Introduction to the Binomial Distribution Quiz

1. According to a recent survey, 31 percent of the residents of a certain state who are age 25 years or older have a bachelor's degree. A random sample of 50 residents of the state, age 25 years or older, will be selected. Let the random variable B represent the number in the sample who have a bachelor's degree. What is the probability that B will equal 40 ?

(A) $\binom{50}{40}(0.31)^{40}(0.69)^{10}$ ✓

(B) $\binom{50}{40}(0.69)^{40}(0.31)^{10}$

(C) $\binom{40}{10}(0.31)^{40}(0.69)^{10}$

(D) $\binom{40}{10}(0.69)^{40}(0.31)^{10}$

(E) $40(0.31)^{50}$

Answer A

Correct. Define success as selecting a person with the degree and failure as selecting a person without the degree. Random variable B has a binomial distribution, with probability of success of 0.31 and probability of failure of 0.69. The probability of 40 out of 50 people having a degree is given by $\binom{50}{40}(0.31)^{40}(0.69)^{10}$.

2. According to a recent survey, 81 percent of adults in a certain state have graduated from high school. If 15 adults from the state are selected at random, what is the probability that 5 of them have not graduated from high school?

(A) $\binom{20}{15}(0.19)^{15}(0.81)^{5}$

(B) $\binom{10}{5}(0.19)^{15}(0.81)^{15}$

(C) $\binom{10}{5}(0.81)^{5}(0.19)^{10}$

(D) $\binom{15}{5}(0.19)^{5}(0.81)^{10}$ ✓

(E) $\binom{15}{5}(0.81)^{5}(0.19)^{10}$

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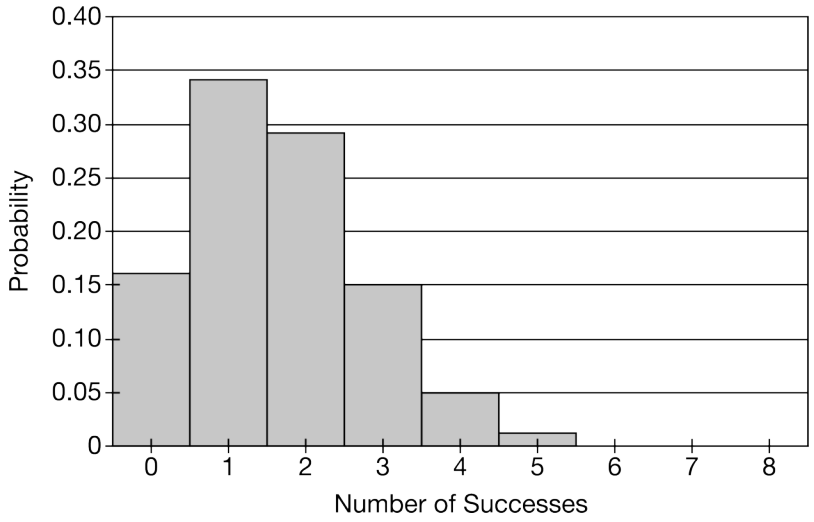
Answer D

Correct. Let X represent the number of adults selected who have not graduated from high school. Random variable X has a binomial distribution. The probability of "success" is the probability that a student has not graduated from high school, or 0.19. So the probability that exactly 5 adults have not graduated from high school is $P(X = 5) = \binom{15}{5}(0.19)^5(0.81)^{10}$.

3. An experiment was conducted in which planks of wood painted red and green were shown to pigeons to investigate a pigeon's ability to select a certain color. Pigeons could accurately select the color of the plank of wood 20 percent of the time. A simulation was conducted in which a trial consisted of a pigeon being shown eight planks of wood and its number of successes being recorded. This process was repeated many times, and the results are shown in the histogram.



Based on the results of the simulation, which of the following is closest to the probability that there were at most three successes in a trial?

(A) 0.06

(B) 0.15

(C) 0.21

(D) 0.79

(E) 0.94 ✓

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Answer E

Correct. The bars corresponding to 0, 1, 2, and 3 represent at most three successes. The sum of the heights of the bars corresponds to a probability of approximately 0.94.