AP Statistics Summer Work

Congratulations! You have decided to challenge yourself by taking an Advanced Placement course. Advanced Placement courses are designed to expose you to college level curriculum and higher expectations. This requires a great amount of planning from your teacher and a greater amount of responsibility and commitment from you.

One of the responsibilities you have accepted in taking an Advanced Placement course is this summer work packet. We need you to begin to review old concepts and explore new ones before you walk back into the classroom next fall. If you turn in this packet on the FIRST day of school, I will add 2 percentage points to your Quarter 1 grade. If you turn in this packet on the SECOND day of school, I will add 1 percentage point to your Quarter 1 grade.

I know you all have busy summers (so do I) but I want you to set yourself up for success in this class. If you decide that you don't want to do the packet because of the extra work, consider reflecting on your choice to take an Advanced Placement course. Do you have the work ethic required to be successful? We want you to be successful! So please follow the time guidelines in this packet.

AP Statistics requires the use of a graphing calculator during the year. A scientific calculator will be sufficient for this packet. If you are planning to purchase a calculator, we recommend the TI-84+ (you will have access to these at JRT).

Please feel free to contact me if you have any questions about the packet or the course. My email is cssilvestri@henrico.k12.va.us

Have a wonderful summer and I will see you in the fall!

Sincerely,
Mrs. Poto

****There are dates on each section of work below. This is just for you to manage your time and break this into pieces!**

AP Statistics Summer Work

Week 1 (July 8-14)

Do cell phones cause brain cancer?
This is a question that statistics can help answer. Statistics is the science of learning from data. So what is data? Data are usually numbers, but they are not "just numbers". Data are numbers with a **context**. The number 10.5, for example, carries no information by itself. But if we hear that a family friend's new baby weighed 10.5 pounds at birth, the number now has meaning and **context.**
One of the things students find most surprising about their first statistics course is how much they work with **WORDS** and not just numbers like a typical math course. Students must therefore learn to **READ** for **context** and express answers (**WRITE**) in terms of **context.**

Nine sales representatives, 6 men and 3 women, at a small company wanted to attend a national convention. There were only enough travel funds to send 3 people. The manager selected 3 people to attend and stated that the people were selected at random. The 3 people selected were women. There were concerns that no men were selected to attend the convention.

*What follows are actual questions from AP Statistics exams. Don't worry, you don't have to do any math yet(!). Just relax and read through the AP questions and then answer the questions that follow about the **context** of the questions.*

a.) How many total sales representatives are considered in this problem?

b.) Is the company small or large?

c.) What do the nine sales representatives want to attend?

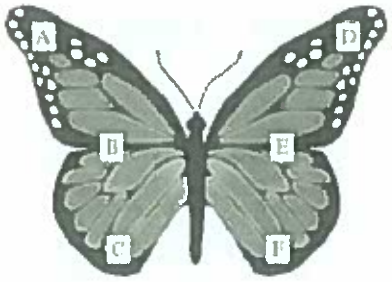
d.) Why can only 3 people attend?

e.) How did the manager select the 3 people?

f.) What is the manager concerned about?

AP Statistics Summer Work

Researchers often mark wildlife in order to identify particular individuals across time or space. A study of butterfly migration is designed to determine which location on the butterflies' wings is best for marking. The six possible locations are those shown as A through F in the figure below. The butterfly in the figure is a monarch (Danaus plexippus).



Because marks in certain locations may be more likely to attract predators or cause problems than marks in other locations, the goal is to determine whether the six marking locations result in equivalent chances of successful migration. To test this, researchers plan to mark 3,600 butterflies and release them, then count how many arrive displaying each marking location at the end of the migratory path.

a.) What type of butterfly is represented in the figure?

b.) How many butterflies does the researcher plan to mark and release?

c.) Why do the researchers need to mark butterflies in different locations?

d.) Describe location D on the butterfly?

e.) How is location A different from location D?

f.) Why do researchers mark wildlife?

g.) Name another type of butterfly that migrates?

AP Statistics Summer Work

Week 2 (July 15-21)

Do pets or friends help reduce stress?

Some of the numbers you encounter in your statistics class will be familiar to you. You have worked with them before. Measures of the CENTER of the data like the mean, median and mode should be numbers in statistics you have worked with before.

Data Set 1: 5, 4, 13, 10, 6, 2, 5, 2, 7, 9, 3
Data Set 2: 105, 123, 107, 115, 100, 109
Mean: average, you add all the numbers and divide by how many there are.

