STATISTICS 2023 NAME IN PRINT _____

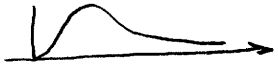
EXAM ONE LEGAL SIGNATURE IN INK _____

FALL 2015 CWID CLEARLY IN INK _____

TRUE OR FALSE. Answer with a capital T or F. **(3 points each)**

F 1. A relative frequency bar graph indicates frequency with height, not width or area, whereas, a pie chart indicates relative frequency with both area and height.

F 2. If the mean and the median of a data set exceed the mode, then the data set is probably left skewed.



right skewed if mode < median < mean

T 3. If the range in a mound-shaped data set is 150 units, then it is reasonable that the standard deviation is 25 units.

range = max − min = 150 if mound shaped ⇒ 6 standeviations
so true 150/6 = 25.

T 4. The variance of a sample of data measures the spread of the data about the sample mean in squared units.

F 5. If a data set is mound shaped, then approximately 95% of the data set is within one standard deviation of the mean.

within 2 standev of the mean ⇒ 95%

F 6. The probability of an event is the likelihood of the event stated as a number between one and zero, which can be equal to one, but cannot be equal to zero.

F 7. Conditional probability is the probability of the intersection of two events.

CALCULATION QUESTIONS. Write the answer on the line. **(3 points each)**

Eight Stillwater, Oklahoma, companies each provided the number of employees gained or lost in the company in the last 6 months. If the number of employees declined at the company the data value is negative.

3, 11, -8, 2, 4, -4, 9, 7

24 8. What is the numerical value of the sum of the observations?

$$\sum X = X_1 + X_2 + \ldots + X_n = 3 + 11 + (-8) + \ldots + 7 = 24$$

360 9. What is the numerical value of the sum of the squares of the observations?

$$\sum X^2 = X_1^2 + X_2^2 + \ldots + X_n^2 = 3^2 + 11^2 + (-8)^2 + \ldots + 7^2 = 360$$

576 10. What is the numerical value of the square of the sum of the observations?

$$(\sum X)^2 = (24)^2 = 576$$

3 11. What is the numerical value of the mean of the data set listed above?

$$\bar{X} = \frac{\sum X}{n} = \frac{24}{8} = 3$$

STATE THE ANSWER. Write the answer on the line. **(3 points each)**

2 12. If the square of the sum of the values in a sample with 260 observations is 270,400 then what is the numerical value of the sample mean?

If $(\Sigma x)^2 = 270,400 \Rightarrow \Sigma x = \sqrt{270,400} = 520$

So $\bar{x} = \frac{\Sigma x}{n} = \frac{520}{260} = 2$

23.04 13. If the sum of squares in a sample with 260 observations is 138,531 and the sum is 520 then what is the numerical value of the sample standard deviation? Round your answer to two digits past the decimal.

If $\Sigma x^2 = 138,531$ and $\Sigma x = 520$ with $n = 260$ then

$$s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} = \sqrt{\frac{138,531 - \frac{520^2}{260}}{260-1}} = \sqrt{530.853} = 23.04$$

3 14. If a data set with ten-thousand observations is comprised of 2,500 ones, 2,000 twos, 3,500 threes, and 2,000 fours, what is the value of the median? 3 is at position 5000.5

$1_1, \ldots, 1_{2500}, 2_{2501}, \ldots, 2_{4500}, 3_{4501}, \ldots, 3_{8000}, 4_{8001}, \ldots, 4_{10,000}$.

The American Dental Association states that people should have their teeth professionally cleaned by a dental assistant every 6 months. In a study at a prominent dental school the following data were recorded that measured the time in months between cleanings for eight randomly chosen patients.

22, 5, 12, 8, 5, 7, 15, 6

10 15. What is the value of the observed mean time between dental cleanings? Round your answer to one digit past the decimal.

$$\bar{x} = \frac{\Sigma x}{n} = \frac{80}{8} = 10$$

7.5 16. What is the value of the median of the time in months between dental cleanings?

5 5 6 7 8 12 15 22

↑ median is average of 7 and 8.

5 17. What is the numerical value of the mode of the time between dental cleanings?

5 has frequency of 2 so is the mode

6 18. What is the numerical value of the standard deviation associated with the time between dental cleanings?

$$s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} = \sqrt{\frac{1052 - \frac{80^2}{8}}{8-1}} = \sqrt{36} = 6$$

62.5 19. What percent of the observed data exceeds the 6 month recommendation?

5 of the 8 values exceeded 6, so $\frac{5}{8} = .625 = 62.5\%$

STATE THE ANSWER. Write the answer on the line. **(3 points each)**

The rate of return on investment savings in the United States is low compared to a decade ago. The rate of return on 160 randomly chosen investment savings accounts produced a mean of 2.8% and a standard deviation of 0.4%. Assume that the variable, return on investment savings, has a mound-shaped distribution. $\bar{X} = 2.8\%$, $S = 0.4\%$, assume mound-shaped.

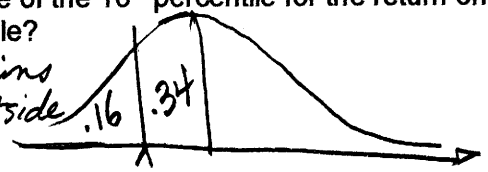
2.4%, 3.2% 20. What is the interval that describes the values for return on investment savings that are within one standard deviation of the mean?

$$\bar{X} \pm S \Rightarrow 2.8 \pm .4 \Rightarrow (2.4\%, 3.2\%)$$

2.4% 21. What is the approximate value of the 16th percentile for the return on investment savings based on the above description of the variable?

