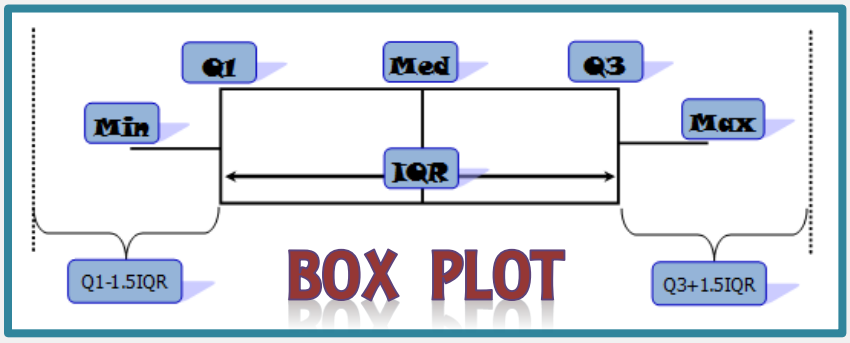
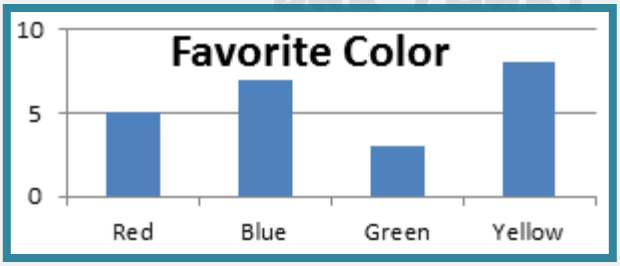
AP Statistics Summer Package

