

Determine whether the given value is a statistic or a parameter.

- 1) After surveying her whole class a teacher finds that 23 out of 35 students recycle at home. What proportion of the students recycle? When would this proportion be considered a statistic and how can we think of it as a parameter?

$$\hat{p} = \frac{23}{35} = .657 \text{ this Sample proportion is a statistic}$$

if we are using it to predict the proportion of all students at the school who recycle.

It is a population parameter if we think of this class as the whole population.

Identify the number as either continuous or discrete.

- 2) The number of stories in a Manhattan building is 22.

Discrete because we count how many floors.

Provide an appropriate response.

- 3) A researcher wants to obtain a sample of 100 school teachers from the 800 school teachers in a school district. Describe procedures for obtaining a sample of each type: random, systematic, convenience, stratified, cluster.

3) \_\_\_\_\_

Cluster - Order Schools, randomly select 5, Interview all teachers at those 5 schools

Random - Order Teachers, Randomly select 100 Numbers from 1 to 800, Interview all teachers selected

Systematic - Order teachers, randomly select number between 1 and 8, select every 8th teacher after that

Stratified - divide teachers by years of experience, 1-5, 6-10, ... interview proportion corresponding to prop in each category.

Solve the problem.

- 5) The ages of the members of a gym have a mean of 40 years and a standard deviation of 14. Use the range rule of thumb to estimate the minimum and maximum "usual" ages. Is 72 an unusual age for a gym member?

You may work with classmates and get help at the Math Lab. This test is worth 20 points in Math 215. It should be finished before class on the class day proceeding the exam. Show all work. You may attach pages if needed.

**Determine whether the given value is a statistic or a parameter.**

- 1) After inspecting all of 55,000 kg of meat stored at the Wurst Sausage Company, it was found that 45,000 kg of the meat was spoiled. What proportion of the meat spoiled? Is this proportion a statistic or a parameter?

Parameter  $\rightarrow$  All meat was tested  $\hat{p} = \frac{45,000}{55,000}$

**Identify the number as either continuous or discrete.**

- 2) The number of stories in a Manhattan building is 22. discrete Count stories

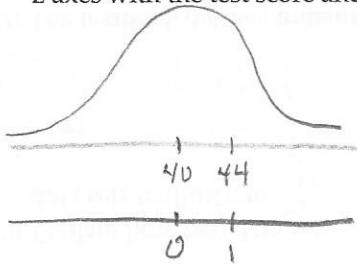
- 3) The average height of all 32 basil plants 3 weeks after germination is 3.4 centimeters.

Continuous we measure cm with a ruler.

- 3) A researcher wants to obtain a sample of 100 school teachers from the 800 school teachers in a school district. On another sheet, describe procedures for obtaining a sample of each type: random, systematic, convenience, stratified, cluster.

**Determine which score corresponds to the higher relative position.**

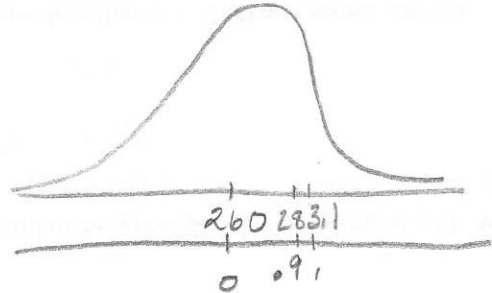
- 4) Draw two Normal curves one for each tests showing a z-axis and an x-axis. Label the mean, test scores and calculated z-score. Which score has a better relative position, a score of 44 on a test for which  $\bar{x} = 40$  and  $s = 4$ , or a score of 283.4 on a test for which  $\bar{x} = 260$  and  $s = 26$ ? Draw a Normal distribution for both tests. Label x and z axes with the test score and it's z-score.



$$z_1 = \frac{x - \bar{x}}{s} = \frac{44 - 40}{4} = 1$$

$$z_2 = \frac{283.4 - 260}{26} = \frac{23.4}{26}$$

$$z_2 = .9$$



the 44 has a higher relative position because  $1 > .9$ .

