
2. Limitations of finite representations (e.g., integer bounds, imprecision of floating-point representations, and round-off error)	Units 2 and 3

IV. Standard Data Structures Data structures are used to represent information within a program. Abstraction is an important theme in the development and application of data structures.	
A. Simple data types (int, boolean, double)	Unit #2
B. Classes	Units 2, 4, 6, and 10
C. One-dimensional arrays	Unit 5

V. Standard Algorithms Standard algorithms serve as examples of good solutions to standard problems. Many are intertwined with standard data structures. These algorithms provide examples for analysis of program efficiency.	
A. Operations on A-level data structures previously listed	
1. Traversals	Unit 5
2. Insertions	Unit 5
3. Deletions	Unit 5
B. Searching	
1. Sequential	Unit 5
2. Binary	Unit 5
C. Sorting	
1. Selection	Unit 5
2. Insertion	Unit 5
3. Mergesort	Unit 5
VI. Computing in Context A working knowledge of the major hardware and software components of computer systems is necessary for the study of computer science, as is the awareness of the ethical and social implications of computing systems. These topics need not be covered in detail but should be considered throughout the course.	
A. Major hardware components	
1. Primary and secondary memory	Unit 1
2. Processors	Unit 1
3. Peripherals	Unit 1
B. System software	
1. Language translators/compilers	Unit 1
2. Virtual machines	Unit 1
3. Operating systems	Unit 1
C. Types of systems	
1. Single-user systems	Unit 1
2. Networks	Unit 1
D. Responsible use of computer systems	
1. System reliability	Unit 1
2. Privacy	Unit 1
3. Legal issues and intellectual property	Unit 1
4. Social and ethical ramifications of computer use	Unit 1



INFORMATION TECHNOLOGY CAREER CLUSTER
PATHWAY: PROGRAMMING & SOFTWARE DEVELOPMENT

DEGREE/TRAINING REQUIRED Standard Occupational System (SOC) Code	OCCUPATION	KANSAS MEDIAN SALARY[i]	% CHANGE / EMPLOYMENT PROSPECTS	
			KANSAS 2004-2014[ii]	USA 2006-2016[iii]
-Associate Degree -Certifications -On the Job Training -2 Yr. Community/Technical Colleges -Registered Apprenticeship				
15-1041	Computer Support Specialists: Software Applications QA Specialist / Software Applications Tester	$18.08/hr.	+19%	+13%
Bachelor's Degrees Colleges / Universities				
15-1031	Computer Software Engineers, Applications: Applications Analyst / Applications Engineer / Applications Business Analyst / Applications Computer Engineer / Software Applications Specialist / Software Applications Architect / Software Applications Design Engineer / Software Applications Development Engineer / Software Applications Engineer	N/A	N/A	+45%
15-2031	Operations Research Analysts: Applications Data Modeler	N/A	N/A	+11%
15-1032	Computer Software Engineers, Systems Software: Operating Systems	$36.00/hr.	+38%	+28%

[i] Salary data from the Kansas Department of Labor, 2007 Kansas Wage Survey
[ii] 2004-2014 Kansas Occupational Outlook Study, http://www.dol.ks.gov
[iii] 2008-2009 National Employment Occupational Outlook Handbook, http://www.bls.gov/oco

DEGREE/TRAINING REQUIRED Standard Occupational System (SOC) Code	OCCUPATION	KANSAS MEDIAN SALARY[i]	% CHANGE / EMPLOYMENT PROSPECTS	
			KANSAS 2004-2014[ii]	USA 2006-2016[iii]
	Designer/Engineer / Systems Test Engineer / Systems Tester			
15-1041	Computer Support Specialists: Software Applications QA Specialist / Software Applications Tester	$18.08/hr.	+19%	+13%
15-1081	Network Systems and Data Communications Analysts: Operating Systems Programmer/Analyst	$26.84/hr.	+45%	+53%
15-1021	Computer Programmers: Operating systems Programmer / Operating Systems Programmer/Analyst	$29.56/hr.	0%	-4%
Graduate Degrees Colleges/Universities				
15-1071	Network and Computer Systems Administrators: Systems Administrator / Operating Systems Project Lead	$26.99/hr.	+31%	+27%
15-1051	Computer Systems Analysts: Network Analyst / Network Systems Support Lead	$29.87/hr.	+22%	+29%

N/A = Data Not Available

Employment is projected to:	Growth compared to average:
increase 21 percent or more	Grow much faster than average
increase 14 to 20 percent	Grow faster than average
increase 7 to 13 percent	Grow about as fast as average
increase 3 to 6 percent	Grow more slowly than average
decrease 2 percent to increase 2 percent	Little or no change
decrease 3 to 9 percent	Decline slowly or moderately
decrease 10 percent or more	Decline rapidly

Name: _____ Class: _____ Date: _____ ID: A

AP Computer Science - Chapter 5 Exam

True/False
Indicate whether the statement is true or false.

____ 1. When an image is loaded by a Web browser, the software maps the bits from the image file into a rectangular area of colored dots for display.

