Name _Key_   Algebra 2 Homework 13-7

1. In the following, based on the subjects determine if you should use the sample or the population. Explain each answer.

Subjects	What is being measured	Sample or Population? Explain.
Some students in your class	Number of books in backpack	Sample — only some of the stud. in class were in the study
Birds in Glacier National Park	Number of species	Population — Appears all birds in the park are to be catelogued.

2. An orange-juice processing plant receives a truckload of oranges. The quality control team randomly chooses three pails of oranges, each containing 50 oranges, from the truckload. Identify the sample and the population in the given scenario.

Sample — 3 pails of oranges (150 oranges)
Population — All oranges on the truck

State one conclusion that the quality control team could make about the population if 5% of the sample was found to be unsatisfactory.

About 5% of all the oranges on the truck may be unsatisfactory.

3. One study of cell phones and the risk of brain cancer looked at a group of 469 people who have brain cancer. The investigations matched each cancer patient with a person of the same age, gender, and race who did not have brain cancer, then asked about the use of cell phones. Result: "Our data suggest that the use of handheld cellular phones is not associated with risk of brain cancer."

    a. Is this an observational study or an experiment? Justify your answer.

Observational study. The researchers didn't assign people to either use or not use cell phones.

    b. Based on this study, would you conclude that cell phones do not increase the risk of brain cancer? Why or why not?

No, it's an observ. study so we can't make cause + effect conclusions (no trmt. was assigned)

4. Describe how a controlled experiment can be created to examine the effect of ingredient X in a toothpaste.

Randomly select subjects to be in the study. Randomly assign half the toothpastes to get ingredient X and the other half not to have ingred. X. After a set amount of time, compare the results of the toothpaste.

5. You want to ask a sample of high school students the question "How much do you trust information about health that you find on the Internet-a great deal, somewhat, no much, or not at all?" You try out this and other questions on a pilot group of 5 students chosen from your class. The members are listed below. Use line 15 on the Table of Random Digits to select your 5 students.

If #'d across:
Zabidi
Husain
De Ramos
Burke
Samuels

01 Anderson	08 Arroyo	15 Batista Bell	22 Burke	28 Cabrera	34 Calloway	
02 Delluci	(09 Deng)	16 De Ramos	23 Drasin	29 Eckstein	35 Fernandez	
03 Fullmer	10 Gandhi	17 Garcia	24 Glaus	30 Helling	36 Husain	
(04 Johnson)	11 Kim	(18 Molina)	25 Morgan	31 Murphy	37 Nguyen	
05 Palmiero	12 Percival	19 Prince	26 Puri	(32 Richards)	(38 Rider)	
06 Rodriguez	13 Samuels	20 Shen	27 Tse	33 Velasco	39 Wallace	
07 Washburn	14 Zabidi	21 Zhao				

64 ~~80~~ ~~00~~ ~~42~~ 38(1) 18(2) ~~40~~ ~~95~~ 09(3) 04(4) 32(5)

6. What are the identification numbers for ten students chosen at random from a population of 78 students based on the following string of random digits? Start at the left.   01-78

~~27~~ ~~81~~ 6 | ~~78~~ ~~41~~ 6 | 01 ~~82~~ 2 | ~~73~~ ~~52~~ 1 | ~~37~~ ~~74~~ 1 | 0 ~~16~~ ~~31~~ 2 | 68000   53645   56644   97892   63408   77919 44575

repeat   *repeat*   27, 67, 16, 01, 35, 21, 37, 74, 10, 31

For Problems 7 & 8, identify (i) the subjects, (ii) the treatments, and (iii) the response variable for each experiment.

7. A botanist was interest in determining the effects of watering (three days a week or daily) on the heat rating of jalapeno peppers. The botanist wanted to know which watering schedule would produce the highest heat rating in the pepper. He conducted an experiment, randomly assigning each watering schedule to half of twelve plots that had similar soil and full sun. The average final heat rating for the peppers grown in each plot was recorded at the end of the growing season.

   i. Plots of peppers

   ii. Watering 3 days a week and watering daily

   iii. heat rating

8. A manufacturer advertises that its new plastic cake pan bakes cakes more evenly. A consumer group wants to carry out an experiment to see if the plastic cake pans do bake more evenly than standard metal cake pans. Twenty cake mixes (same brand and type) are randomly assigned to either the plastic pan or the metal pan. All of the cakes are baked in the same oven. The rating scale was then used to rate the evenness of each cake.

   i. cake mixes

   ii. Plastic pan and metal pan

   iii. evenness rating

Last Minute Review

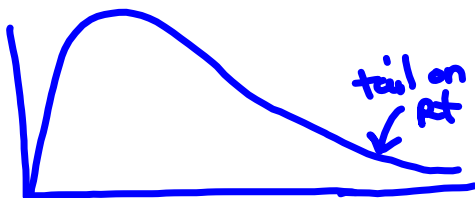$$Z = \frac{Value - Mean}{SD} \qquad Z = invnorm \left(\begin{array}{c} decimal\ \% \\ below \end{array} \right)$$

$$normalcdf \left(Z_{low}, Z_{high} \right) = \begin{array}{c} prop., \%, \\ Area, prob. \end{array}$$

Experiment → ✱ to determine <u>cause + effect</u>
  - Random selection
  - Random assignment
  - Apply treatment
  - Measure Response

Obs. study
- No C+E
- No Trmt

tail on
Rt

Skewed Rt
↳ IQR, Median
Mean pulled toward
tail

Normal curve - needs to be symmetric (mound)
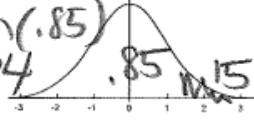
Random Selection - allows us to generalize
results over represented population.