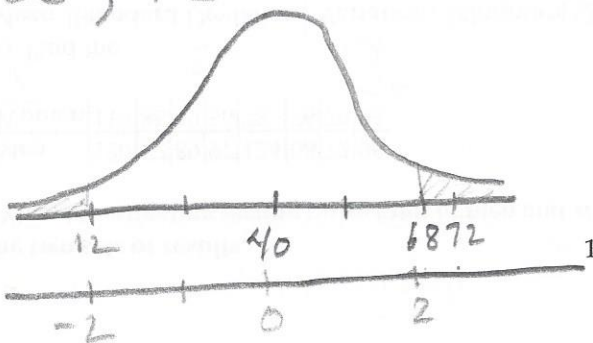
**Solve the problem.**

- 5) The ages of the members of a gym have a mean of 40 years and a standard deviation of 14. Use the range rule of thumb to estimate the minimum and maximum "usual" ages. Is 72 an unusual age for a gym member?

$$\text{Min Usual} = \bar{x} - 2s = 40 - 2(14) = 12$$

$$\text{Max Usual} = \bar{x} + 2s = 40 + 2(14) = 68$$

Yes,  $72 > 68$  so 72 is statistically high.





Compare the two sets of results.

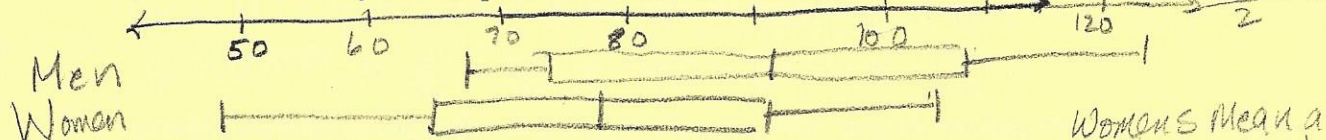
- 6 When investigating resting pulse rates of men and women the following results were obtained.

Men	120	77	89	97	124	68	72	96
Women	115	86	49	56	78	76	78	95

a) Find the  $\bar{x}$ ,  $s_x$ ,  $s_x^2$

	Mean	Standard Deviation	Variation	Minimum	Q1	Median	Q3	Maximum	Mode	Range	Midrange
Men	92.9	20.9	436.1	68	74.5	92.5	108.5	124	None	56	96
Women	79.1	20.8		49	66	78	90.5	115	78	66	82

b) Construct a side by side box plot and for these two data sets.



c) Compare the centers of these two sets.

Women have a lower center than Men, than men's pulse rate

d) Compare the spread of these two sets.

Men & Women have Similar Spread,  $s_m \approx s_w$

- 7 Explain how two data sets could have equal means and modes but still differ greatly. Give an example with two data sets to illustrate. One set can be much more spread out than the other.

$L_1 = 10 \ 20 \ 50 \ 80 \ 90 \ \bar{x}_1 = 50 \ s_1 = \text{Large}$

$L_2 = 47 \ 48 \ 50 \ 52 \ 53 \ \bar{x}_2 = 50 \ s_2 = \text{Small}$

- 8 The textbook defines **unusual** values as those data points with z scores less than  $z = -2.00$  or z scores greater than  $z = 2.00$ . Comment on this definition with respect to "the Empirical Rule"; refer specifically to the percent of scores which would be defined as **unusual** according to "the Empirical Rule".

The Empirical Rule tells us that when data is **NORMALLY** Distributed then 95% of Data lies within 2 standard deviations of the mean

Determine which of the four levels of measurement (nominal, ordinal, interval, ratio) is most appropriate.

10) Temperatures of the ocean at various depths.

Interval

11) Amount of fat (in grams) in cookies.

Ratio

Determine whether the numerical value is a parameter or a statistic. Explain your reasoning.

12) (3 points) The average salary of all assembly-line employees at a certain car manufacturer is \$41,500.

Parameter, Since all employees are included

Find the range, variance, and standard deviation for each of the two samples, then compare the two sets of results.

- 6) When investigating times required for drive-through service, the following results (in seconds) were obtained.