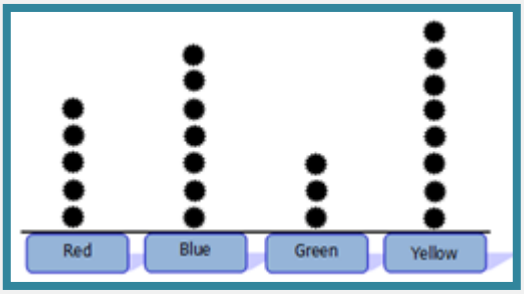
Graphical Displays



BOX PLOT

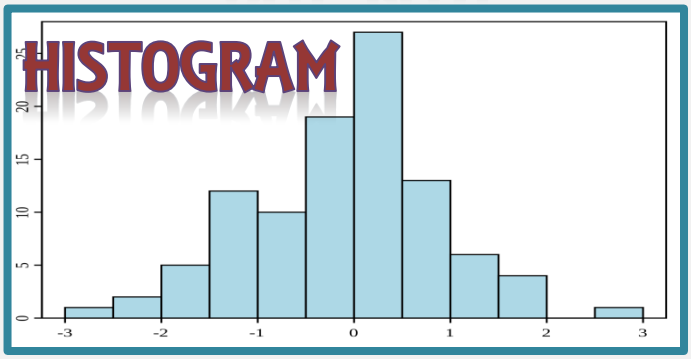
BAR CHART





DOT PLOT

HISTOGRAM

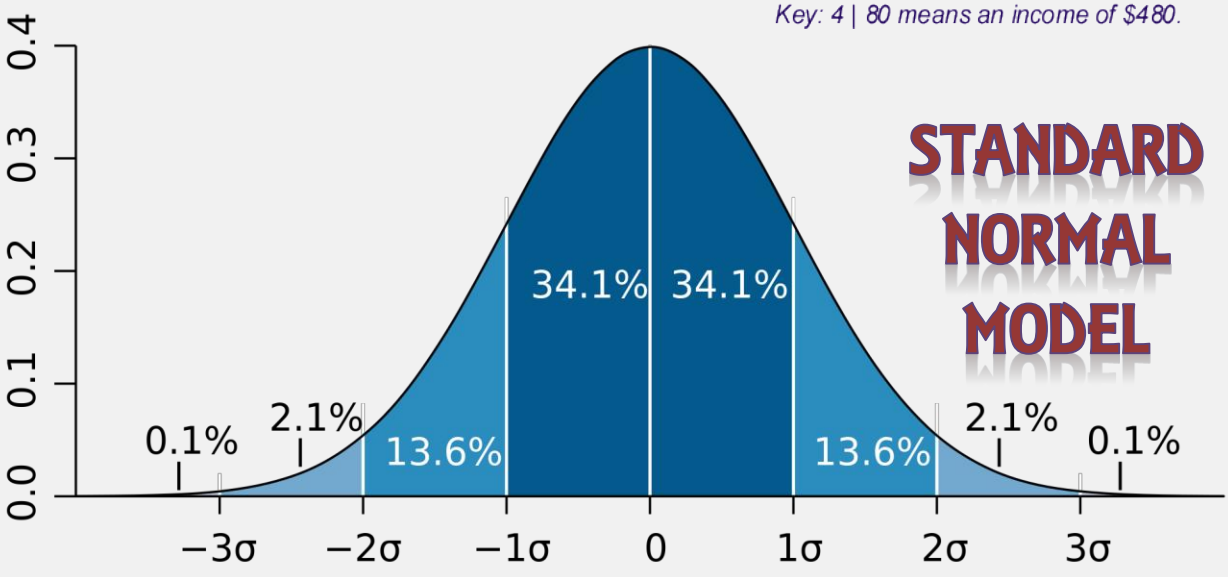


Per Capita GNP
Western Africa

Stem	Leaf
1	80
2	40 60 70
3	10 30 60 70 90
4	10 80
5	00
6	
7	10 30
8	90

STEM & LEAF

Key: 4 | 80 means an income of $480.



STANDARD NORMAL MODEL

Frequently Used Formulas

Z-Statistic

1-Proportion z-interval $\hat{p} \pm z^* \sqrt{\frac{\hat{p}\hat{q}}{n}}$

1-Proportion z-test $z = \frac{(\hat{p}-\rho)}{\sqrt{\frac{\rho q}{n}}}$

2-Proportion z-interval $\hat{p}_1 - \hat{p}_2 \pm z^* \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$

2-Proportion z-test $z = \frac{(\hat{p}_1-\hat{p}_2)-0}{SE_{pooled}(\hat{p}_1-\hat{p}_2)}$

$$SE_{pooled}(\hat{p}_1 - \hat{p}_2) = \sqrt{\frac{\hat{p}_{pooled}\hat{q}_{pooled}}{n_1} + \frac{\hat{p}_{pooled}\hat{q}_{pooled}}{n_2}}$$

T-Statistic

1-Sample t-interval $\bar{x} \pm t^*_{n-1}\left(\frac{s}{\sqrt{n}}\right)$

1-Sample t-test $t_{n-1} = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}$

2-Sampe t-interval $(\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

2-Sample t-test $t_{n-1} = \frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$

Matched Pairs t-test $t_{n-1} = \frac{\bar{d}-\mu_d}{\frac{s_d}{\sqrt{n}}}$ where d represents the difference between pairs of data

χ^2 statistic

$$\frac{(Observed-Expected)^2}{Expected}$$

Common Calculator Commands

5-Number Summary

STAT-EDIT-ENTER DATA

STAT-CALC-1-Var Stats

Box Plot

STAT-EDIT-ENTER DATA

2^{ND}-Y=-TURN PLOT ON

TYPE: CHOOSE BOXPLOT W/DOTS

CHOOSE Xlist

ZOOM-9:ZoomStat

Histogram

STAT-EDIT-ENTER DATA

2^{nd}-Y=-TURN PLOT ON

TYPE: CHOOSE HISTOGRAM

CHOOSE Xlist

ZOOM-9:ZoomStat

Diagnostics On

2^{nd}-0-x^{-1} – DiagnosticOn-ENTER

Statistics Tests

2^{nd} – VARS

STAT – CALC

STAT - TESTS

Week 1:

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**.

*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.*

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.

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

b.) Is the company small or large?

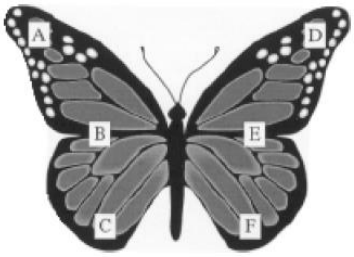
c.) What do the nine sales representatives want to attend?

d.) Why can only 3 people attend?

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

f.) What is the manager concerned about?

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?

Week 2:

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.

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.

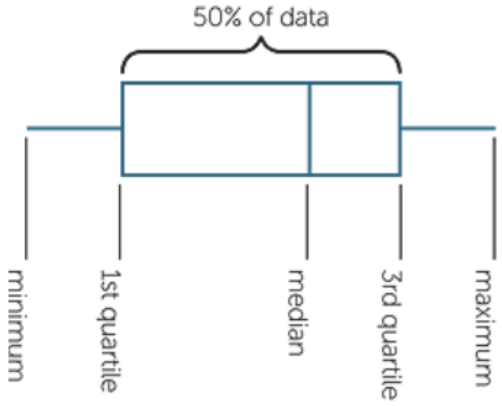
4.) Do pets or friends help reduce stress? Support your response.

Week 3:

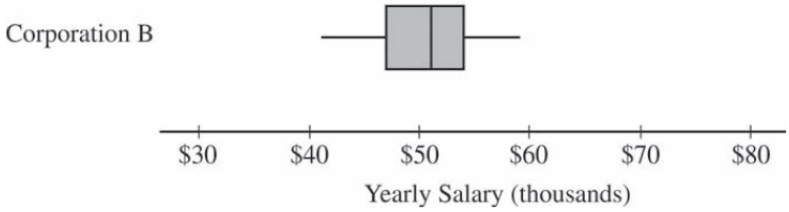
Is there too much sugar in cereal?