<u>Unit 13 Review</u>

1. Some IQ tests are standardized to a Normal model, with a mean of 100 and a standard deviation of 16. <u>Fifteen percent</u> of the participants are above what score?

$z = invNorm(.85)$
$= 1.0364$

$1.0364 = \dfrac{X - 100}{16}$

$16.5824 = X - 100$

$X = 116.5824$

2. A company that manufactures rivets believes the sheer strengths are modeled by a Normal distribution with a mean of 800 and a standard deviation of 50. About what percent of these rivets would you expect to fall <u>below</u> 900 pounds?

$Z = \dfrac{900 - 800}{50} = 2$

$Prob = normalcdf(-100, 2)$
$= .9772 \approx 97.72\%$
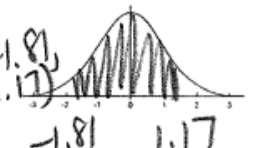
3. A researchers records the daily yields of chemicals manufactured at a chemical plant. The yields are normally distributed, with a mean yield of 700 tons and a standard deviation of 22 tons. What is an approximate z-score of a yield of 650 tons?

$Z = \dfrac{650 - 700}{22} = -2.27$

4. The Virginia Cooperative Extension reports that the mean weight of yearling Angus steers is 1152 pounds. Suppose that weights of all such animals can be described by a Normal model with a standard deviation of 84 pounds. What percent of steers weigh between 1000 and 1250 pounds?
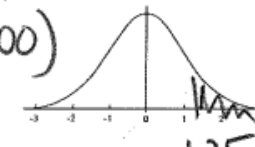
$1000: Z = \dfrac{1000 - 1152}{84} = -1.81$

$1250: Z = \dfrac{1250 - 1152}{84} = 1.17$

$Prob = normalcdf(-1.81, 1.17)$
$= .84 \approx 84\%$ -1.81 1.17

5. IQ scores of 5000 people are based on a Normal model with a mean of 100 and standard deviation of 16. Approximately how many people scored an IQ <u>above</u> 120? (Round your probability to the nearest thousandth.)

$Z = \dfrac{120 - 100}{16} = 1.25$

$Prob = normalcdf(1.25, 100)$
$= .106$

$.106(5000) = 530$

6. Sketch a uniform distribution.

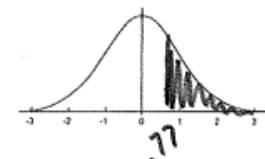7. Sketch a skewed left distribution.

8. Sketch a mound shaped distribution.

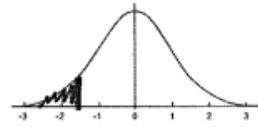9. Sketch a skewed right distribution.

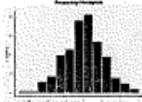10. Find the area to the right of z = 0.77 to the nearest ten-thousandth.

$.2206$

11. Find the area to the left of z = -1.54 to the nearest ten-thousandth.
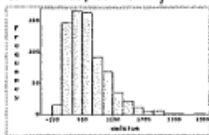
.0618

12. Given the histogram below, would you use the IQR or range to describe the spread of the data? Explain your choice.

Range because it's mound shaped, ~symmetric

13. Given the histogram below, would you use the IQR or range to describe the spread of the data? Explain your choice.
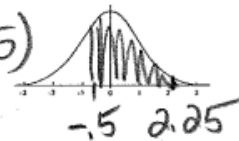

IQR because it's skewed right

14. Costs for standard veterinary services at a local animal hospital follow a Normal model with a mean of $80 and a standard deviation of $20. What's the probability (to the nearest thousandth) that customers would you have a vet bill between $70 and $125?

$70: z = \dfrac{70-80}{20} = -.5$ Prob = normalcdf(-.5, 2.25)
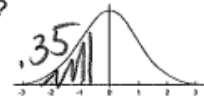
$125: z = \dfrac{125-80}{20} = 2.25$ = .679

-.5 2.25

15. Costs for standard veterinary services at a local animal hospital follow a Normal model with a mean of $80 and a standard deviation of $20. 35% of clients have a vet bill below what price?

$z = $ InvNorm(.35) $= -.3853$ $-7.706 = x - 80$

$-.3853 = \dfrac{x - 80}{20}$ $x = \$72.29$

.35

16. Owners of an exercise gym believe that a Normal model is useful in projecting the number of clients who will exercise in their gym each week. They use a mean of 800 clients and a standard deviation of 90 clients. What's the probability (to the nearest thousandth) that they expect to have more than 1020 clients?

