For all questions, answer choice (E) NOTA means that none of the given answers is correct. Good Luck!

1. What is the probability that the intended correct answer to this question is A?

   (A) 0.2   (B) 0.1   (C) 1   (D) 0   (E) NOTA

2. Jessie claims that the majority (more than 50 percent) of students at her school (with 302 students) do not like her signature combination of vanilla ice cream and soy sauce. She decides to take a simple random sample of 32 students from her math competition team and finds that 20 of the surveyed students claimed to NOT like the combination of ice cream and soy sauce. Then, she performs a One-Sample Z-Test for a population proportion to test her claim. Based on the results of this test, can she conclude at the $\alpha = 0.05$ significance level that more than 50 percent of the students at her school do NOT like vanilla ice cream and soy sauce together?

   (A) Yes, since the p-value of the test is rounded to 0.017
   (B) No, since the p-value of the test is rounded to 0.983
   (C) The test cannot be appropriately performed as the randomness condition (and only this condition) was violated
   (D) The test cannot be appropriately performed as two or more of the inference assumptions were violated
   (E) NOTA

3. The Stats Orca wants to know if a certain diet significantly decreases the hbA1C levels (a measure of blood sugar) of diabetic patients. If the Stats Orca performs the appropriate test using the following dataset, which includes the hbA1C levels of 10 diabetics before and after the diet, what is the standard deviation of this test rounded to 3 decimal places? Assume all inference conditions and assumptions are met.

Patient:	1	2	3	4	5	6	7	8	9	10
hbA1C before diet:	9.6	11.0	8.6	8.3	7.9	14.0	10.5	10.5	12.1	11.7
hbA1C after diet:	5.6	7.5	6.4	6.2	5.5	7.6	12.1	11.0	6.5	11.4

   (A) 2.535   (B) 3.167   (C) 2.559   (D) 2.428   (E) NOTA

4. Let's say that x=100. Follow each step in order to determine the final answer to this question:

   Step 1: If the following statement is true, add 54 to the current value of x. If the statement is false, subtract 54: A type 1 error is committed when a false null hypothesis is falsely not rejected.
   Step 2: If the following statement is true, add 26 to the value of x after step 1. If it is false, subtract 26: Power is the probability of correctly rejecting a false null hypothesis.
   Step 3: If the following statement is true, multiply the value of x after step 2 by 2. If it is false, divide the value of x after step 2 by 2: Decreasing the sources of variability of a test will increase the power.

   What is the final value of x after step 3 has been completed?

   (A) 144   (B) 360   (C) 36   (D) 90   (E) NOTA

5. Considering that people in richer nations have bigger houses and people in richer nations also have a higher life expectancy, which of the following best characterizes this non-linear relationship between house size and life expectancy?

   (A) Correlation   (B) Causation   (C) Common Response   (D) Confounding   (E) NOTA

6. Philipe has 4 green balls, 3 purple balls, and 3 orange balls. If he is taking two random balls from the bag without replacement, what is the probability that Philipe takes out two balls of the same color?

   (A) 8/27   (B) 1/3   (C) 5/18   (D) 19/27   (E) NOTA

7. Four dice have the following probabilities of showing a 3 when rolled: die 1 has probability a, die 2 has probability b, die 3 has probability c, and die 4 has probability d. One of the four dice is randomly chosen and rolled. Given that a 3 appears, what is the probability that die 1 was the one randomly chosen?

(A) $\frac{a}{a+b+c+d}$ (B) $\frac{4a}{a+b+c+d}$ (C) $\frac{a}{4}$ (D) $\frac{a}{(a+b+c+d)^4}$ (E) NOTA

8. Leeni likes to shoot free throws at her local gym. She's quite talented, and the probability that she makes any free throw is a constant 70%. Whether she makes or misses a free throw is independent of previous attempts. Find the sum of the mean and standard deviation of the number of free throws she makes out of 50 attempts, rounded to the hundredths place.
   (A) 2.08   (B) 40.32   (C) 11.76   (D) 38.24   (E) NOTA

9. A spinner has areas labeled 1-4 with the probability distribution given below:

x:	1	2	3	4
p(x):	0.04	0.30	0.26	0.40

   Find $E(X^2)$ to two decimal places.