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.



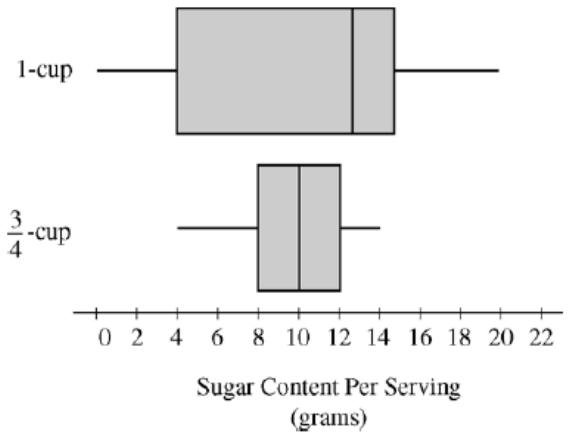
Below is a boxplot that appeared recently on an AP exam.



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.



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?

Week 4:

Graphs, Graphs, Graphs?

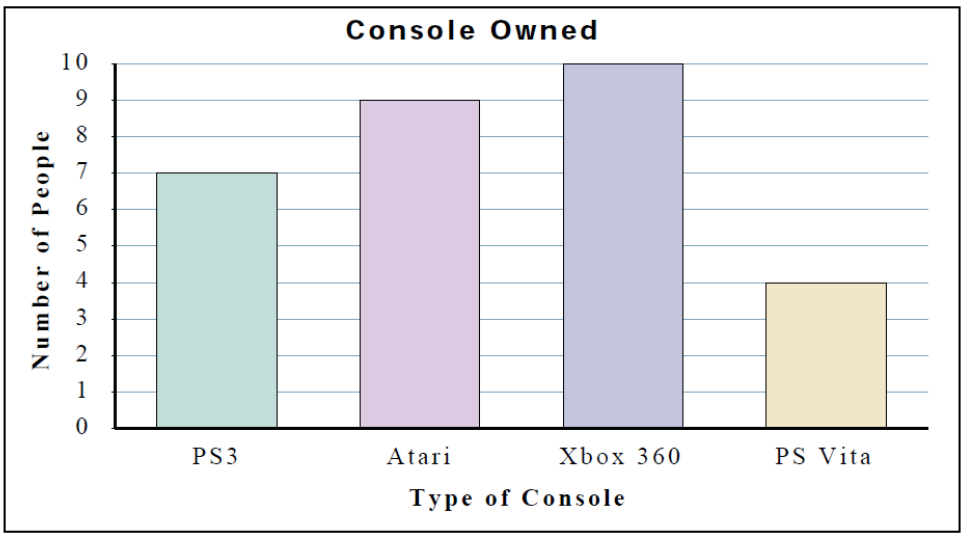
In Statistics we organize and display data using graphs. We will teach you how to read, create and interpret many graphs. We will practice this summer using published graphs and charts from internet sites and news organizations. They assume you know how to interpret the data…or…do they count on you not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

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?

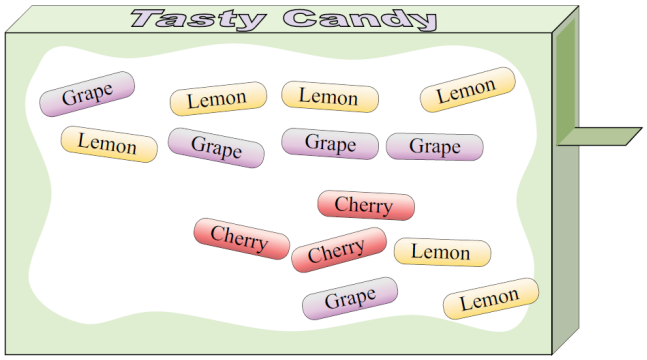
6.) What type of console do "most" people own? How did you decide?

Week 5:

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.



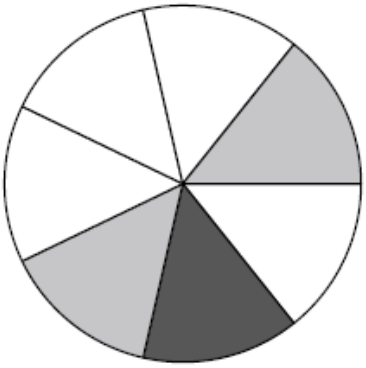
1) How many total pieces of candy are in the box?

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?

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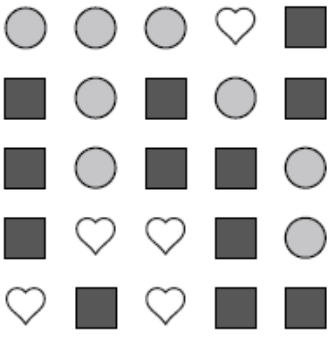
9) How many shapes are there total in the array?



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?

Week 6:

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

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

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

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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. $y = -2.4x - 3$