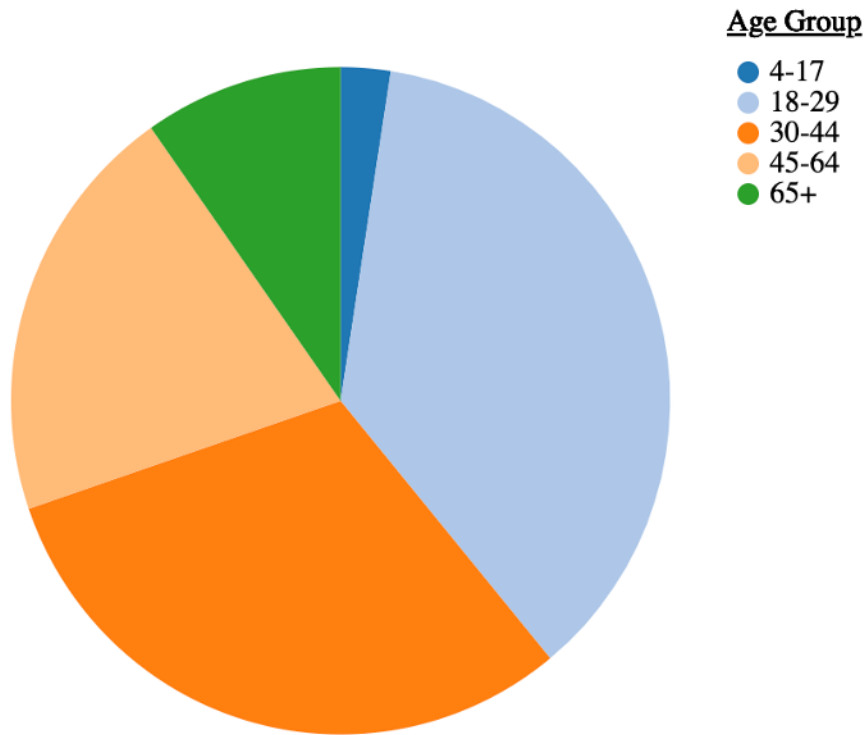


**Important Instructions for this Test:** Please pay close attention to and carefully follow all rounding instructions. Round any steps as indicated or as necessary to make the final answer as accurate as possible. Good luck, have fun, and as always: “NOTA” stands for “None of These Answers is correct.”

1. The Stats S.E.A.L. Commander loves statistics so much that while he is forced against his will to go see the movie premiere of “Barbie,” he decides to do some statistics! What a DORK! He surveys of all the movie goers in the theater that night and collects some data, including their ages. He then arbitrarily groups some of the ages together to form a set of age groups. The distribution the age groups of the responses of the movie goers in the theater that night is displayed by the following pie chart.



Which of the following is the best description of the shape of this distribution of age groups?

- A: Skewed to the left
- C: Skewed to the right
- E: NOTA
- B: Uniform
- D: Roughly symmetric

2. A random variable  $X$  has a geometric distribution with mean of 15. How many total positive integral factors does  $\sigma_X^2$  (the variance of random variable  $X$ ) have?

- A: 2
- B: 4
- C: 8
- D: 16
- E: NOTA

3. In President Snow’s Statistics class, final exam scores are approximately normally distributed. Suppose Daniel’s final exam score was an 89.8, which put him at the 99.7<sup>th</sup> percentile, while Rick’s final exam score was an 80.3 and only 32% of scores are greater than his score. To the nearest integer, what is the sum of the mean and standard deviation of the distribution of President Snow’s Statistics class final exam scores?

- A: 81
- B: 82
- C: 83
- D: 84
- E: NOTA

4. Effie Trinket wants to randomly select high school students to participate in the  $MA\theta$  Hypothesis Games. Effie has decided to first split the country into the 50 states; and then, she will divide each state into a set of regions by county and then randomly select a set of 10 counties within each state. Effie will then randomly select 10 high schools within each of these randomly selected counties; and finally, Effie will randomly select a set of 10 students from each of these randomly selected high schools. What is the name of the sampling method that Effie is using in this scenario?