The interval $\bar{X} \pm S$ contains about 68%, so 32% outside, half on either side

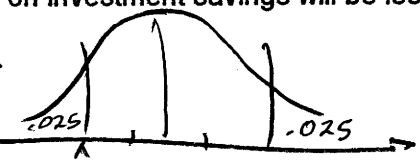
$\bar{X} - S = 2.4\%$



2.0% 22. About 2.5% of the time the return on investment savings will be less than what value based on the description above?

$\bar{X} \pm 2S$ contains approximately 95%, so outside the interval about 5%, half on either side

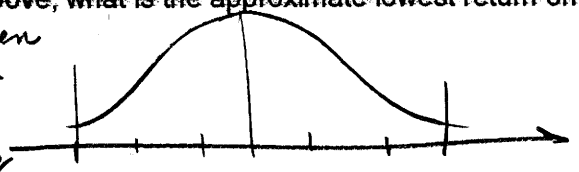
$\bar{X} - 2S = 2.8 - 2(.4) = 2.0\%$



1.6% 23. Based on the description above, what is the approximate lowest return on investment savings?

Approximately 100% between $\bar{X}-3S$ and $\bar{X}+3S$. So the approximate lowest is

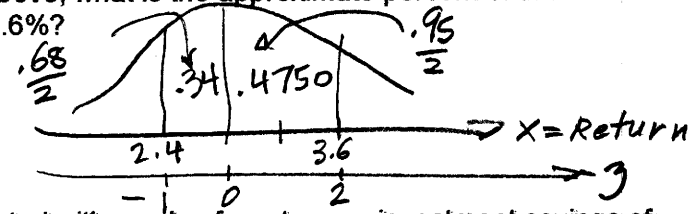
$\bar{X} - 3S = 2.8 - 3(.4) = 1.6\%$



81.5% 24. Based on the description above, what is the approximate percent of the return on investment savings that is between 2.4% and 3.6%?

$.34 + .4750 = .8150$

or 81.50%



−2.5 25. What is the z-score associated with a value for return on investment savings of 1.8%?

$$z = \frac{X - \bar{X}}{S} = \frac{1.8 - 2.8}{.4} = -2.5$$

3.3% 26. What is the return on investment savings that is associated with a z-score of 1.25?

$$X = \bar{X} + zS = 2.8 + 1.25(.4) = 3.3\%$$

PROBABILITY QUESTIONS. State the answer on the line. **(3 points each)**

0.002 27. Assume you have two wireless networks connected to your home computer that do not function independently. One network, Network A, has a failure rate of 0.014 and the other, Network B, has a failure rate of 0.0025. If the probability of Network A failing given that Network B has already failed is .8, what is the probability that they will both fail? State your answer with 3 digits past the decimal. $P(A\text{ Fail}) = .014$, $P(B\text{ Fail}) = .0025$ $P(A\text{ Fail} \mid B\text{ Fail}) = .8$

$P(A\text{ Fail} \cap B\text{ Fail}) = P(A\text{ Fail} \mid B\text{ Fail}) \cdot P(B\text{ Fail}) = .8(.0025) = .002$

0.44 28. Forty percent of all the employees of a company have an MBA degree. Twenty percent of all of the employees are managers. Of the managers in the company eighty percent have MBA degrees. What is the probability that a randomly chosen employee has an MBA degree or is a manager? Do not round your answer. $P(MBA) = .40$, $P(manager) = .20$ $P(MBA \mid manager) = .80$

$P(MBA \cup manager) = P(MBA) + P(manager) - P(MBA \cap manager) = P(MBA) + P(manager) - P(MBA \mid manager) \cdot P(manager)$

$= .4 + .2 - .8(.2) = 0.44$

Five hundred OSU students were questioned about whether they thought a plain lunch-room cafeteria would be a good addition to the dining choices for students. Data on whether the student had a full meal plan was also recorded. The data resulted in the following table. Use it to answer the remaining questions on this page. State your answer as an unreduced ratio fraction, do not simplify, and do not state a decimal fraction.

		In favor of a plain lunch-room type cafeteria		
		YES	NO	
Has a full meal plan?	YES	180	65	245
	NO	85	170	255
		265	235	500

$\frac{265}{500}$ 29. What is the probability that a randomly chosen student is in favor of a plain lunch-room type cafeteria? $\frac{265}{500}$

$\frac{180}{500}$ 30. What is the probability that a randomly chosen student is in favor of the plain lunch-room type cafeteria and has a full meal plan? $\frac{180}{500}$

$\frac{180}{245}$ 31. If a student has the meal plan, what is the probability that the student is in favor of the addition of a plain lunch-room type cafeteria to the dining choices? $\frac{180}{245}$

$\frac{85}{265}$ 32. What is the probability that a student who is in favor of the addition of the plain lunch-room type cafeteria to the dining choices does not have a meal plan? $\frac{85}{265}$

$\frac{330}{500}$ 33. What is the probability that a randomly chosen student either favors the addition of a plain lunch-room type cafeteria to the dining choices or has a full meal plan?

$$\frac{265}{500} + \frac{245}{500} - \frac{180}{500} = \frac{330}{500}$$