ARE YOU READY FOR AP STATISTICS?

The first unit of AP Statistics begins with the basics of descriptive statistics. Many of these concepts have been covered in previous math and science courses. Over the summer you will review these topics and complete this packet. Writing and reading comprehension are important components to the course. In this packet are three tasks that require you to justify your reasons. Listed below are some Internet sites that contain information about descriptive statistics.

www.mste.uiuc.edu/hill/dstat/dstat.htm

www.habermas.org/stat2f98.htm

The following packet is due at the first meeting of AP Statistics. This will be graded as the first homework assignment. There will two parts to the grade:

1. consideration of correctness of answer.
2. completeness of work.

There will be a quiz on this material.

I. Measuring Central Tendency

a. Find the mean, median, and mode of the following collection.

15, 11, 19, 15, 14, 13, 17, 11, 12, 17, 15, 14, 15

To begin, order the fourteen numbers.

11, 11, 12, 13, 14, 14, 14, 15, 15, 15, 17, 17, 19

To find the **mean**, divide the sum of the numbers by 14.

$$mean = \frac{2(11)+12+13+3(14)+4(15)+2(17)+19}{14} \approx 14.4$$

The **median** is the average of the two middle numbers for even data list.

$$Median = \frac{14+15}{2} = 14.5$$

The **mode** is 15 because that is the number that occurs the most frequently.

For odd data list, the median is the middle number.

b. Find the quartiles of the collection in Example a. Then, sketch a box-and-whisker plot of the data

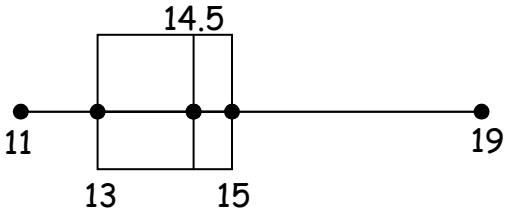
$$\underbrace{11,11,12,13,14,14,14}_{\text{Lower half}},\underbrace{15,15,15,15,17,17,19}_{\text{Upper half}}$$

The **first quartile** is 13 (the median of the lower half)

The **second quartile** is 14.5 (the median)

The **third quartile** is 15 (the median of the upper half).

A **box-and-whisker plot** for the data labels the endpoints of the data and marks the quartiles. It is shown at the right.



The **range** is the difference of the highest and lowest data points. That is, the range is 19-11 = 8.

Exercises

1. Find the mean, median, mode, and range of the following collection of scores on a test.
   32, 72, 81, 95, 98, 58, 77, 75, 83, 97, 45, 89, 93, 57,
   82, 97, 52, 75, 79, 78, 99, 98, 54, 75, 85, 61, 55, 86
2. Find the first, second, and third quartiles of the collection of data in Exercise 1.
3. Construct a box-and-whisker plot of the collection of data in Exercise 1.
4. Complete #1-3 for the following set of data. The weights (in pounds) of eleven children are as follows: 39, 52, 40, 45, 46, 55, 48, 40, 43, 47, 44

II. Organizing Data

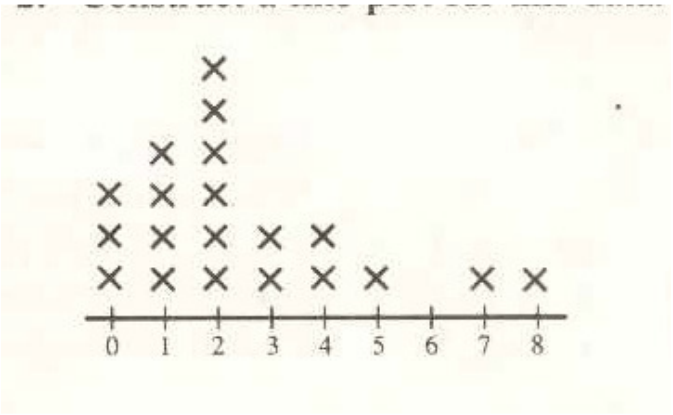
At a car dealership, the number of new cars sold in a week by each salesperson was as follows:

5, 8, 2, 0, 2, 4, 7, 4, 1, 1, 2, 2, 0, 1, 2, 0, 1, 3, 3, 2.

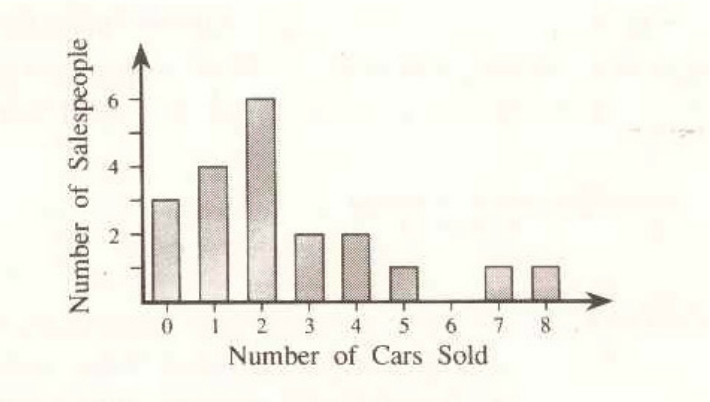
a. Construct a frequency distribution for this data.