- A: Cluster random sampling      C: Systematic random sampling      E: NOTA  
B: Stratified random sampling      D: Multistage random sampling

**Please Use the Following Information to Answer Questions 5 and 6:**

Normie and Harry have been training to compete in the 2024 Worldwide Wing Eating Championship in Clearwater Beach, FL, where they are each given 10 minutes to eat as many chicken wings as they can! Suppose the number of chicken wings Normie can consume in the 10 minutes,  $N$ , is approximately Normally distributed with a mean of 88.4 wings and a standard deviation of 2.3 wings. Also, suppose the number of chicken wings Harry can consume in the 10 minutes,  $H$ , is approximately Normally distributed with a mean of 72.5 wings and a standard deviation of 5.6 wings.

5. Assuming  $N$  and  $H$  are independent Normal random variables, what is the approximate probability that Harry eats more wings than Normie in the given 10-minutes of the 2024 Worldwide Wing Eating Championship? Round your final answer to four decimal places.

- A: 0.0043      B: 0.0034      C: 0.0021      D: 0.0012      E: NOTA

6. Suppose Normie attends 50 similar wing-eating competitions during the next year and that his wing-eating distribution,  $N$ , remains the same at each one of these competitions and that all of these 50 competitions are independent of each other. Define random variable  $T$  as *the total number of wings eaten by Normie throughout these 50 independent wing-eating competitions*. What is  $P(T > 4400)$  rounded to four decimal places?

- A: 0.9757      B: 0.9689      C: 0.8906      D: 0.5698      E: NOTA

7. If  $P(A \cup B^c) = 0.9$  and  $P(A \cap B) = 0.3$ , then what is  $P(A|B)$ ?

- A:  $\frac{1}{4}$       B:  $\frac{1}{3}$       C:  $\frac{1}{2}$       D:  $\frac{3}{4}$       E: NOTA

8. A blind taste test is conducted with a classroom of 25 statistics students to determine whether or not the students can taste a difference between different types of carbonated water: *Perrier*, *Pellegrino*, and *La Croix*. Each student is given three identical glasses containing each of the different types of carbonated water and then asked to identify which glass contains *La Croix*. Assuming that the students cannot taste the difference between the three different types of carbonated water and each of their selections are independent of each other, what is the probability that at least 14 of the students will correctly identify the glass that contains *La Croix* rounded to four decimal places?

- A: 0.0056      B: 0.9836      C: 0.0164      D: 0.9944      E: NOTA

9. Dr. Santos has two bags of Lego pieces. The first bag (*bag 1*) contains 2 red and 8 blue Lego pieces, while the second bag (*bag 2*) contains 6 red and 2 blue Lego pieces. Benny draws one Lego piece at random and finds that it is red. Find the probability that the Lego piece was drawn from *bag 1*.

- A:  $\frac{3}{8}$       B:  $\frac{4}{9}$       C:  $\frac{4}{19}$       D:  $\frac{9}{40}$       E: NOTA

**Please Use the Following Information to Answer Questions 10 to 12:**

The Minitab output given below references the linear relationship between the average points per game (PPG) and the ranking (Rank) of the top 20 basketball players in the NBA during the 2022-2023 season.

NOTE: A player's "Rank" is defined as being 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, etc. in terms of their average points per game.

## Regression Analysis: PPG versus Rank

## Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	41.92	1.32	31.84	0.000	
Rank	-0.518	0.110	-4.71	0.000	1.00

## Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
2.83451	55.19%	52.71%	37.09%

**10.** One of the basketball players was ranked 7<sup>th</sup> and had an average of 36.13 points per game. Using the appropriate rounded values from the output table above, what is the approximate value of the residual for this player rounded to the nearest thousandth?

- A: -4.178      B: -2.164      C: 2.164      D: 4.178      E: NOTA

**11.** Approximately what percent of the variation in points per game is unexplained by the least-squares regression line when rounded to the nearest hundredth of a percent?

- A: 55.19%      B: 52.71%      C: 47.29%      D: 44.81%      E: NOTA

**12.** Using the appropriate rounded values from the output table above, find the sum of the standard error of the regression and the value of the correlation coefficient according to the linear regression output. Express your final answer as a decimal rounded to the nearest thousandth.

