

## Review Session – AP Statistics – Unit 2

1. Which of these variables is *least* likely to have a Normal distribution?
  - (a) Annual income for all 150 employees at a local high school
  - (b) Lengths of 50 newly hatched pythons
  - (c) Heights of 100 white pine trees in a forest
  - (d) Amount of soda in 60 cups filled by an automated machine at a fast-food restaurant
  - (e) Weights of 200 of the same candy bar in a shipment to a local supermarket
  
2. The proportion of observations from a standard Normal distribution that take values larger than  $-0.75$  is about
  - (a) 0.2266
  - (b) 0.7704
  - (c) 0.7734
  - (d) 0.7764
  - (e) 0.8023
  
3. A smooth curve which approximates the shape of a histogram and describes the overall pattern of a distribution is called
  - (a) a stemplot
  - (b) a Normal probability plot
  - (c) a destiny curve
  - (d) a density curve
  - (e) none of the above
  
4. The following graph is a Normal probability plot for the amount of rainfall (in acre-feet) obtained from 26 randomly selected clouds that were seeded with silver oxide. Which of the following statements about the shape of the rainfall distribution is true?
 

Standard Deviations

  - (a) The distribution is Normal.
  - (b) The distribution is approximately Normal.
  - (c) The distribution is roughly symmetric.
  - (d) The distribution has no potential outliers.
  - (e) The distribution is skewed.
  
5. The distribution of the heights of students in a large class is roughly Normal. Moreover, the average height is 68 inches, and approximately 95% of the heights are between 62 and 74 inches. Thus, the standard deviation of the height distribution is approximately equal to
  - (a) 2
  - (b) 3
  - (c) 6
  - (d) 9
  - (e) 12
  
6. If a store runs out of advertised material during a sale, customers become upset, and the store loses not only the sale but also goodwill. From past experience, a music store finds that the mean number of CDs sold in a sale is 845, the variance is 225, and a histogram of the demand is approximately Normal. The manager is willing to accept a 2.5% chance that a CD will be sold out. About how many CDs should the manager order for an upcoming sale?
  - (a) 1295
  - (b) 1070
  - (c) 935
  - (d) 875
  - (e) 860
  
7. If the median of a set of data is equal to the mean, then
  - (a) The data are Normally distributed.
  - (b) The data are approximately Normally distributed.
  - (c) The distribution is skewed.
  - (d) The distribution is symmetric.
  - (e) One can't say anything about the shape of the distribution with any certainty.

8. The average yearly snowfall in Chillyville is Normally distributed with a mean of 55 inches. If the snowfall in Chillyville exceeds 60 inches in 15% of the years, what is the standard deviation?
- (a) 4.81 inches      (b) 5.18 inches (c) 6.04 inches (d) 8.93 inches  
(e) The standard deviation cannot be computed from the given information.
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FREE-RESPONSE

9. The length of human pregnancies from conception to birth varies according to a distribution that is approximately Normal, with mean 266 days and standard deviation 16 days.
- a. What percent of pregnancies last less than 240 days?
- b. What percent of pregnancies last between 240 and 270 days (roughly between 8 and 9 months)?
- c. How long do the longest 20% of pregnancies last?
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10. One of the most popular IQ tests is called the "Stanford-Binet Intelligence Scale". Scores on this test are generally Normally distributed with a mean of 95 and  $\sigma=15$ .
- a. If someone scores at the 16<sup>th</sup> percentile, about what score did that individual have?
- b. Suppose that among 1000 individuals, a person named Einstein scores 130. How many of those 1000 individuals scored higher than Einstein?

## ANSWERS

- A.** All the other answers can be reasonable assumed to be symmetric with an equal amount of variability both below and above the mean. But annual income of employees is probably skewed right, with most teachers making a certain amount of money when they start teaching, but fewer and fewer teachers remaining in the profession as they get older.
- C.** Don't forgot to "1-", it says "larger".
- D.** This is the definition of a density curve.
- E.** To begin with, "A" and "B" must be wrong, because you only get Normality if a normal quantile plot is linear, and this definitely isn't. In fact, it has a few weird dots in the top-right. That means potential outliers, so "D" is wrong. And if there are outliers, it's skewed!
- B.** If 95% of heights are between 62 and 74 inches, then that must be 2 standard deviations above and below the mean. Remember that the Empirical Rule states that 68% of values are within one standard deviation, 95% within 2 standard deviations, and 99% within 3 standard deviations. So 95% must be within 2. And if 62 and 74 are both 6 inches away from the stated mean of 68, and 6 inches is two standard deviations, then the standard deviation must be 3.
- D.** A "2.5% chance" that a CD will be sold out means that more people wanted CD's, so we actually look up 0.975 in the chart, not 0.025. The z-score is 1.96. Remember also that "variance" is the square of standard deviation, so our standard deviation is  $\sqrt{225}=15$ . The formula is  $z = (\# - \text{mean}) / \text{std.dev.}$ , so  $1.96 = (\# - 845) / 15$ . The answer is 874.4, or 875 CD's.
- D.** If the mean is in the middle (median), then there are no outliers pulling it one way or another, so the data are symmetric. We don't know if it's Normal, though....we'd need a normal quantile plot or a comparison with the Empirical Rule to know that.
- A.** The problem says exceeds in 15% of years, so we actually look up 0.85 in the cart, to get a z-score of 1.04. Remember that the formula is  $z = (\# - \text{mean}) / \text{std.dev.}$ , so  $1.04 = (60 - 55) / \text{std.dev.}$  Solve to get  $\text{std.dev.} = 4.808$ .

## FRQ #9: Answers

9. Human pregnancies are Normal with mean 266 days and standard deviation 16 days.

- a. What percent of pregnancies last less than 240 days?

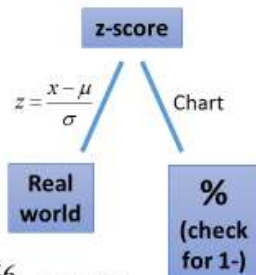
$$z = \frac{240 - 266}{16} = -1.63 \xrightarrow{\text{Chart}} 0.0516$$

- b. What percent of pregnancies last between 240 and 270 days?

$$\frac{240 - 266}{16} = -1.63 \xrightarrow{\text{Chart}} 0.0516 \quad \frac{270 - 266}{16} = 0.25 \xrightarrow{\text{Chart}} 0.5987$$

- c. How long do the longest 20% of pregnancies last?  $0.5987 - 0.0516 = 0.5471$

$$0.84 = \frac{x - 266}{16} \quad x = 279.44$$



## FRQ #10: ANSWERS

- One of the most popular IQ tests is called the "Stanford-Binet Intelligence Scale". Scores on this test are generally Normally distributed with a mean of 95 and  $\sigma=15$ .

- a. If someone scores at the 16<sup>th</sup> percentile, about what score did that individual have?

$$-0.99 = \frac{x - 95}{15} \quad x = 80.15$$

16<sup>th</sup> percentile in chart

- b. Suppose that among 1000 individuals, a person named Einstein scores 130. How many of those 1000 individuals scored higher than Einstein?

$$z = \frac{130 - 95}{15} = 2.33$$

$$1 - 0.9901 = 0.0099$$

Looked up  $z=2.33$  in chart

$$0.0099 \cdot 1000 = 9.9$$