Ex. Data Set 1: $\frac{5+4+13+10+6+2+5+2+7+9+3}{11} = 6$

Ex. Data Set 2: $\frac{105+123+107+115+100+109}{6} = 109.833$

Median: the data value in the middle. If the data is odd it will be a specific data value. If the data is even you will need to average the two middle numbers. You must put the data in order from smallest to largest before you can find the median.

Ex. Data Set 1: ~~2,2,3,4,5~~, **5**, ~~6,7,8,10,13~~

The median for Data Set 1 is 5.

Ex. Data Set 2: ~~100,105~~,107,109,~~115,123~~ → Average 107 and 109: $\frac{107+109}{2} = 108$

The median for Data Set 2 is 108.

Mode: the mode is the data value that occurs **MOST** frequently. If every value occurs with equal frequency there is no mode, you can have one mode or many modes.

Ex. Data Set 1: **2, 2**, 3,4, **5, 5**, 6,7,8,10,13

The mode for Data Set 1 is 2 and 5.

Ex. Data Set 2: 100,105,107,109,115,123

There is no mode for Data Set 2.

AP Statistics Summer Work

Data Sets are not usually given in AP Statistics in a straight forward way with no context. If and when data is given you may need to do some work to pull it out of a table or diagram. To examine the effects of pets and friends in stressful situations, researchers recruited 45 women who were dog lovers. Fifteen were assigned at random to each of three groups: to do a stressful task alone, with a good friend present or with their dogs present. The woman's average heart rate (bpm) was the measure of the effect of stress. The table below represents the data.

Pet (P), Friend (F) and Alone (C)

Group	Rate	Group	Rate	Group	Rate	Group	Rate
P	69	P	69	C	85	C	75
F	100	C	87	C	85	C	63
P	70	P	64	P	59	P	70
C	80	C	92	P	80	F	88
C	87	C	88	P	69	F	82
P	76	F	91	C	73	F	87
F	83	F	101	C	85	F	92
F	102	C	78	C	71	P	72
P	86	P	98	F	90	P	65
F	80	P	85	F	98		
C	90	F	101	F	77		
C	99	F	97	P	70		

1.) Find the mean, median and mode of those who did the stressful task with a pet.

2.) Find the mean, median and mode of those who did the stressful task with a friend.

3.) Find the mean, median and mode of those who did the stressful task alone.

4.) Do pets or friends help reduce stress? Support your response.

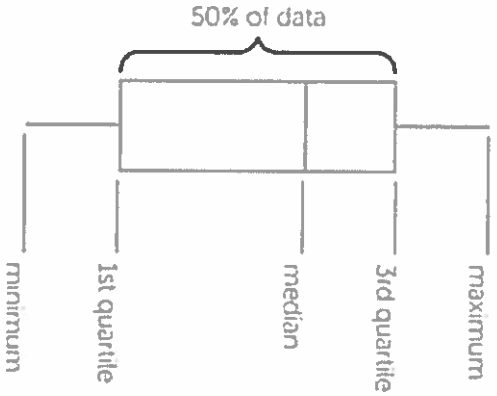
AP Statistics Summer Work

Week 3 (July 22-28)

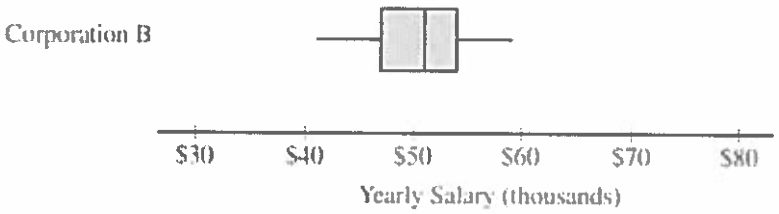
Is there too much sugar in cereal?

In AP Statistics we will need to be able to read and create many graphs. Graphs are a way to display and organize data. There will be graphs that you have encountered in the past and new graphs to discover. One graph that you have likely encountered in the past is a BOXPLOT.

Below is a diagram of a boxplot with an explanation of the values represented in the boxplot.



Below is a boxplot that appeared recently on an AP exam.

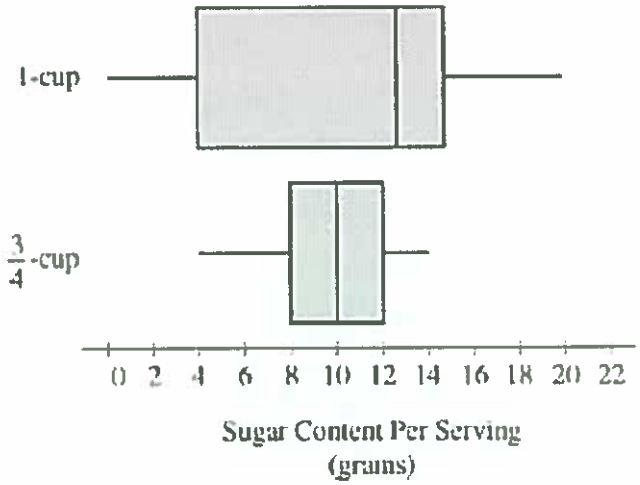


1.) Approximate the median salary for a person who works for corporation B.