Number	Tally	Frequency
8	|	1
7	|	1
6		0
5	|	1
4	||	2
3	||	2
2	|||| |	6
1	||||	4
0	|||	3

b. Construct a line plot for this data



c. Construct a bar graph that shows the number of salespeople who sold 0-8 cars.



Exercises

1. Twenty-eight students in a class were asked how many cars their family owned. The results were as follows:

2, 2, 3, 2, 1, 2, 2, 4, 3, 2, 0, 1, 0, 1, 1, 2, 2, 3, 2, 3, 3, 5, 1, 1, 3, 0, 1, 2

Construct a frequency distribution and a line plot for this data.

2. Each of the members of a recent high school graduating class was asked to name his/her favorite among these subjects: English, foreign language, history, mathematics, science. The results are shown in the table. Construct a bar graph that shows these results.

English	62
Foreign Language	40
History	40
Mathematics	18
Science	33

III. Constructing Stem-and-Leaf Plots and Histograms

I. Construct a stem-and-leaf plot for the data

Unordered Data

63, 52, 84, 83,
51, 32, 58, 35,
45, 41, 65, 75,
59, 67, 25, 46

Stem-and-leaf Plot

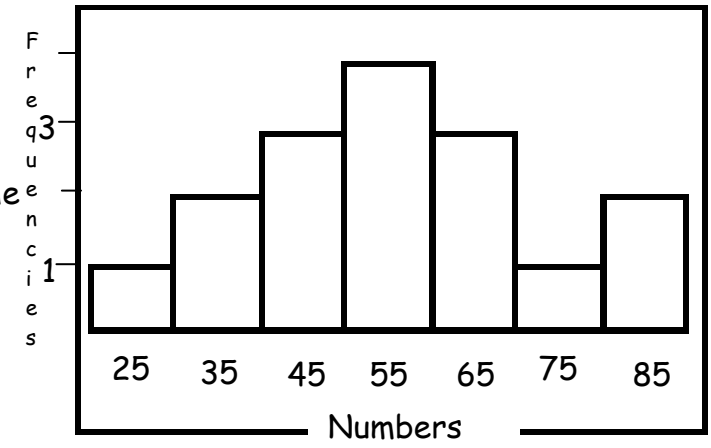
2	5
3	2 5
4	1 5 6
5	1 2 8 9
6	3 5 7
7	5
8	3 4

Leaves should be in increasing order.

A stem-and-leaf plot orders data in increasing or decreasing order.

II. Histograms

1. Construct and label a horizontal number line that is scaled to contain all of the values of the variable of interest.
2. Construct and label a vertical axis so that the greatest frequency can be represented.
3. Construct the bars of equal width that are centered above each value. The heights of the bars represent the frequencies of the values.



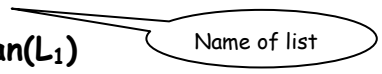
Exercises

1. Construct a stem-and-leaf plot for the data
   15, 59, 66, 42, 48, 23, 70, 81, 35, 51, 68, 29, 77, 92,
   85, 16, 37, 59, 61, 76, 40, 25, 86, 11

2. Construct a histogram for the above data.

IV. Using the TI-83 Calculator

1. Entering data into a list: **STAT→ 1:Edit→ enter data in appropriate list**
2. To clear a list: **highlight the list name and hit clear.** The list is empty when you see the dashes.
3. To sort a list in ascending order: **STAT→ 2:SortA(L_1)**
4. To find the mean of a list: **2^{nd} STAT→ MATH →3:mean(L_1)**
5. To find the median of a list: **2^{nd} STAT→ MATH →4:median(L_1)**
6. To find the sum of a list: **2^{nd} STAT→ MATH →5:sum(L_1)**



Exercises

1. Enter the data from Part I Exercise 1 in a list.
2. Sort the data in ascending order and find the mode.
3. Find the mean of the data.
4. Find the median of the data.
5. Find the sum of the data.

Task 1: Write two specific survey questions that you would ask voters in the next senatorial election in your state. Choose the type of question and response (yes/no, scale of 1 to 5, numerical responses, etc.) that would be most appropriate for the issues involved. What relationships would be expected when the responses are analyzed?

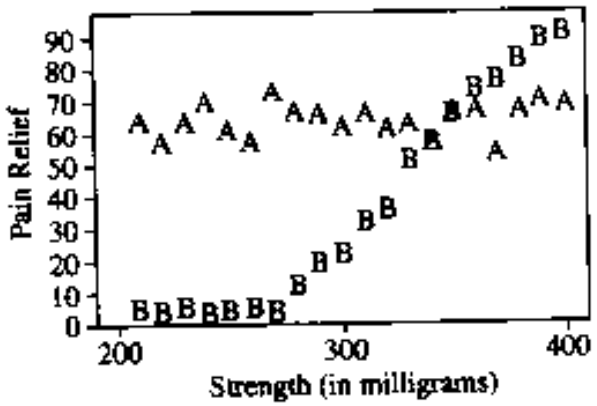
Task 2: Find a set of numbers that will satisfy the following conditions:

- The median of a set of 20 numbers is 24.
- The range is 42.
- To the nearest whole number the mean is 24.
- No more than three numbers are the same.