6) \_\_\_\_\_

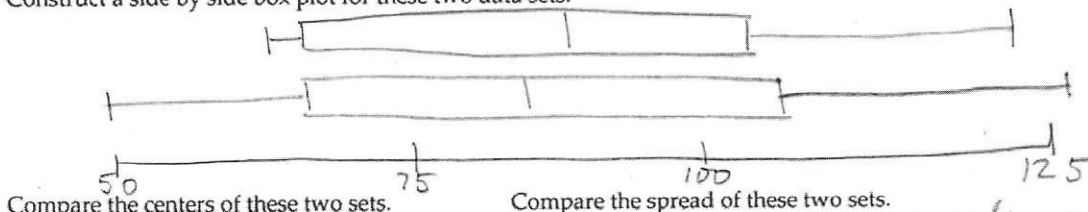
Restaurant A	120	67	89	97	124	68	72	96
Restaurant B	115	126	49	56	98	76	78	95

Use One Var Stat (L1) to find Summary Statistics

Mean	A 91.6	B 86.6	$S_x$ = Standard Deviation	A 22.2	B 27.0
Q1	A 70	B 66	Minimum	A 67	B 49
Median	A 92.5	B 86.5	$S_x^2$ = Variation	A 493.98	B 728.0
Q3	A 108.5	B 106.5	Maximum	A 124	B 126
Mode	A none	B none	Range	A 57	B 77
Midrange	A 95.5	B 87.5			

$$\frac{\text{max} + \text{min}}{2}$$

Construct a side by side box plot for these two data sets.



Compare the centers of these two sets.

A is lower than B  
But Similar

Compare the spread of these two sets.

A has less Spread than B  
But Similar

- 7) Explain how two data sets could have equal means and modes but still differ greatly. Give an example with two data sets to illustrate.

7) \_\_\_\_\_

6.5 6.9 7.0 7.0 7.1 7.5  
4.0 6.0 7.0 7.0 8.0 10.0

Different spreads

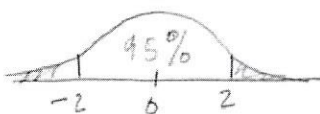
$$\bar{x} = 7.0 \quad \text{mode} = 7.0 \quad \text{med} = 7$$

Same middle

S = Small  
S = Big

- 8) The textbook defines **unusual** values as those data points with z scores less than  $z = -2.00$  or z scores greater than  $z = 2.00$ . Comment on this definition with respect to "the Empirical Rule"; refer specifically to the percent of scores which would be defined as **unusual** according to "the Empirical Rule".

8) \_\_\_\_\_



5% of Scores are unusual by the empirical Rule

9

- 1) Sometimes probabilities derived by the relative frequency method differ from the probabilities expected from classical probability methods. How does the law of large numbers apply in this situation?

9) \_\_\_\_\_

As an experiment is repeated many times the relative frequency of an event approaches the value given by the classical probabilities.



Find the indicated probability.

- 10) A class consists of 69 women and 68 men. If a student is randomly selected, what is the probability that the student is a woman? 10) \_\_\_\_\_

$$\frac{69}{69+68} = .504$$

- 11) If you pick a card at random from a well shuffled deck, what is the probability that you get a face card or a spade? 11) \_\_\_\_\_

$$P(\heartsuit \text{ or } \spadesuit) = P(\heartsuit) + P(\spadesuit) - P(\heartsuit \text{ and } \spadesuit) \\ = \frac{12}{52} + \frac{13}{52} - \frac{3}{52} = \frac{22}{52} = .423$$

- 12) A sample of 100 wood and 100 graphite tennis rackets are taken from the warehouse. If 5 wood and 10 graphite are defective and one racket is randomly selected from the sample, find the probability that the racket is wood or defective. 12) \_\_\_\_\_

$$P(W \text{ or } D) = P(W) + P(D) - P(W \text{ and } D) \\ = \frac{100}{200} + \frac{15}{200} - \frac{5}{200} \\ = \frac{110}{200} = .55$$

- 13) A bag contains 7 red marbles, 4 blue marbles, and 1 green marble. Find  $P(\text{not blue})$ . 13) .666

$$P(B) = \frac{4}{12} \quad P(\bar{B}) = 1 - \frac{4}{12} = \frac{8}{12} = \frac{2}{3}$$

Find the indicated probability.

- 14) A restaurant offers 9 entrees and 11 desserts. In how many ways can a person order a two-course meal? 14) 9 \cdot 11 = 99

Find the indicated probability.