- A: 2.092      B: 2.109      C: 3.578      D: 3.561      E: NOTA

**13.** Tim is interested in finding out which of the F1 drivers has the largest fan base amongst his high school classmates. So, he takes a random sample of students at his very large high school by first splitting his school by grade level (Freshman, Sophomore, Junior, and Senior) and then he takes an SRS of 10 students from each grade level. The random sampling methodology Tim is using for this study is best classified as which of the following?

- A: Cluster      B: Systematic      C: Stratified      D: Simple random      E: NOTA

**14.** Suppose random variable  $Z$  is given by  $Z = 2X - Y - 3$ , such that  $X$  and  $Y$  are independent random variables with  $Var(X) = 2$  and  $Var(Y) = 4$ . What is the variance of random variable  $Z$ ?

- A: 3      B: 4      C: 5      D: 8      E: NOTA

**15.** Romir (who is a self-proclaimed “Pub Sub” connoisseur) is interested in determining the most popular Publix sandwich on the menu. Romir stands in his local Publix store near the deli and records customers’ orders during lunch rush hour. He finds that 20% of customers ordered a chicken tender sub, 30% ordered an Italian sub, and 50% ordered a turkey sub. He also noticed that those who ordered an Italian sub were twice as likely as customers who ordered a turkey sub to get their sub toasted and that those who ordered an Italian sub were only half as likely as those who ordered a chicken tender sub to get their sub toasted. If a randomly selected customer who toasted their sub is chosen from Romer’s data, what is the probability that the customer ordered a chicken tender sub?

- A:  $\frac{4}{35}$       B:  $\frac{8}{19}$       C:  $\frac{4}{7}$       D:  $\frac{19}{70}$       E: NOTA

**16.** Researchers at *Aspirin Academy* conduct a study to test the reduction in migraine symptoms of a sample of patients using four different dosages of an over-the-counter experimental drug. Which of the following statements is true?

- A: Migraine symptom reduction is the only explanatory variable.  
 B: There is a single explanatory variable with four levels.  
 C: There are four explanatory variables and each one has a single level.  
 D: There are four explanatory variables and a single response variable.  
 E: NOTA

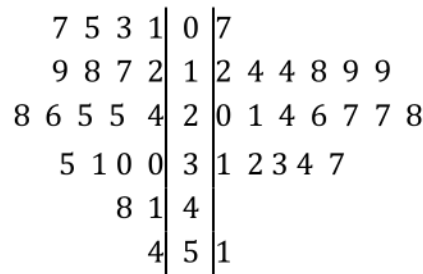
**17.** While filling out the paper work for her new leased car, Kelley is asked for her age (in years) , gender, number of years she has lived at her current address, annual salary, and her marital status. How many of these items represent variables that can be displayed using a histogram?

- A: 0      B: 1      C: 2      D: 3      E: NOTA

**18.** Suppose  $X$  is a random variable where  $P(X = n) = \binom{16}{n}(0.2)^n(0.8)^{16-n}$  for  $n = 0, 1, \dots, 16$ . What is the product of the mean and standard deviation of random variable  $X$ ?

- A: 4.8      B: 5.12      C: 6.6      D: 8      E: NOTA

**19.** Consider the following back-to-back stemplot of two samples of data:



Key: 5|1 = 51

Which of the following statements is / are true about the distributions of these two data sets?

- I. The two distributions have the same median.  
 II. The two distributions have the same sample standard deviation.  
 III. The two distributions have the same number of outliers according to the 1.5(IQR) rule.

- A: I and II      B: I and III      C: II and III      D: I, II, and III      E: NOTA

**Please Use the Following Information to Answer Questions 20 to 21:**

In the finals of a tennis competition, the Florida Flamingos went head-to-head against the New York Apples. The final round of the competition consists of a three-game series of independent games where the winner is declared after they have won two out of the three games. NOTE: The third game is only played if the series is tied at one game apiece after the first two games.

**20.** If the Florida Flamingos are twice as likely to win any independent game as the New York Apples are, what is the probability that the series has to go to the third game?

- A:  $\frac{2}{9}$       B:  $\frac{1}{3}$       C:  $\frac{4}{9}$       D:  $\frac{5}{9}$       E: NOTA

**21.** Given that the New York Apples won the series, what is the probability that no winner was decided until after the three games were played?

