AP Biology – Introduction to Statistics

AP BIOLOGY STUDENTS: Due to changes in the curriculum, you may use ANY calculator that you would be allowed to use on other standardized tests. You will NOT be asked to calculate SD on the exam, but you may be asked to graph SEM's and explain! You will also have to calculate SD and SEM for every lab!!!

This is a site you may find useful over the year:
https://www.youtube.com/watch?v=3UPYpOLeRJg

Watching the following videos and working through the questions will give you a big head start in the data analysis we will be doing this year. If you have any questions, please feel free to email me at hallorank@bolles.org.

Watch the following videos. Answer the following questions directly on this sheet. You must be able to APPLY and/or ANALYZE data on most EVERY assignment throughout this course based on these principles, concepts and practices:

1. Bozeman - Types of Graphs
   http://www.bozemanscience.com/beginners-guide-to-graphing-data
   (**MUST know when to use each type appropriately!*)

   a. What type of graph uses a 'best fit' line?

   b. Explain the difference in a bar graph and a histogram.

   c. What type of graph shows a change over time?

   d. What type of graph displays a correlation of variables?
      1. Distinguish between the independent variable and dependent variable and where they are placed on a graph.

   e. Which type of graph is best for comparing 2 or more different groups?

   f. Which type of graph is better for showing distribution of data?

   g. Explain when a pie graph should be used and give (draw) any example.

h. State at least 5 elements that any graph should **always** display.

i. Watch 'Graphing Data by Spreadsheet'.
http://www.bozemanscience.com/graphing-data-by-spreadsheet
ii. Take notes in for reference.
iii. Watch 'Graphing Data by Hand', if needed.
http://www.bozemanscience.com/graphing-data-by-hand

2. Bozeman- Statistics for Science
http://www.bozemanscience.com/statistics-for-science

a. What is n?
b. What is x (bar)?
c. What is M?
d. What was the range of the sample he gave?
e. Explain 'Degrees of Freedom' (with any example) and why the formula is n-1.

3. Bozeman- Standard Deviation
http://www.bozemanscience.com/standard-deviation

a. What is meant by normal distribution?

b. What does standard deviation (SD) measure?

c. Can 2 sets of data have the same mean but a different SD? Explain.

d. 1 SD means _____% of the population falls within this range; while 2 SD means _____% falls in this range.

e. Pause the video and calculate the SD from the second set of data given BY HAND. Show your work.

f. Take notes as to how to solve for SD using Excel. You may want to bookmark the video for quick reference for labs we will be doing throughout the course. **Note- The AP Bio Exam only allows you to use a **BASIC** 4 function (with square root) calculator, so make sure you learn to solve it by hand!*

4. Bozeman - Standard Error
http://www.bozemanscience.com/standard-error
and Kevin Piers - Standard Deviation & Standard Error of Mean
https://www.youtube.com/watch?v=3UPYpOLeRJg

a. From Bozeman: Explain the significance of standard error among 2 different sets of data with different sample sizes that have the same Mean (in terms of precision).

b. From Piers:

1- What do SEM bars that have overlapping Means on a graph indicate?

2- Explain the significance if SEM bars overlap, but the Means do not overlap.

3- Explain the significance if there is no overlap between SEM bars.

IF YOU WANT SOME PRACTICE, HERE ARE A FEW PROBLEMS. TOTALLY OPTIONAL.

1. Graph the following sample data set showing the number of leaf disks that rise in a solution over time as photosynthesis occurs.

Time (min)	Number of Disks Floating
1	0
2	0
3	0
4	0
5	0
6	0
7	1
8	1
9	1
10	2
11	5
12	8
13	10
14	14
15	14
16	15
17	20
18	20
19	20
20	18

Graph

2. Calculate the mean and standard deviation for the data set of annual monthly rainfall. B- Use the data to sketch the appropriate type of graph.

Month	Rainfall (cm)
Jan	2.0
Feb	1.8
Mar	1.2
Apr	5.7
May	6.2
Jun	5.9
Jul	1.0
Aug	1.1
Sep	1.1
Oct	2.3
Nov	2.7
Dec	2.5

Mean =

Standard Deviation =

Graph

3. Below are 2 samples of data that were collected

(*we will ignore Units & Graph Title for this one):

Sample A: 12, 13, 14, 15, 16, 17, 18

Sample B: 10, 15, 20

Calculate the mean for Sample A _____

Calculate the mean for Sample B _____

Are the calculated means sufficient in explaining the data? Why or why not? (*Be specific!)

Calculate:

SD for Sample A _____

SD for Sample B _____

Explain the significance of the results.

Calculate the Standard Error of Mean for Sample A _____

Calculate the SEM for Sample B _____

Graph your results, showing error bars for each.

Do the bars overlap? Do the means overlap?

Explain whether or not there are 'significant' differences between the 2 populations.

Big thanks and credit to Susan Phillips for a great deal of the content here. Mistakes are totally my own!