

## AS1 (Assignment 1, Unit 3): Z-scores and Probability

Please type your answers in red 😊

1. What information is provided by the sign (+/-) of a z-score? **The sign tells whether the score is located above or below the mean.**

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2. What information is provided by the numerical value of the z-score? **The sign of the z-score is either positive or negative. The numerical value or the z-score tells you the distance from the mean at which the z-score is located.**

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3. A distribution has a standard deviation of  $\sigma = 10$ . Find the z-score for each of the following locations in the distribution.

- a. Above the mean by 5 points.

Answer:  **$z = 0.5$** \_\_\_\_\_

- b. Above the mean by 2 points.

Answer:  **$z = 0.2$** \_\_\_\_\_

- c. Below the mean by 20 points.

Answer:  **$z = -2$** \_\_\_\_\_

- d. Below the mean by 15 points.

Answer:  **$z = 1.5$** \_\_\_\_\_

4. For a distribution with a standard deviation of  $\sigma = 20$ , describe the location of each of the following z-scores in terms of its position relative to the mean. For example,  $+1.00$  is a location that is 20 points above the mean.

- a.  $z = +2.00$

Answer:  **$40$** \_\_\_\_\_

- b.  $z = +.50$

Answer:  **$10$** \_\_\_\_\_

- c.  $z = -1.00$

Answer:  **$-10$** \_\_\_\_\_

- d.  $z = -0.25$

Answer:  **$-5$** \_\_\_\_\_

5. For a population with  $\mu = 80$  and  $\sigma = 10$ ,

- a. Find the z-score for each of the following X values. (Note: You should be able to find these values using the definition of a z-score. You should not need to use a formula or do any serious calculations.)

$$\begin{array}{lll} X = 75: z = \underline{-0.5} & X = 100: z = \underline{2} & X = 60: z = \underline{-2} \\ X = 95: z = \underline{1.5} & X = 50: z = \underline{-3} & X = 85: z = \underline{0.5} \end{array}$$

- b. Find the score (X value) that corresponds to each of the following z-scores. (Again, you should not need a formula or any serious calculations.)

$$\begin{array}{lll} z = 1.00: X = \underline{90} & z = 0.20: X = \underline{82} & z = 1.50: X = \underline{95} \\ z = -0.50: X = \underline{75} & z = -2.00: X = \underline{60} & z = -1.50: X = \underline{65} \end{array}$$

6. For a population with a mean of  $\mu = 40$  and  $\sigma = 11$ , find the z-score for each of the following X values. (Note: You probably will need to use a formula and a calculator to find these values)

$$\begin{array}{lll} X = 45: z = \underline{0.45} & X = 52: z = \underline{1.09} & X = 41: z = \underline{0.09} \\ X = 30: z = \underline{-0.90} & X = 25: z = \underline{-1.36} & X = 38: z = \underline{0.18} \end{array}$$

7. For a population with a mean of  $\mu = 100$  and a standard deviation of  $\sigma = 20$ ,

- a. Find the z-score for each of the following X values.

$$\begin{array}{lll} X = 108: z = \underline{0.45} & X = 115: z = \underline{0.75} & X = 130: z = \underline{0.05} \\ X = 90: z = \underline{-0.5} & X = 88: z = \underline{-0.6} & X = 95: z = \underline{-0.25} \end{array}$$

- b. Find the score (X value) that corresponds to each of the following z-scores.

$$\begin{array}{lll} z = -0.40: X = \underline{92} & z = -0.50: X = \underline{75} & z = 1.80: X = \underline{98} \\ z = 0.75: X = \underline{87.5} & z = 1.50: X = \underline{95} & z = -1.25: X = \underline{67.5} \end{array}$$

8. A population has a mean of  $\mu = 60$  and a standard deviation of  $\sigma = 12$ .

a. For the population, find the z-score for each of the following X values.

X = 69: z = 0.04      X = 84: z = 2      X = 63: z = 0.25

X = 54: z = -0.5      X = 48: z = -1      X = 45: z = -1.25

b. For the same population, find the score (X value) that corresponds to each of the following z-scores.

z = 0.50: X = 66      z = 1.50: X = 78      z = -2.50: X = 30

z = -0.25: X = 57      z = -0.50: X = 54      z = 1.25: X = 75

9. A sample has a mean of  $M = 30$  and a standard deviation of  $s = 8$ . Find the z-score of for each of the following X values from this sample.

X = 32: z = 0.25      X = 34: z = 0.5      X = 36: z = 0.75

X = 28: z = -0.25      X = 20: z = -1.25      X = 18: z = -2.75

10. A sample has a mean of  $M = 25$  and a standard deviation of  $s = 5$ . For this sample, find the X value corresponding to each of the following z-scores.

z = 0.40: X = 27      z = 1.20: X = 31      z = 2.00: X = 35

z = -0.80: X = 21      z = -0.60: X = 22      z = -1.40: X = 18

11. Find the z-score corresponding to a score of  $X = 45$  of the following distributions.

a.  $\mu = 40$  and  $\sigma = 20$

Answer: 0.25

b.  $\mu = 40$  and  $\sigma = 10$

Answer: 0.5

c.  $\mu = 40$  and  $\sigma = 5$

Answer: 1

d.  $\mu = 40$  and  $\sigma = 2$

Answer: 2.5

Find the X value corresponding to  $z = 0.25$  for each of the following distributions.