2.) Approximate the largest salary for a person who works for corporation B.

3.) The Interquartile Range is the 3rd quartile minus the 1st quartile. Approximate the Interquartile Range for Corporation B.

AP Statistics Summer Work



The Boxplots above represent a sample of cereals with a 1 cup serving size and a ¾ cup serving size.

1.) What is the approximate median sugar content for cereals with a 1 cup serving size?

2.) What is the approximate median sugar content for cereals with a ¾ cup serving size?

3.) In AP Statistics we will be asked to COMPARE distributions and we want to use QUANTIFIERS. So…which serving size has a HIGHER median sugar content?

4.) The Interquartile Range is also the length of the BOX in a boxplot. What is the Interquartile Range (IQR) for cereals with a 1 cup serving size?

5.) What is the IQR for cereals with a ¾ cup serving size?

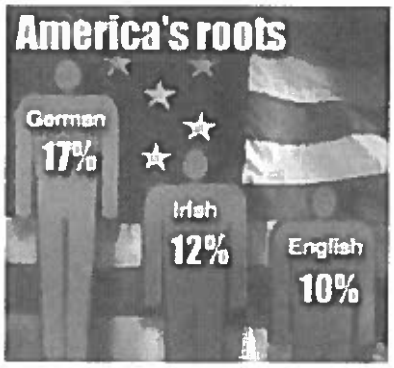
AP Statistics Summer Work

Week 4 (July 29-August 4)

Graphs, Graphs, Graphs?

In Statistics we organize and display data using graphs. We will teach you how to read, create and interpret many graphs. We will practice this summer using published graphs and charts from internet sites and news organizations. They assume you know how to interpret the data…or…do they count on you not understanding data displays? Hmmmmmm?????

1.) What percent of Americans do NOT trace their ancestry to European descent (German, Irish or English)?

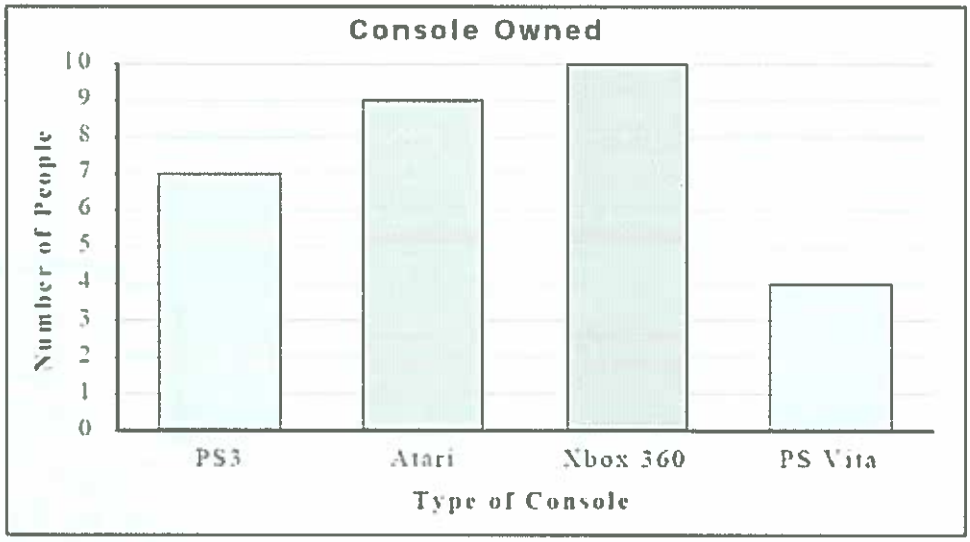


2.) USA Today stated, "More Americans trace their roots to Europe more than anywhere else in the world." is that a valid statement based on the graph?

3.) Does this graph give you the impression that gasoline prices are down? Explain.

AP Statistics Summer Work

A survey was conducted of AP Statistics students who own a video game system. They were asked which video game system they bought most recently. The data is displayed in the bar graph below.



1.) How many people own a PS3?

2.) Write exactly 2 sentences that describe 2 different characteristics of this graph.

3.) How many people own an Atari or an Xbox 360?