- 15) Describe an event whose probability of occurring is 1 and explain what that probability means. Describe an event whose probability of occurring is 0 and explain what that probability means. 15) \_\_\_\_\_

$$P(E) = 0, E \text{ can't happen} \quad E = \{ \text{pigs fly today} \} \\ P(E) = 1, E \text{ is certain} \quad E = \{ \text{sun rose today} \}$$

16

16) Consider the frequency table below which has single values as classes:

16) \_\_\_\_\_

12 classes

4 classes

6 classes

Value	Frequency
10	1
11	3
12	7
13	18
14	10
15	4
16	2
17	7
18	16
19	10
20	6
21	2

Value	Frequency
10-12	11
13-15	32
16-18	25
19-21	18

Value	Frequency
10-11	4
12-13	25
14-15	14
16-17	9
18-19	26
20-21	8

Construct a new frequency table for this data with 4 classes.

Now construct a another frequency table for this data with 6 classes.

Suppose that you construct a histogram corresponding to the original data and histograms corresponding to each of the new frequency tables. Describe the shapes of the three histograms. Does the histogram with six classes capture the distribution of the data? Does the histogram with four classes capture the distribution of the data?

The Bimodal Nature of the data is seen in the Original data and with 6 classes, but is missed when there are only 4 classes.

Solve the problem.

Provide an appropriate response.

17

- 17) A computer company employs 100 software engineers and 100 hardware engineers. The personnel manager randomly selects 20 of the software engineers and 20 of the hardware engineers and questions them about career opportunities within the company. a) What sampling technique is being used? b) Does this sampling plan result in a random sample? c) Simple random sample? d) Explain.

a) Stratified

b) yes

c) NO, Since Not every Sample of 40 employees is Possible it is Not a Simple random Sample.  
for instance we could never get a sample with 19 Software engineers and 21 of the hardware engineers.

Find the indicated probability.

18)

- A batch consists of 12 defective coils and 88 good ones.

Find the probability of getting two good coils when two coils are randomly selected if the first selection is replaced before the second is made.

$$\frac{88}{100} \cdot \frac{88}{100} = .7744$$

If  $X$  = the number of defective coils when 2 are selected. Make a probability distribution for the number of defective coils out of 2. You may assume that the selections are done with replacement.

$X$	$P(X)$	$X = \# \text{ of defective}$
0	.7744	$= P(\text{Both good}) = .88 \cdot .88$
1	.2112	$= 1 - (.0144 + .7744) = 2 \cdot .88 \cdot .12$
2	.0144	$= P(\text{Both Bad}) = .12 \cdot .12$

19)

- Among the contestants in a competition are 42 women and 28 men. If 5 winners are randomly selected, what is the probability that they are all men?

In how many ways can 5 people be selected from this group of 70?

$${}_{70}C_5 = 12103014$$

In how many ways can 5 men be selected from the 28 men?

$${}_{28}C_5 = 98280$$

Find the probability that the selected group that will consist of all men.

$$P(\text{all men}) = \frac{98280}{12103014} = .00812$$

Solve the problem.

20)

- 8 basketball players are to be selected to play in a special game. The players will be selected from a list of 27 players. If the players are selected randomly, what is the probability that the 8 tallest players will be selected?

$$P(8 \text{ tallest}) = \frac{{}_8P_8}{{}_{27}C_8} = \frac{1}{2220075} = .0000004504$$

21)

- There are 9 members on a board of directors. If they must elect a chairperson, a secretary, and a treasurer, how many different slates of candidates are possible?

$${}_9P_3 = 504$$

BCA  
CBA

olve the problem involving probabilities with independent events.

- 22) A single die is rolled twice. Find the probability of getting a 2 the first time and a 2 the second time.

$$\frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

22) \_\_\_\_\_

Find the indicated probability.

- 23) The following table contains data from a study of two airlines which fly to Small Town, USA.

23) \_\_\_\_\_

	Number of flights which were on time	Number of flights which were late
Podunk Airlines	33	6
Upstate Airlines	43	5
	76	11

- a) If one of the flights is randomly selected, find the probability that the flight selected arrived on time given that it was an Upstate Airlines flight.

$$\frac{43}{48} = .8958$$

- b) If one of the flights is randomly selected, find the probability that the flight selected arrived on time and was an Upstate Airlines flight.

$$\frac{43}{87} = .4943$$

- c) If one of the flights is randomly selected, find the probability that the flight selected arrived on time or was an Upstate Airlines flight.