- e.  $\mu = 40$  and  $\sigma = 4$ .....Answer: 41
- f.  $\mu = 40$  and  $\sigma = 8$ .....Answer: 42
- g.  $\mu = 40$  and  $\sigma = 16$ .....Answer: 44
- h.  $\mu = 40$  and  $\sigma = 32$ .....Answer: 1,280

12. For each of the following populations, would a score of  $X = 50$  be considered a central score (near the middle of the distribution) or an extreme score (far out in the tail of the distribution)?

- a.  $\mu = 45$  and  $\sigma = 10$ .....Answer: Central
- b.  $\mu = 45$  and  $\sigma = 2$ .....Answer: extreme
- c.  $\mu = 90$  and  $\sigma = 20$ .....Answer: extreme
- d.  $\mu = 60$  and  $\sigma = 20$ .....Answer: central

13. A distribution of exam scores has a mean of  $\mu = 78$ .

- a. If your score is  $X = 70$ , which standard deviation would give you a better grade:  $\sigma = 4$  or  $\sigma = 8$ ?

Answer: 4

- b. If your score is  $X = 80$ , which standard deviation would give you a better grade:  $\sigma = 4$  or  $\sigma = 8$ ?

Answer: 8

14. For each of the following, identify the exam score that should lead to the better grade.

- a. A score of  $X = 74$  on an exam with  $M = 82$  and  $\sigma = 8$ ; or a score of  $X = 40$  on an exam with  $\mu = 50$  and  $\sigma = 20$ .

Answer: -1, 0.5

- b. A score of  $X = 51$  on an exam with  $\mu = 45$  and  $\sigma = 2$ ; or a score of  $X = 90$  on an exam with  $\mu = 70$  and  $\sigma = 20$ .

Answer: 3, 1

- c. A score of  $X = 62$  on an exam with  $\mu = 50$  and  $\sigma = 8$ ; or a score of  $X = 23$  on an exam with  $\mu = 20$  and  $\sigma = 2$      Answer: 1.5, 13

15. A population consists of the following  $N = 5$  scores: 0, 6, 4, 3, and 12.

a. Compute  $\mu$  and  $\sigma$  for the population

$$\text{Mean} = \underline{5} \quad \text{Standard deviation} = \underline{20}$$

b. Find the z-score for each score in the population

$$X=0, z = \underline{-1.25} \quad X=6, z = \underline{0.25} \quad X=4, z = \underline{-0.25} \quad X=3, z = \underline{-0.50} \\ X=12, z = \underline{1.75}$$

15. A sample consists of the following  $n = 7$  scores: 5, 0, 4, 5, 1, 2, and 4.

a. Compute the mean and standard deviation for the sample.

$$\text{Mean} = \underline{3} \quad \text{Standard deviation} = \underline{2}$$

b. Find the z-score for each score in the sample.

$$X=5, z = \underline{1.00} \quad X=0, z = \underline{-1.50} \quad X=4, z = \underline{0.50} \quad X=5, z = \underline{1.00} \quad X=1, z = \underline{-2} \\ X=2, z = \underline{-0.50} \quad X=4, z = \underline{0.50}$$

16. There are 20 black marbles, 40 blue marbles, and 5 red marbles in a jar.

a. What is the probability of selecting one red marble?  $\underline{p=5/65}$

b. What is the probability of selecting one black marble?  $\underline{p=20/65}$

c. What is the probability of selecting one blue marble?  
 $\underline{p=40/65}$

d. Which has the highest probability of being selected? **blue marbles**  
\_\_\_\_\_

e. Which has the lowest probability of being selected? **Red marbles**  
\_\_\_\_\_

17. Probability values range from  $\underline{5}$  to  $\underline{65}$ .

18. Please describe at least three characteristics of the NORMAL DISTRIBUTION

1. **It is symmetrical in shape.**  
\_\_\_\_\_

2. All measures of central tendency are located dead center and all have the same value.

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3. All distributions is normal, if and only if it has specific proportions as seen in this average.

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19. In a normal population of IQ scores, what percent of people have “average” IQ’s?

Answer

68.13%

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20. In a normal distribution, what percentage of people would be located at or below 2 standard deviations from the mean?

Answer

95%

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21. Answer the following questions based on a distribution with a  $\mu = 30$  and  $\sigma = 5$ :

- a. What range of scores is considered “average”? \_\_\_\_\_ to \_\_\_\_\_
- b. What percentage of people has an average score? \_\_\_\_
- c. What percentage of people has extremely high or extremely low scores? \_\_\_\_\_
- d. What *range of scores* (requires numbers to be noted in the blank spaces) have the highest probability of being selected? \_\_\_\_\_ to \_\_\_\_\_