4.) How many people are represented in this graph?

5.) What percent or proportion of people own a PS Vita?

6.) What type of console do "most" people own? How did you decide?

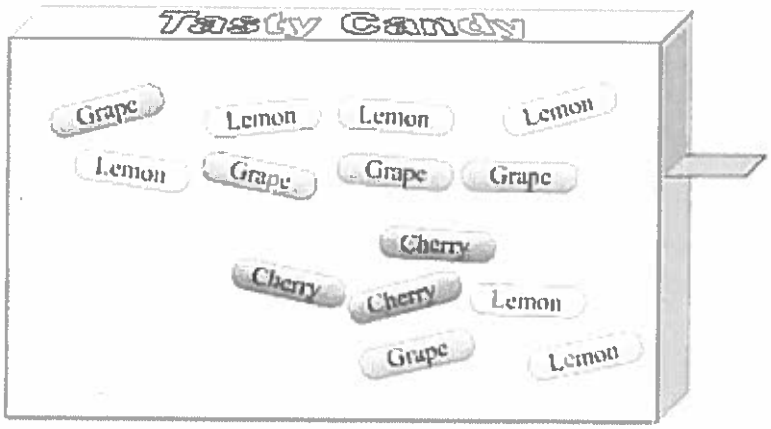
AP Statistics Summer Work

Week 5 (August 5-11)

Do you have chance-phobia?

One of the more challenging topics we will cover in AP Statistics is the concept of probability. Probability requires you to use some basic logic. The major issue students have with probability is that while some of the mathematics that govern it "make sense," other parts require students to gain new perspective. The use of formulas helps us obtain the correct answer before we gain this intuition. The good news is, you probably already have some experience with probability for your earlier studies.

The following probabilities can be calculated using techniques you should already know.



1) How many total pieces of candy are in the box?

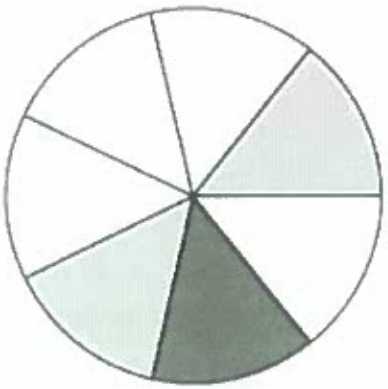
2) What is the probability of selecting a cherry piece?

3) What is the probability of selecting a lemon piece?

4) What is the probability of selecting a grape piece?

AP Statistics Summer Work

1) How many pieces are there total in the spinner?

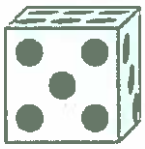


2) If you spun the spinner 1 time, what is the probability it would land on a gray piece?

3) If you spun the spinner 1 time, what is the probability it would land on a black piece?

4) If you spun the spinner 1 time, what is the probability it would land on a white piece?

5) If you spun the spinner 1 time, what is the probability of landing on either a white piece or a black piece?



6) If you were to roll the dice one time what is the probability it will land on a 3?

7) If you were to roll the dice one time what is the probability it will NOT land on a 2?

8) If you were to roll the dice one time, what is the probability of it landing on an even number?

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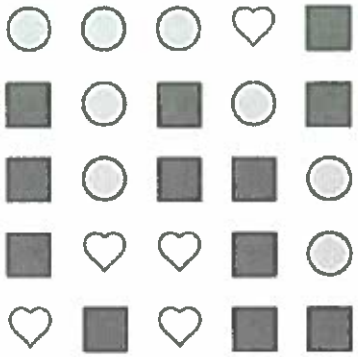
9) How many shapes are there total in the array?



10) If you were to select 1 shape at random from the array, what is the probability it will be a circle?

11) If you were to select 1 shape at random from the array, what shape do you have the greatest probability of selecting?

12) Which shape has a 32% chance (8 out of 25) of being selected?

AP Statistics Summer Work

Week 6 (August 12-18)

Why is the prerequisite for this course Algebra 2?

An AP Statistics course will not feel like a "regular" math course. The requirement for this course is a valid credit in Algebra 2. We will not use a large amount of the Algebra 2 you learned.

The following is a good sampling of some of the things we would need you to be able to do.