$$\frac{76}{87} + \frac{48}{87} - \frac{43}{87} = \frac{81}{87} = .9310$$

d)  $P(\text{ontime}) = \frac{76}{87} = .874$

- e) If two flights were randomly selected find the probability that both flights were on time. Calculate this probability with and without replacement.

with replacement

$$P(1\text{st Ontime and } 2\text{nd Ontime}) = \frac{76}{87} \cdot \frac{76}{87} = .763$$

without replacement

$$P(1\text{O} \& 2\text{O}) = \frac{76}{87} \cdot \frac{75}{86} = .762$$

- f) No,  $P(\text{OnTime}) = .874 \neq p(\text{ontime} | \text{upstate}) = .896$   
 However, this difference is small and  
 could be within sampling error expected.



Provide an appropriate response.

26 A group of men aged 50-59 followed a strict exercise regime for one year. The mean reduction in systolic blood pressure at the end of the year was 2.7 mmHg. Methods of statistics were used to determine that if the exercise regime had no effect on blood pressure, the likelihood of seeing this reduction in blood pressure by chance would be less than 1 in 100.

a) What is the sample for this study?

The group of Men on strict exercise.

b) What is the population for this study?

All Men 50-59

c) Is this study observational or an experiment?

Experiment

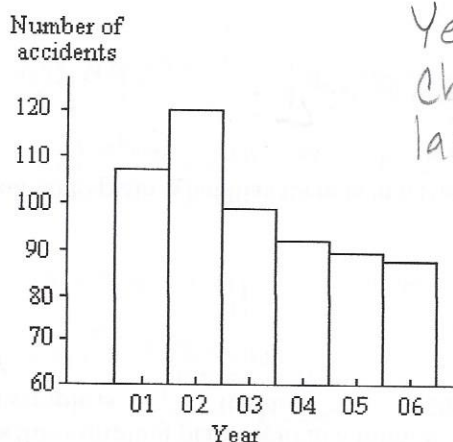
d) Do the results have statistical significance?

yes,  $.01 < .05$  so it is statistically significant

e) Do they have practical significance? Explain.

No, a decrease of 2.7 mmHg is practically small

14) (3 points) The graph below shows the number of car accidents occurring in one city in each of the years 2001 through 2006. The number of accidents dropped in 2003 after a new speed limit was imposed. Does the graph distort the data? How would you redesign the graph to be less misleading?



Yes, the Nonzero Y-axis Makes the change in Number of accidents look larger than it is.

Fix by starting y-axis at zero

Find the number of standard deviations from the mean. Round your answer to two decimal places.

24 (3 points) The number of hours per day a college student spends on homework has a mean of 6 hours and a standard deviation of 0.5 hours. Yesterday she spent 3 hours on homework. How many standard deviations from the mean is that?

The Number of Standard deviations From the Mean

$$= Z = \frac{X - \bar{X}}{S} = \frac{3 - 6}{.5} = \frac{-3}{.5} = -6$$

3 hours is 6 Standard deviations below the mean.  
this is way below average.

Provide an appropriate response.

$$Z = \frac{x - \bar{x}}{s}$$

$$\bar{x} = 2353 \quad s = 647$$

25

- 16 (3 points) The birth weights for twins are normally distributed with a mean of 2353 grams and a standard deviation of 647 grams. Calculate the z-scores and use them to determine which birth weight could be considered statistically high or low?

A) 2000 g

B) 1200 g

C) 3647 g = Max Usual

D) 2353 g

$$Z = \frac{2000 - 2353}{647} = -0.54$$

$$Z = \frac{1200 - 2353}{647}$$

$$Z = \frac{3647 - 2353}{647}$$

$$Z = 0$$

$$Z = 2$$

$$Z = -1.78$$

3647 is a statistically high/heavy weight

$$\text{Min usual} = \bar{x} - 2s = 2353 - 2(647) = 1059$$

- 17 (4 points) A market researcher obtains a sample of 50 people by standing outside a store and asking every 20th person who enters the store to fill out a survey until she has 50 people. The method of sampling used was

simple random, stratified, systematic, cluster, or convenience.

Does this sampling plan result in a random sample? Simple random sample?

This sample is

Random

Simple Random

Both

Neither

Why Every person is equally likely to be included  
No sample will include adjacent customers

- 18 (3 points) Explain what bias there is in a study done entirely online.