$z = \dfrac{1020 - 800}{90} = 2.44$ Prob = normalcdf(2.44, 100)

= .007

2.44
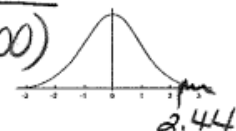
17. For each of the following study descriptions tell whether it is an observational study (O) or a controlled experiment (E).

___**E**___ a. A student randomly sorts 20 volunteers for a study into two groups. Over 6 weeks, one group runs on a treadmill 30 minutes each school day and the other group does not run. Each volunteer's weight is recorded each school day.

___**O**___ b. A lab technician records the diameter of 3 different bacterial colonies every 4 hours for 3 days.

___**O**___ c. A field biologist records the type and number of each bird he observes from one location, every Friday for 12 months.

18. State whether the situation describes a POPULATION (P) or SAMPLE (S).

___**P**___ a. All the people on your flight to Venice, Italy.

___**S**___ b. A random selection of some females from the people on your flight to Venice, Italy.

___**S**___ c. The mean age of a random sample of passengers on your flight.

19. For each statement, put a check mark in the appropriate column(s).

	Random Assignment *(Trmt.)*	Random Selection *(People)*
Allows a cause and effect conclusion	✓	
Allows generalization to the population		✓
Used in observational studies		✓
Used in experiments	✓	✓

20. Explain the difference between random selection and random assignment and the purpose of each.

Random selection is using a chance process to determine which members of a population are included in the sample → allows generalization to the population. Random assignment is used in experiments to assign experimental units to trmts → allows cause + effect conclusions

21   For each of the following study descriptions:
- Identify whether the study is a survey, observational study, or experiment, **and** give a reason for your answer.
- For observational studies, identify the population of interest.
- For experiments, identify the treatment and response variables.

a. A veterinarian monitors a litter of 8 kittens and records their ages in days when they first open their eyes.

Observational study – a vet only observes + records (no trmt imposed)

Population of Interest – litter of 8 kittens

b. The manager of an athletic store selects every tenth name on a list of the players in a city baseball league for middle school students. He asks each selected player what brand of glove he or she uses while playing baseball.

Survey – People are asked what glove he/she uses while playing baseball

c. A pharmaceutical company asks for volunteers to test a new drug to treat high blood pressure. Half of the volunteers will be given the drug, and half will be given a placebo. The researcher will monitor the blood pressure of each volunteer.

Experiment – Trmt (drug vs. placebo) is imposed on subject

Trmt – Drug and placebo

Response Variable – Blood pressure

22. A headline in the newspaper stated "Chewing Mint Gum Makes You More Alert and Focused While Working." Researchers observed students while testing and made note of those that were chewing gum during the test and those that weren't. They found that those who were chewing gum did better on the test than those who didn't. Do you think the headline was appropriate? Explain.

NO, this was an observational study so cause + effect conclusions can't be made (only in experiments with random assignment)

23. Mr. Root is randomly selecting 5 students from Baker's population of 528 students that will win $1,000 each from the NYS Lottery. Using line 19 of the Table of Random Digits, what 5 students win the money?

535 X   736 X   317 ①   255 ②   147 ③   165 ④   659 X   119 ⑤

Students: 317, 255, 147, 165, 119

24. There are 25 members in your extended family. You need to decide who sits at each of the three tables during a get together. You randomly assign each member a number between 01 and 25. Using line 31 of the Table of Random Digits, see what members will sit at the first table that sits 7 people.

64 X   80 X   00 X   42 X   38 X   18 ①   40 X   95 X   09 ②   04 ③   32 X   38 X   48 X   86 X

29 ⑦   10 ④   19 ⑤   93 X   07 ⑥   35 X   66 X   72 X   80 X   08 ⑦

25. Marketing researchers wonder if the color and type of a candy's packaging may influence sales of the candy. They manufacture test packages for chocolate mints in three colors (white, green, and silver) and three types (box, bag, and roll). Suspecting that sales may depend on a combination of package color and type, the researchers prepare nine different packages and then market them for several weeks in convenience stores in various locations.

    a. Name the subjects.   candy packages

    b. Name the treatment(s).   Color of packages (white, green, silver)   Type of package (box, bag, roll)

    c. Name the response variable(s).   candy sales

26. You can use Voice over Internet Protocol (VoIP) to make long-distance telephone calls over the Internet. How will the cost affect the use of this service? A university plans an experiment to find out. It will offer the service to all 350 students in one of its dormitories. Some students will pay a low flat rate. Others will pay higher rates at peak periods and very low rates off-peak. The university is interested in the amount and time of use and the congestion on the network.

    a. Name the subjects.   350 students in one of the dorms

    b. Name the treatment(s).   Low Flat Rate vs. Higher rates at peak periods and very low rates off-peak

    c. Name the response variable(s).   Amount and time of use. Congestion on the network.