STATISTICS 2023 **NAME IN PRINT** Key

EXAM ONE **SIGNATURE IN INK** _____

FALL 2019 **CWID IN INK** _____

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

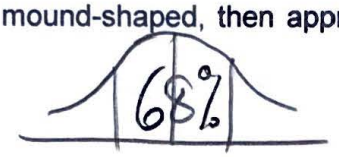
T 1. A sample is a subset of the population and the observed data in the sample are described using graphs and numerical measures.

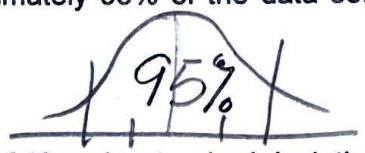
F 2. In a pie chart the relative frequency of each category of data is represented by height of the bars in the graph.

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

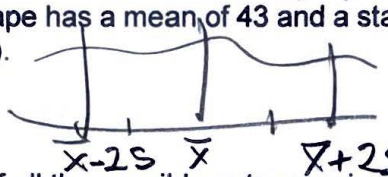
F 4. The numerical measures of variation include variance, standard deviation, median, and range.

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





T 6. If a data set with unknown shape has a mean of 43 and a standard deviation 7 then at most 25% of the data are outside of the interval (29, 57).



T 7. The sum of the probabilities of all the possible outcomes in an experiment is equal to one.

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

Assume that a major stock index changed by the following percentages for each of the last 8 business days.

-2.7, 3.3, 4.0, -1.8, 3.1, -2.9, 3.6 2.8.

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

$\Sigma x = (-2.7) + 3.3 + \ldots + 2.8 = 9.4$

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

$\Sigma x^2 = (-2.7)^2 + 3.3^2 + \ldots + 2.8^2 = 76.24$

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

$(\Sigma x)^2 = 9.4^2 = 88.36$

3.1 11. What is the numerical value of the standard deviation of the observations listed above? Round your answer to one digit past the decimal.

$$s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} = \sqrt{\frac{76.24 - \frac{9.4^2}{8}}{8-1}} = 3.0518$$

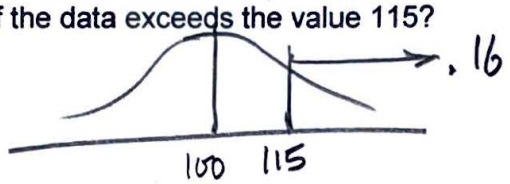
0.2 12. If one category of data is represented in a pie chart with an arc that measures 72 degrees, what is the relative frequency of that category of data?

$\text{degree} = \text{RelFreq}(360)$ so $72 = \text{RelFreq}(360) \Rightarrow \text{RelFreq} = \frac{72}{360}$

2 13. If the sum of squares in a sample with 260 observations is 126,876 and the sum is 5,720 then what is the numerical value of the sample standard deviation?

$$S = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} = \sqrt{\frac{126{,}876 - \frac{5720^2}{260}}{260-1}} = 2$$

.16 or 16% 14. If a data set is mound shaped with a mean of 100 and a standard deviation of 15 then approximately what percent of the data exceeds the value 115?



49.2 15. If a data set has a mean of 54 and a standard deviation of 12 then what is the data value associated with a z score of -0.4?

$$x = \bar{x} + zs = 54 + (-0.4)12 = 49.2$$

1.2 16. If a data set has a mean of 54 and a standard deviation of 12 then what is the z score for the value 68.4?

$$z = \frac{x - \bar{x}}{s} = \frac{68.4 - 54}{12} = 1.2$$

(23.6, 26.8) 17. A sample of 16 red tail hawks had an average wingspan of 25.2 inches and a standard deviation of 0.8. Based on this sample, about 95% of all red tail hawks should have wingspans between what two numbers if wingspan is assumed to have a mound-shape?

$\bar{x} \pm 2s$ contains about 95%.

$25.2 \pm 2(0.8) \Rightarrow (23.6, 26.8)$

92 18. If a data set with unknown shape has a mean of 68 and a standard deviation of 12 units, then at most twenty-five percent of the data will be greater than what value?

$$\bar{x} + 2s = 68 + 2(12) = 92$$

2 19. A data set with 1,400 values contains 350 ones, 450 twos, 400 threes and 200 fours. What is the numerical value of the median for this data set?

$1_1, \ldots 1_{350}, 2_{351}, \ldots 2_{800}, 3_{801}, \ldots 3_{1200}, 4_{1201}, \ldots 4_{1400}$

↑ 2 @ place 700.5

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

The Oklahoma State University Water Ski Team recorded the time in seconds required by 7 members of the team to perform a difficult water ski event. The times in seconds required by each student to perform the water ski event are as follows: 38, 29, 42, 62, 28, 26, 44
Use these data to answer the next four questions.