People choose to reply or be included so it is Voluntary Response

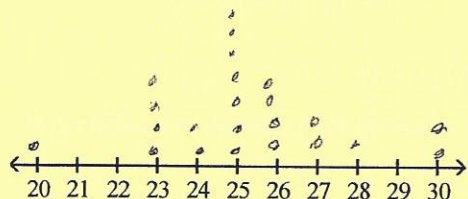
Construct the dotplot for the given data.

27

- 19 (5 points) An instructor encourages students in her class to use reusable drink containers by recording the number of students who remember to bring their reusable drink container each class meeting.

Make a dot plot for the data below.

20 23 24 25 25 23 26 26 30 30 25 25 26 26 27 28 27 23 23 24 25 25 25



Does the graph indicate that the data comes from a populations that is far from normal? Explain.

No, There is one max in middle, low on sides and is fairly symmetric

Be ready to make any of the graphs



Find the z-score corresponding to the given value and use the z-score to determine whether the value is unusual. Consider a score to be unusual if its z-score is less than -2.00 or greater than 2.00. Round the z-score to the nearest tenth if necessary.

28

- (15 points) On a recent road trip a Chevy Bolt had a range of 91 miles among a population of all such electric cars which having a mean range of 162 miles and a standard deviation of 24.5 miles.

Is the range in miles discrete or continuous? cts

What is the Z-score when the range is 91 miles  $Z = \frac{x - \bar{x}}{s} = \frac{91 - 162}{24.5} = -2.90$

Use the range rule of thumb to estimate the minimum and maximum "usual" range in this population.

min usual range = 113

max usual range = 211

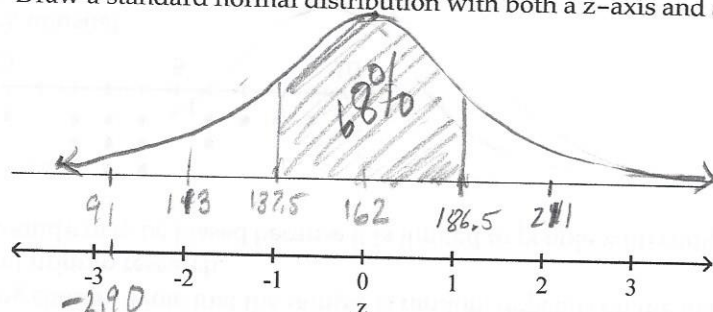
$$162 - 2(24.5) = 113$$

$$162 + 2(24.5) = 211$$

Is a range of 91 miles statistically low yes Why?  $-2.90 < -2$  and  $91 < 113$  miles

According to the Empirical Rule, what percentage of the population of all such electric cars have ranges between 137.5 miles and 186.5 miles? 68%

Draw a standard normal distribution with both a z-axis and an x-axis. Label all of the above information.



Identify the data set's level of measurement.

29

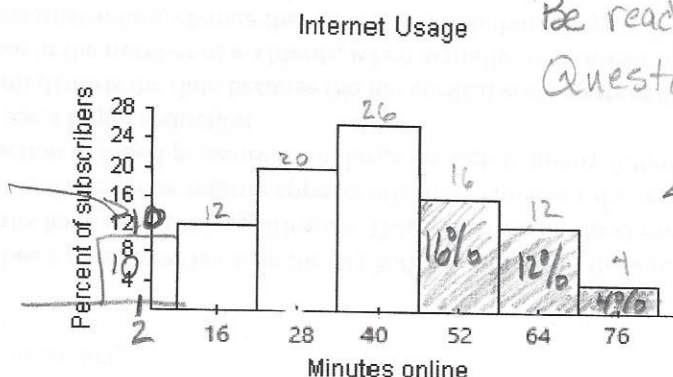
(8 points)

Boundaries 9.5, 21.5, 33.5, 45.5, 57.5, 69.5, 81.5

Be ready for any histogram

Questions

Sum of % Must be 1



Identify the data set's level of measurement (nominal, ordinal, interval or ratio) for the data listed on the horizontal axis in the graph. Minutes are Ratio

Does the data appear to be normally distributed? yes

What is the width of each class? 12 minutes

Approximately what percentage of internet users spend at least 46 minutes online? 32%

$$P(x \geq 46) = 32\%$$