   (A) 3.95   (B) 9.98   (C) 3.02   (D) 10.05   (E) NOTA

10. The principal of Lincoln Middle wants a random sample of scores on the Unit 9 biology test, a test given by 4 biology teachers to their respective classes. If he selects a SRS of 10 scores from each teacher, what type of sampling method did the principal use?
    (A) Stratified   (B) Cluster   (C) Multistage   (D) Systematic   (E) NOTA

11. Two frogs: ribertribert and rubertrubert are at diametrically opposite vertices of a regular octagon. Every second, simultaneously, ribertribert and rubertrubert randomly jump to an adjacent vertex independently and with equal probability. ribertribert and rubertrubert stop jumping when they land on the same vertex. What is the expected number of seconds until the frogs stop jumping?
    (A) 6   (B) 8   (C) 3   (D) 17/2   (E) NOTA

12. Now, two different frogs: rabertrabert and reburtreburt are on opposite vertices of a regular hexagon. Every second, they simultaneously jump to an adjacent vertex of the hexagon independently and with equal probability. rabertrabert and reburtreburt stop jumping when they both land on the same vertex. What is the expected number of seconds until the frogs stop jumping?
    (A) 6   (B) 8   (C) 4   (D) 10   (E) NOTA

13. Ibn Aud, king of Audi Arabia wants to know his approval rating, so he hires you to create a 95% confidence interval for the true proportion of the citizens of Audi Arabia who support Ibn Aud. What is the sum of the upper and lower bounds of the interval rounded to three decimal places if 6969 out of the 10000 citizens of Audi Arabia support Ibn Aud?
    (A) 1.393   (B) 1.396   (C) 1.394   (D) 1.395   (E) NOTA

14. The phenomenon where experimental subjects behave differently when they know they are being observed is known as the _____ effect. What is the number of permutations of the letters in _____?
    (A) 5040   (B) 2520   (C) 362880   (D) 40320   (E) NOTA

15. The One-armed Bandit scored a 94 on Liquan Khan's History of Math test. When he asked Liquan how he did, Liquan told him that the scores were normally distributed and that he scored in the 80th percentile. Bun Head scored a 110 on the same test and Liquan told her that she scored in the 95th percentile. What is the sum of the mean and standard deviation of the scores of Liquan Khan's History of Math test? (Round all z scores, the mean, and the standard deviation to 3 decimal places.)
    (A) 97.148   (B) 87.345   (C) 98.582   (D) 84.263   (E) NOTA

16. Canadian Descent High School offers three math classes to juniors: Calculus AB, Calculus BC, and Statistics. Every student in the junior class must take either one or two of the classes, but math competition students are required to take two, including one Calculus and one Statistics class. The Statistics teacher, Mr. T, sees that he has 76 juniors enrolled in Statistics, but he wants to know how many of them are math competition students. Mr. Lampar, who teaches both Calculus classes, notices that they each have 140 students enrolled, 20 of which are double-enrolled in AB and BC. While he doesn't see which students are in math competition, he knows that 25 percent of his Calculus AB students and 20 percent of his Calculus BC students are taking another math class. He also sees that among non-competition students, 10 percent chose to take two classes. How many math competition students are in the junior class at Canadian Descent High School? (not necessarily in any particular math class)

(A) 13   (B) 28   (C) 30   (D) 43   (E) NOTA

17. An insulin manufacturer wants to conduct a study on the effectiveness of their untested product. A scientist injects the old or new insulin into different volunteers (no one volunteer receives both), then inserts a device in their arm to track their blood sugar levels. A computer reads out changes in blood sugar at time intervals of 15 minutes until an hour has passed. What are the experimental units in this experiment?

(A) Type of insulin   (B) Time intervals   (C) Blood sugar levels   (D) Computer   (E) NOTA

18. At a small gathering, a group of mathematicians move around a room with tables and talk to each other. Some of the mathematicians are already friends, and some are not. If a group of 4 mathematicians who are already friends see each other, they will sit down at a table together, and if a group of 3 mathematicians who were not previously friends see each other, they will also sit down together. The gathering extends for a sufficiently long time such that every permutation of group interactions occurs, and all mathematicians are left standing. What is the maximum number of mathematicians at this gathering?

(A) 6   (B) 7   (C) 8   (D) 9   (E) NOTA

19. A company advertising its new diet plans wants to study their effectiveness. They have 800 volunteers, 400 each of men and women and equally distributed by starting BMI across the following ranges: 15-20, 20-25, 25-30, and 30-35. An equal number of volunteers receives each of the four diet plans, and change in their BMI is tracked over a month. How many blocks are in this experiment?

(A) 25   (B) 80   (C) 100   (D) 400   (E) NOTA

20. Bernie is flipping 3 coins. She knows that 2 of the coins are fair, and one is tails on both sides. She takes a coin at random and sees that it is showing heads. What is the probability that she is looking at a fair coin?