Evaluate Expressions:

1. $\frac{x-\bar{x}}{s}$ *when* $x = 83, \bar{x} = 91$ *and* $s = 14$

2. $\sqrt{\frac{pq}{n}}$ *when* $p = .30, q = .70$ *and* $n = 23$

3. $\frac{s}{\sqrt{n}}$ *when* $s = 17.03$ *and* $n = 20$

4. $\hat{y} = 63.1 - 12.3x$ *find* $\hat{y}$ *when* $x = 4$

5. $\sqrt{\frac{p(1-p)}{n_1} + \frac{p(1-p)}{n_2}}$ *when* $p = .34, n_1 = 24$ *and* $n_2 = 31$

AP Statistics Summer Work

Solve Equations:

1. $x^2 = 29$
2. $\frac{1}{x} = 29$
3. $\ln(x) = 3$
4. $\log(x) = 3$
5. $1.645 = \frac{x-7}{13.2}$
6. $.04 = 1.96\left(\frac{2.4}{\sqrt{x}}\right)$

Create an interval:

Example: $6 \pm (1.64)(3.7)$

$$(6 - (1.64)(3.7), 6 + (1.64)(3.7)) = (-.068, 12.068)$$

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1. $.47 \pm (1.96)(.03)$
2. $9 \pm (2.09)(2)$

Equation of a line: Algebra: $y = mx + b$ *where* m *is slope and* b *is the* $y-$*intercept*

Statistics: $\hat{y} = a + bx$ *whete* b *is slope and* a *is the* $y-$*intercept*

Write the following equations for line in algebra as equations for lines in statistics:

1. $y = 6x + 3$
2. $y = -2.4x - 3$

AP Statistics Summer Work

Week 7 (August 19-25)

What is flipping?

There are lots of different ways to learn things and your teacher may occasionally decide to "flip" the classroom. When your teacher decides to "flip" you will be asked to watch a video on line or perhaps just read a few pages of text to try to gain some understanding of the material before you enter the classroom. When you come into the classroom there will be a brief amount of lecture and more time to explore and practice the material with your teacher present to help facilitate your learning. This means less time watching your teacher demonstrate what they already know.

Let's try a little flipping. Read through the following…

Most statistical studies examine data on more than one variable. Fortunately, analysis of several-variable data builds on the tools we used to examine individual variables. The principles that guide our work also remain the same:

- Plot the data, then add numerical summaries.
- Look for overall patterns and departures from those patterns.
- When there's a regular overall pattern, use a simplified model to describe it.

Explanatory and Response Variables

We think that car weight helps explain accident deaths and that smoking influences life expectancy. In these relationships, the two variables play different roles. Accident death rate and life expectancy are the **response variables** of interest. Car weight and number of cigarettes smoked are the **explanatory variables**.

DEFINITION: Response variable, explanatory variable

A response variable measures an outcome of a study. **An explanatory variable** may help explain or predict changes in a response variable.

It is easiest to identify explanatory and response variables when we actually specify values of one variable to see how it affects another variable. For instance, to study the effect of alcohol on body temperature, researchers gave several different amounts of alcohol to mice. Then they measured the change in each mouse's body temperature 15 minutes later. In this case, amount of alcohol is the explanatory variable, and change in body temperature is the response variable. When we don't specify the values of either variable but just observe both variables, there may or may not be explanatory and response variables. Whether there are depends on how you plan to use the data.

AP Statistics Summer Work

EXAMPLE Linking SAT Math and Critical Reading Scores

Explanatory or response?

Julie asks, "Can I predict a state's mean SAT Math score if I know its mean SAT Critical Reading score?" Jim wants to know how the mean SAT Math and Critical Reading scores this year in the 50 states are related to each other.

PROBLEM: For each student, identify the explanatory variable and the response variable if possible.

SOLUTION: Julie is treating the mean SAT Critical Reading score as the explanatory variable and the mean SAT Math score as the response variable. Jim is simply interested in exploring the relationship between the two variables. For him, there is no clear explanatory or response variable.

In many studies, the goal is to show that changes in one or more explanatory variables actually *cause* changes in a response variable. However, other explanatory-response relationships don't involve direct causation. In the alcohol and mice study, alcohol actually causes a change in body temperature. But there is no cause-and-effect relationship between SAT Math and Critical Reading scores. Because the scores are closely related, we can still use a state's mean SAT Critical Reading score to predict its mean Math score. We will learn how to make such predictions in Section 3.2.

Now do the "check your understanding" questions:

CHECK YOUR UNDERSTANDING

Identify the explanatory and response variables in each setting.

1. How does drinking beer affect the level of alcohol in people's blood? The legal limit for driving in all states is 0.08%. In a study, adult volunteers drank different numbers of cans of beer. Thirty minutes later, a police officer measured their blood alcohol levels.

2. The National Student Loan Survey provides data on the amount of debt for recent college graduates, their current income, and how stressed they feel about college debt. A sociologist looks at the data with the goal of using amount of debt and income to explain the stress caused by college debt.