Show your strategy. Be specific...show your process. Saying guess and check is not a strategy.

Task 3: Two pain relievers, A and B, are being compared for relief of postsurgical pain. Twenty different strengths (doses in milligrams) of each drug were tested. Eight hundred postsurgical patients were randomly divided into 40 different groups. Twenty groups were given drug A. Each group was given a different strength. Similarly, the other twenty groups were given different strengths of drug B. Strengths used ranged from 210 to 400 milligrams. Thirty minutes after receiving the drug, each patient was asked to describe his or her pain relief on a scale of 0 (no decrease in pain) to 100 (pain totally gone).

The strength of the drug given in milligrams and the average pain rating for each group are shown in the scatterplot below. Drug A is indicated with A's and drug B with B's.



(a) Based on the scatterplot, describe the effect of drug A and how it is related to strength in milligrams.
(b) Based on the scatterplot, describe the effect of drug B and how it is related to strength in milligrams.
(c) Which drug would you give and at what strength, if the goal is to get pain relief of at least 50 at the lowest possible strength? Justify your answer based on the scatterplot.

VI. Combinations and Permutations

This a review topic from Algebra II that we will use in probability.

<u>An Important Counting Principle</u> The computation of theoretical probabilities is based upon an important counting principle called logical multiplication.

- If a person has 3 different sweatshirts and 2 different pairs of jeans, then there are 3 x 2 = 6 possible outfits.
- If there is a family of 6 children, and assuming both genders are equally likely at birth, how many different gender arrangements are there? For each child, there are 2 possibilities (B or G) and each birth is independent of the others, therefore $2^6 = 64$ possible arrangements.
-

- How many ways are there of arranging 5 children to stand in a line? For the first space, there are 5 choices, for the next space, 4 choices, and so on until the last space when there is only one choice, the last child. The total number of ways is
  5 x 4 x 3 x 2 x 1 = 5! = 120. To calculate this on a TI83 press 5, go to MATH, scroll right to PROB, then down to #4 !

Permutations have ORDER.

- **In how many ways can we pick a 4 letter word from the word MATH? As explained above, the answer would be 4! = 24 ways.**
- In how many ways can we pick a 7 letter word from the letters ENGLAND? If all the letters were different, there would be 7! ways. However, there are 2 N's and so there would be half as many $\left(\frac{7!}{2!}\right)$ ways. Similarly, there are $\left(\frac{9!}{2!\bullet 2!}\right)$ ways are getting a 9 letter word from the letters JEFFERSON.
- In how many ways can we arrange 4 letters from a total of 6 letters? Using the counting principle, we can see that it would be 6 x 5 x 4 x 3 = $\frac{6!}{2!} = \frac{6!}{(6-4)!}$. In general, the number of different permutations of n items taken r items at a time is denoted by ${}^{n}P_{r} = \frac{n!}{(n-r)!}$
- To evaluate ${}^{10}P_{3}$ (arranging 3 items from 10), press 10 MATH PROB ${}_{n}P_{r}$ 3

Combinations ORDER DOES NOT MATTER

- There is only 1 way to choose 3 letters from C A T because CAT is considered the same choice as TAC. So, there are FEWER ways of arranging items than when order matters.
- For example from the set of 5 elements, {a,b,c,d,e} there are 10 ways of choosing 3 letters: {abc} {abd} {abe} {acd} {ace} {ade} {bcd} {bce} {bde} {cde}
- In general, the number of ways that r items can be chosen from n elements is ${}^{n}C_{r} = \frac{n!}{r!(n-r)!}$

To evaluate ${}^{5}C_{3}$ (choosing 3 items from 5), press 5 MATH PROB ${}_{n}C_{r}$ 3

Counting Rule

1. If a sandwich shop has 3 different types of meat, 4 types of bread, and 3 different type of cheese. How many types of sandwiches can you create if you must have meat, bread and cheese on each?

2. How many ways can you hang 3 pictures in a row on a wall?

3. How many ways can you visit 5 exclusive shops when you are looking for the perfect present for Mrs. Gustafson?

4. If a person has 4 pairs of shoes and 6 pairs of socks, then how many shoe-sock combos are possible?

5. If there is a family of four, how many different gender arrangements are there?

6. If you are taking a multiple choice test (a, b, c, & d) consisting of 10 questions, then how many different arrangements of answers are there?

Permutations: Order matter; think "president"; key word: arrange

7. How many ways can we pick a 6 letter "word" from the word HOKIES?

8. How many ways can we pick a 10 letter "word" from the word STATISTICS?

9. How many ways can we pick 3 different officers from a club of 20 members?

Combinations: Order doesn't matter; think "committee"; key word: select

10. ${}^{5}C_{3} = \frac{5!}{3!2!} =$ ${}^{7}C_{4} =$ ${}^{10}C_{3} =$

11. How many ways can we select a committee of 3 people from a club of 20 members?

12. How many ways can we pick 4 winners for 8 prizes if each prize is the same?