____ 2. In a pixel grid, the y-coordinates increase positively towards the top.

____ 3. Each pixel is accessible by means of its (x, y) coordinates.

____ 4. To convert an image to grayscale, the average of a pixel's color values is calculated, and each value is reset to the average.

____ 5. An image with a file size of 120 kilobytes and an image size of 300 by 225 pixels is a large file.

____ 6. Loops that march across a row before moving onto the next row use a row-major traversal pattern.

____ 7. To create a copy of an image, it is easiest to start by treating a new, blank image with the same height and width as the original.

____ 8. The aspect ratio of a pixel is used to detect an edge.

____ 9. When the resolution of a monitor is increased, the images appear larger.

____ 10. A sample size of 16 bits allows signed integers from 0 to 1.

Modified True/False
Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

____ 11. In a pixel grid, the x-coordinates increase positively towards the bottom. _____

____ 12. A mutator is a method that is used to modify the internal contents of an object. _____

____ 13. Use the method setColor to replace an RGB value at a given position in an image. _____

____ 14. For the color white, the RGB values are all 255. _____

____ 15. Use the saveAs method to overwrite an image file with the changes made in the program.
_____

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 16. ____ give programmers access to complex behavior.
a. Objects
b. Aspects
c. Samples
d. Mutators

____ 17. In a pixel grid, the position (0, 0) is in the ____ corner of the grid.
a. upper-right
b. upper-left
c. lower-right
d. center

____ 18. In a pixel grid, the position (*width*-1, *height*-1) is in the ____ corner of the grid.
a. upper-right
b. upper-left
c. lower-right
d. center

____ 19. An image basically consists of all of the following EXCEPT ____.
a. width
b. height
c. depth
d. set of pixels

____ 20. A pixel contains integer values that represent its color in terms of ____ components.
a. PPI
b. aspect
c. height and width
d. RGB

____ 21. A program instantiates a class by using one of its ____ with the new operator.
a. variables
b. constructors
c. accessors
d. mutators

____ 22. Object ____ makes a new object available to a program.
a. orientation
b. definition
c. instantiation
d. access

____ 23. The area of RAM reserved for Java objects is called the ____ space.
a. heap
b. free
c. storage
d. save

____ 24. To use an object effectively, the programmer must know the set of ____ that it recognizes.
a. classes
b. methods
c. parameters
d. packages

____ 25. A(n) ____ is a method that returns a value and is used to examine part of the contents of an object.
a. mutator
b. evaluator
c. instantiator
d. accessor

____ 26. A constructor without parameters is known as a(n) ____ constructor.
a. default
b. uninstantiated
c. mutated
d. object

____ 27. An enhanced for loop is also called a(n) ____ loop.
a. for-for
b. for-each
c. then-for
d. if-for

____ 28. A(n) ____ loop structure visits each element in a sequence or counts through a sequence of numbers using a single loop control variable.
a. nested
b. linear
c. single
d. straight

____ 29. The ____ method builds and return a new image with the same attributes as the original one, but with an empty string as the filename.
a. copy
b. duplicate
c. clone
d. repeat

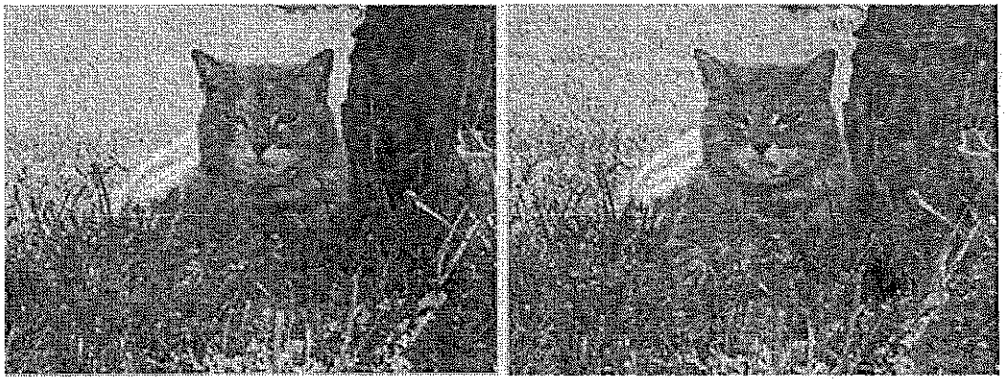
____ 30. A sound with higher ____ results in a higher fidelity to the original sound as well in a large file size.
a. frequency
b. volume
c. density
d. sampling rate

____ 31. The sounds package includes the ability to ____.
a. record new sound clips
b. open files containing existing clips
c. play the currently loaded clip
d. all of the above

____ 32. One way of rearranging sound clips, called ____, is to place one clip after another to form a new sound.
a. splicing
b. dubbing
c. composing
d. echoing

____ 33. The inputs to an echo algorithm are a sound clip and an integer ____.
a. coordinate
b. value
c. variable
d. delay

FIGURE 5-1



____ 34. The image to the right in Figure 5-1 above has ____.
a. been converted to black and white
b. had its brightness adjusted
c. had its edges detected
d. been converted to grayscale

FIGURE 5-2



____ 35. ____ detection was used in Figure 5-2 above to remove the full colors of the original image to uncover the outlines of the objects represented in the image.
a. Line
b. Edge
c. Luminance
d. Color

Case 5-1
Emma is writing a program that will adjust a sound clip's volume.