38 20. What is the numerical value of the mean for this sample of water ski event times? Round your answer to have no digits past the decimal.

$$\bar{X} = \frac{\Sigma x}{n} = \frac{269}{7} = 38.42857$$

12.6 21. What is the numerical value of the standard deviation for the time required for members of the water ski team to perform this difficult event? Round your answer to one digits past the decimal.

$$S = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} = 12.5944$$

38 22. What is the numerical value of the median of the above sample of times required to perform this difficult water ski event?

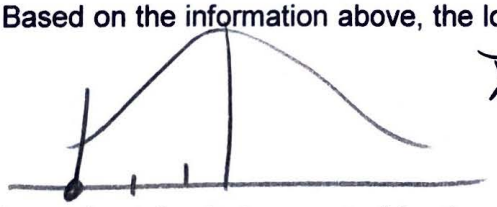
26 28 29 (38) 42 44 62

3/7 23. What fraction of the members on the water ski team can perform this difficult water ski event in less than half a minute? State your answer as a ratio; do not state a decimal answer.

3/7 3 of the 7 values were < 30 secs.

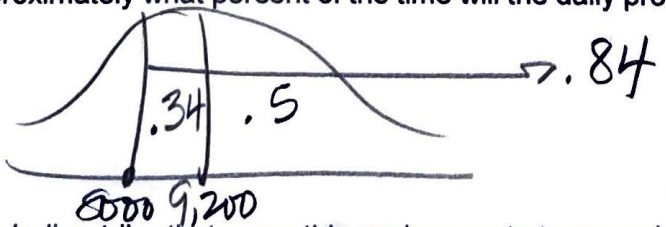
The daily profit in a casino outside a small Oklahoma town is mound-shaped with a mean of $9,200 and a standard deviation of $1,200. Use this information to answer the remaining questions on this page.

$5,600 24. Based on the information above, the lowest daily profit for this casino is approximately what value?

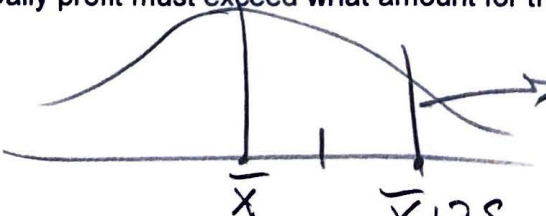


$\bar{X} - 3S = 9,200 - 3(1,200) =$
$= \$5,600$

.84 or 84% 25. Approximately what percent of the time will the daily profit in this casino exceed $8,000?



$11,600. 26. The Indian tribe that owns this casino wants to reward the employees when the profits are in the top 2.5%. Daily profit must exceed what amount for the employees to receive a bonus based on this criterion?



$\bar{X} + 2S =$
$9,200 + 2(1,200) =$
$\$11,600$

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

0.734 27. At a state university 70% of all faculty have Ph.D. degrees and 65% of all faculty are tenured. Of the faculty with Ph.D. degrees, 88% are tenured. What is the probability that a randomly chosen faculty member has a Ph.D. degree or is tenured?

$P(PhD) = .70$, $P(Tenured) = .65$ $P(Tenured \mid PhD) = .88$

$P(PhD \cup Tenured) = P(PhD) + P(tenured) - P(Tenured \mid PhD) \cdot P(PhD)$

$= .70 + .65 - .88(.75) = 0.734$

0.1 or 10% 28. Most Oklahomans want air-conditioning in their car. Eighty percent of all cars have air-conditioning, but only forty percent of economy cars have air-conditioning. If twenty-five percent of all cars are economy cars, what is the probability that a car will be an economy car and will have air conditioning?

$P(AC) = .80$ $P(AC \mid Economy) = .40$, $P(Economy) = .25$

$P(Economy \cap AC) = P(AC \mid Economy) \cdot P(Economy) =$

$= .40 (.25) = 0.1$

A research and develop company surveyed all 200 of its employees over the age of 60 and obtained the information given in the table below. One of these 200 employees is selected at random. **Do not reduce fractional answers. State all of your answers as ratio fractions. Do not state decimal fraction answers.**

	UNDER 20 YEARS WITH COMPANY		OVER 20 YEARS WITH COMPANY		
	Technical Staff	**Non-technical Staff**	**Technical Staff**	**Non-technical Staff**	
Plan to Retire at Age 65	31	5	45	12	93
Plan to Retire at Age 68	59	25	15	8	107
	90	30	60	20	200

50/200 29. What is the probability that the person selected is on the non-technical staff?

$\frac{30+20}{200}$

84/120 30. If the person selected has under 20 years of service with the company, what is the probability that the person plans to retire at age 68?

60/150 $\frac{59+25}{90+30} = \frac{84}{120}$

31. If the person selected is on the technical staff, what is the probability that the person has been with the company over 20 years? $\frac{45+15}{90+60} = \frac{60}{150}$

45/200 32. What is the probability that the person selected has over 20 years with the company, is on the technical staff, and plans to retire at age 65?

72/80 $\frac{45}{200}$

33. Assume the person selected has over 20 years with the company, what is the probability that the person is on the technical staff or plans to retire at age 65?

$\frac{60+57-45}{60+20} = \frac{72}{80}$