- A:  $\frac{2}{9}$       B:  $\frac{2}{7}$       C:  $\frac{4}{7}$       D:  $\frac{4}{27}$       E: NOTA

**22.** A random variable  $X$  has a binomial distribution with mean of 18.24 and variance of 4.3776. What is  $P(X > 14)$  rounded to the nearest thousandth?

- A: 0.999      B: 0.984      C: 0.979      D: 0.958      E: NOTA

**23.** Which of the following are all equivalent in a standard Normal distribution?

- I. Mean      II. Median      III. Mode      IV. Variance
- A: I and II only      C: II, III, and IV      E: NOTA  
 B: I, II, and III      D: I, II, III, and IV

**24.** A probability distribution of the amount of time it takes to wait in line to ride the Magic Kingdom's newest attraction, *TRON Lightcycle/Run*, is given in the following table:

Time (t) (in minutes)	Probability
$15 \leq t < 25$	0.15
$25 \leq t < 35$	0.10
$35 \leq t < 45$	0.05
$45 \leq t < 55$	0.20
$55 \leq t < 65$	0.10
$65 \leq t < 75$	0.10
$75 \leq t < 85$	0.30

Using the midpoints of each time interval, which of the following is the best approximation to the percentage of attendees of *TRON Lightcycle/Run* who will have to wait strictly within one standard deviation of the mean waiting time for the attraction when rounded to the nearest five percent?

- A: 35%      B: 45%      C: 55%      D: 65%      E: NOTA

25. This type of graphical display of the conditional distribution of categorical response variable for each value of a categorical explanatory variable is similar to a stacked (or segmented) bar graph except that the width of each stacked (or segmented) bar is proportional to the relative frequency of the category of the explanatory variable being represented by that bar is called a(n) \_\_\_\_\_. Find the number of distinct permutations of the letters in the two missing words needed to fill in the blank and do not treat the space between the two words as a letter.

- A: 1,814,400      B: 60,480      C: 20,160      D: 10,080      E: NOTA

26. Let  $X$  be a discrete random variable with the probability function  $P(X = x) = \frac{1}{2^x}$  for  $x = 1, 2, 3, \dots$  What is the probability that  $X$  is even?

- A:  $\frac{1}{2}$       B:  $\frac{1}{3}$       C:  $\frac{1}{4}$       D:  $\frac{1}{5}$       E: NOTA

27. Let  $X$  be a binomial random variable with a probability of success of  $p$  on each independent trial,  $n$ . If  $P(X = n) = 0.00032$  and  $P(X = n - 1) = 0.00128n$ , what is  $p$ ?

- A: 0.8      B: 0.40      C: 0.2      D: 0.1      E: NOTA

28. Alan, an Amazon employee, is constructing boxes such that the height is 9 inches and their base is  $X$  inches by  $X$  inches. If  $X$  has a continuous uniform distribution over the real interval  $(4, 8)$ , what is the expected value of the volume of the box ( $V = 9X^2$ ) in cubic inches? HINT: The variance of a continuous uniform distribution,  $X$ , defined on an open real interval  $(a, b)$  is given by  $Var(X) = \frac{(b-a)^2}{12}$ .

- A: 256      B: 280      C: 288      D: 336      E: NOTA

29. Suppose Rithvik rolls a fair die until a 6 is obtained. Let random variable  $X$  represent the number of rolls needed until the first 6 is obtained. What is the smallest value of  $x$  for which  $P(X \leq x) \geq \frac{1}{2}$ ?

- A: 6      B: 5      C: 4      D: 3      E: NOTA

30. Let's recall some of the random variables used throughout this test. First, random variables  $N$  and  $H$  as they are defined for questions 5 and 6; and then, random variable  $X$  as it is defined in question number 22. Suppose that random variables  $N$ ,  $H$ , and  $X$  are all independent of each other and we now define random variable  $Y$  as  $Y = (2N - 3) - (4H + 10) + (5X + 2)$  and random variable  $\bar{Y}$  as the sample mean of an SRS of  $n = 100$  independent observations from random variable  $Y$ . What is the approximate probability of  $P(-40 < \bar{Y} < -30)$  rounded to the hundredths place?

- A: 0.88      B: 0.85      C: 0.16      D: 0.32      E: NOTA