(A) 1/6   (B) 1/4   (C) 1/3   (D) 1/2   (E) NOTA

21. What percent of scores that lie more than one standard deviation away from the mean lies more than three standard deviations below the mean? Assume a normal distribution and use the empirical rule.

(A) 3/640   (B) 3/100   (C) 3/320   (D) 3/80   (E) NOTA

22. If the equation of the line of best fit between two variables is y = -0.53x + 0.67, what is the coefficient of correlation given that Sx = 3.2 and Sy = 4.1? Round answer to 2 decimal places.

(A) 0.52   (B) 0.41   (C) 0.68   (D) 0.46   (E) NOTA

X:	18	26	32	66	43	29	81	13
Y:	53	29	38	75	31	30	64	18

23. What is the y-intercept of the line that yields the lowest sum of squared residuals for the given data points? Round answer to 4 decimal places.

(A) 13.06761   (B) 13.06760   (C) 0.69304   (D) 0.69305   (E) NOTA

24. If the mean of a normal distribution is 12, with a standard deviation of 1.5, what is the probability of randomly selecting a value less than 9, given that the value is less than 13.5? Use the empirical rule and round answer to 4 decimal places.

    (A) 0.0262   (B) 0.9738   (C) 0.0298   (D) 0.0270   (E) NOTA

x:	1	2	3	4	5	6
p(x):	0.24	0.31	0.16	0.12	0.02	0.05

25. What is the standard deviation of the probability density function? Round answer to 4 decimal places.

    (A) 1.6632   (B) 1.3674   (C) 1.3597   (D) 2.4667   (E) NOTA

26. Here are the probability distributions for random variables x and y.

x:	1	2	3
p(x):	?	?	?

y:	1	2	3
p(y):	?	?	0.4

    If it is given that $p(x = 1, y = 2) = 0.175$ and $p(x = 1, y = 3) = 0.2$, what is $p(x = 2 \lor 3, y = 1)$?

    (A) 0.25   (B) 0.125   (C) 0.35   (D) Not enough information

    (E) NOTA

27. In the world of Doolville, you can either be a fool or a drool. Everyone can have up to 5 tools each (keep in mind: they can have 0!), everyone has a 0.6 probability of having a pool, and everyone goes to one of three schools: School A, school B, or School C. What is the probability that, out of a random sample of 3 fools and 7 drools, you pick a fool that has 3 tools, has a pool, and goes to school B, AND THEN, without replacement, pick a drool that has anywhere between 1 and 4 tools inclusive, does not have a pool, and goes to either School B or C? For the purpose of this question, assume an equal probability of having any number of tools and of going to each school (for example, the probability of anyone going to School A is 1/3).

    (A) $\frac{14}{10125}$ (B) $\frac{7}{3375}$ (C) $\frac{7}{5625}$ (D) $\frac{56}{28125}$ (E) NOTA

28. Doolfus, the mayor of Doolville is concerned about the efficiency of his citizens, the drools and the fools. In his mind, to be an efficient citizen, you must be in possession of at least 3 tools and furthermore, he believes that less than 40 percent of his citizens are efficient workers. He conducts a 94.5 percent confidence interval to see how ALL of his citizens match up with his standards. Out of a random sample of 156 fools, 57 had at least 3 tools, and out of a random sample of 234 drools, 130 of them had less than 3 tools. What is the confidence interval that Doolfus created (assuming that he is correct), rounded to 4 decimal places?

    (A) (0.3649, 0.4607)   (B) (0.0934, 0.2869)   (C) (0.3650, 0.4607)   (D) (-0.0177, 0.1758)   (E) NOTA

29. Now that mayor Doolfus has his confidence interval, he should be set to make some changes in his town. Unfortunately, he forgot how to interpret a confidence interval! Using the correct confidence interval from the previous question, help mayor Doolfus out by deciding whether there is reason to believe that less than 40 percent of his citizens are efficient workers, with a corresponding reason why.

    (A) Yes, there is reason to believe that less than 40 percent of his workers are efficient because 0.4 is in the interval

    (B) Yes, there is reason to believe that less than 40 percent of his workers are efficient because 0.4 is not in the interval.

    (C) No, there is no reason to believe that less than 40 percent of his workers are efficient because 0.4 is in the interval.

    (D) No, there is no reason to believe that less than 40 percent of his workers are efficient because 0.4 is not in the interval.

    (E) NOTA

30. Let's say you have three normal distributions. Distribution X is N(0,1), distribution Y is N(1,2), and distribution Z is N(2,3). What is the expected value of the sum of the squares of these three distributions?

    (A) 19   (B) 3   (C) 5   (D) 9   (E) NOTA