

Student Name:

contact: wilde.m@stowevalley.com

# Southam College Computing & ICT Department



## Summer Project

This booklet provides several tasks for you to update your current knowledge and learn new concepts required for A Level

Please complete the research and tasks. These will form the basis of a suitability test when you return in September.

Bring this booklet back in for checking on your first lesson in September

Some Sources Of Information:

[www.teach-ict.com](http://www.teach-ict.com) --- YouTube: CraignDave --- [www.orc.org.uk](http://www.orc.org.uk) --- bbc bitesize

## Contents

Recommended resources .....	3
Systems Architecture .....	4
Memory.....	4
Storage .....	4
Networks.....	5
Systems Software.....	5
Ethical, Legal, Cultural and Environmental Concerns .....	5
Computational Thinking – Theory.....	6
Computational Logic and Calculations.....	6
Programming Tools and Standards.....	8

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## Using this pack

The transition from working at a GCSE standard to an A-Level is significant, including an increasing emphasis on technical content, extended answers and independent research. This pack is designed to allow you to practice some of these skills, building on the work that you may have covered at GCSE. Whether you have studied GCSE Computer Science or not, and whatever your grade, there will be something here to support your preparation for A-Level.

This transition pack is organised into three sections:

- Computer Science Theory
- Algorithmic Thinking and Problem Solving

This broadly matches the examination and non-examination assessments of the new GCSEs and A Levels. Within each section there will be practice questions to support both the content and style of writing required at A-Level, plus various links to books and other resources that you can use to study any topics that require attention. Each section is based on the GCSE specification, so that the content should be familiar if you have already studied GCSE Computer Science; if you are new to the subject, this should give you an overview of the main topic areas that you will study.

The questions are designed to go beyond GCSE standard and prepare you for A-Level study. Some questions are quite straightforward, and test core knowledge. Others are chosen to give you a chance to extend both your thinking and writing skills and to demonstrate your creativity in solving problems. There are also some genuinely hard extension questions if you want them!

Note that this is not a “self-study” document on its own. This resources contains questions, prompts, starting points and solutions to help you study one or more core topics before starting the A-Level.

## Computer Science Theory

### Recommended resources

To complete you can use Teach ICT, and the A level Craig and Dave resources.

I highly recommend that you purchase the following book as it is really good for your A level and we will be using it in you're A level

OCR AS and A Level Computer Science by P.M Heathcote



## Systems Architecture

1. Produce an annotated diagram showing how the CPU processes data. This should include
  - a. The purpose of the CPU
  - b. Common CPU components and their function
    - i. Arithmetic and Logic Unit (ALU)
    - ii. Control Unit (CU)
    - iii. Cache
    - iv. Registers
      1. Memory Address Register (MAR)
      2. Memory Data Register (MDR)
      3. Program Counter
      4. Accumulator
  - c. Reference to the fetch-execute cycle
2. Discuss, with examples, how the performance of a CPU can be improved, including:
  - a. Increasing the clock speed
  - b. Increasing the cache size
  - c. Increasing the number of processing cores

## Memory

1. Compare RAM and ROM
2. Explain the need for virtual memory in a computer system
3. Describe the characteristics of flash memory

## Storage

1. Complete the following table comparing optical, magnetic and solid state storage media

	Capacity	Speed	Portability	Durability	Reliability	Cost
Optical						
Magnetic						
Solid State						

2. Justify one use of each storage method

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## Networks

1. Explain the similarities and differences between
  - a. A LAN and a WAN
  - b. Client-server and peer-to-peer networks
2. Explain the difference between the Internet and the World Wide Web
3. Describe the factors that affect network performance, and explain how network performance can be improved
4. Draw three different network topologies
  - a. Label all the components required to create each network
  - b. Explain the purpose of each component in the network, including
    - i. Wireless Access Points
    - ii. Routers
    - iii. Switches
    - iv. Network Interface Cards
    - v. Transmission media, such as Ethernet Cables
5. There have been many recent high-profile cyber-attacks across the world, including the attack on the NHS in May 2017. Some commentators have said that “we now rely too much on technology”. Write an essay explaining how far you agree with this statement and including descriptions of threats to IT systems and ways to reduce vulnerabilities.

## Systems Software

1. Create a presentation comparing Windows, Linux, iOS, Android (which is based on Linux) and Unix. Discuss the features of each operating system, comparing the benefits and limitations of each. Note that you can try a basic Unix interface here: <http://www.masswerk.at/jsuix/>

## Ethical, Legal, Cultural and Environmental Concerns

Find a recent news story on one of the following topics:

- A legal issue in computing, such as a breach of the Data Protection Act
- An ethical issue in computing, such as the development of AI
- An environmental issue in computing, such as the disposal of waste equipment
- A technical development in computer science, such as the Internet of Things

Summarise the story, explaining any technical content for a student in year 10. Explain how the story affects you as a student of computer science.

# Computational Thinking – Theory

## Computational Logic and Calculations

1. Complete the truth tables for the following expressions

a.  $A \text{ AND } (B \text{ OR } C)$

A	B	C	B OR C	A AND (B OR C)
0	0			
0	0			
0	1			
0	1			
1	0			
1	0			
1	1			
1	1			

b.  $(\text{NOT } A) \text{ OR } (\text{NOT } B)$

i. What single logic gate produces the same result as this expression?

A	B			

c. Draw a circuit to represent each expression

2. Calculate each of the following, showing any appropriate working you need

- 13 MOD 2
- 16 MOD 6
- 15 MOD 3
- 7 MOD 8
- 13 DIV 2

Student Name:

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- f. 16 DIV 6
- g. 15 DIV 3
- h. 7 DIV 8
- i.  $2^0$
- j.  $2^7$
- k.  $2^8$
- l.  $2^{10}$

3. Convert the following into the units given

- a. 4 bytes = bits
- b. 1 TB = bytes
- c. 80 kB = GB
- d. 40 MB = nibbles

4. Complete the table, converting between binary, hexadecimal and denary as required

Binary	Hex	Denary
0010 1010		
	0B	
		255
0110 0111		
	F5	
		48
	CD	

5. Complete the following calculations

- a.  $0110\ 0011 + 0011\ 0001$
- b.  $1010\ 0110 + 1100\ 1111$
- c.  $0110\ 0011 \ll 2$  (bit shift left two places)

6. Check if these are valid ASCII characters. If they are, give their character equivalent. Note that the first bit is a check digit using even parity, and the remaining 7 bits are the character

- a. 1110 0010
- b. 1100 0111
- c. 0011 0110
- d. 1100 1010

## Programming Tools and Standards

1. Compare the use of jpg, png and gif to store images, explaining the benefits, properties and uses of each image format
2. Produce an annotated diagram of the IDE you prefer to use to write code, explaining any features of the IDE that help you to produce your code. You may need to show examples of the IDE in use to highlight the different features