____ 36. Emma knows that to increase a sound clip's volume, she needs to instruct the program to ____.
a. increase the size of the sample value
b. decrease the amplitude
c. divide the sound clip's old value by a given factor
d. adjust the sound's aspect ratio

____ 37. If the factor Emma uses in her algorithm is ____, the product of the sample and the factor might exceed the limit of the legitimate sample range.
a. greater than 32767
b. less than -32768
c. greater than 1
d. less than 1

Case 5-2
Nico is writing a program that combines sound files.

____ 38. Nico wants to ____, or blend together two sound clips so that they will play simultaneously.
a. splice
b. echo
c. compose
d. blur

____ 39. Nico wants to add a(n) ____, an effect wherein an earlier part of a sound clip is heard concurrently with the sound at the present moment.
a. splice
b. echo
c. compose
d. blur

Completion
Complete each statement.

40. A(n) _____ is a colored dot that is used as a part of an image file display.
41. Image-manipulation packages allow you to transfer images from file to working storage in _____.
42. _____-based programming is the discipline of using existing classes, objects, and methods to solve problems.
43. The set of an object's methods available to users is called its _____.
44. The RGB value (0, 0, 0) represents the color _____.

Matching

Identify the letter of the choice that best matches the phrase or definition.

a. API
b. PPI
c. Xmx
d. Luminance
e. Amplitude

____ 45. A sound's volume at a given moment.
____ 46. The set of interfaces in a package or an entire language.
____ 47. The average of a pixel's RGB values.
____ 48. Used to adjust the heap space used for data memory.
____ 49. Used to measure monitor resolution.

Essay

50. List three ways that digital sound differs from digital images. What are some capabilities for sound manipulation?

AP Computer Science
Lesson 5
Assignment: 5-4

Name: _____
Pts. Possible 42
Student Score ____ / 42

Proficient = 3pts Acceptable = 2pts Progressing = 1pt Unacceptable = 0 N/A = Not Applicable

_____ **Headings containing Name, Subject and Assignment are present in all code, typed NOT written**
Form Code & Assembly Code

_____ **Labels containing Name, Subject and Assignment Number are present on form**
Present on the Form Design, not just headings in the code

_____ **Form, Labels, Text Boxes and Command Buttons are appropriately named on Form and in Properties of the Label**
Named something that makes sense, such as cmdCalculate or txtUserInput. lblLabel1 is not acceptable!

_____ **Form Design is well thought out and readable (Text Boxes should have label also explaining what the text box is)**
Design your form as if you were going to sell it to a customer. Form should be usable for a stranger off the street that knows nothing about programming

_____ **Code is well thought out and readable (Constant Numbers should not be present in code unless instructed to do so)**
Constant numbers are only acceptable if the number cannot change. Items like price are variable and can change. Items like calories burnt per minute will not change

_____ **Tab order of text boxes and labels is appropriate, not random**
Start the cursor where the user should start entering data. They should not have to use the mouse to get to the right fields

_____ **Mathematical Operations are exact and working**
Double check your calculations and make sure they are working

_____ **Spelling, on both the form and in code**
Spelling is important in all aspects of school work and life. Practice it here as well

_____ **Convert Color Image to Gray Scale**
Converts a color image to gray scale

_____ **Convert Gray Scale Image to Sepia**
Converts a gray scale image to sepia

_____ **Use of Conditional Operators**
For comparing two values

_____ **Use of If/If Else Statements in code**
For choosing between two separate paths

_____ **Output is labeled and readable (DO NOT be satisfied with "5", it should read "5 Pounds" or whatever the output is)**
Just giving an answer is not acceptable. The user needs to know what the data given to them is. If it is 5.03 for an answer, make it read $5.03 Total Cost

_____ **Comments are present, readable and used correctly (if applicable)**
Complex programs are not normally written by one person but a group of people. Commenting your code enables you to pass along the program once your portion is done and the next programmer will know exactly what you have done and what each line of code you entered is, without having to ask you for clarification

PLC Meeting on 10-19-2011

Members Present: Mike Stoppel, Jeremy Willig, Zac Kliewer, Krissy Hummel

Topic: State Standards for new courses

As we develop new courses for the department, we have a new process for submitting the courses for district approval. We looked at the State standards for the Java IP course. Jeremy has created a unit for the process. We looked at the standards for Math, Reading, Writing, and Science. There a MANY standards for the first three areas with only 3-4 for Science. Jeremy will continue to work on narrowing-down the pertinent standards so the course can be submitted for approval.

Zack is looking for sample textbooks for the two courses that can be added to the Business Administration strand. A problem he has encountered is trying to find textbooks that will meet all of the needs of the IB program and the State. He will continue to do more research.

Mike Stoppel
Recorder