

## Parameters for a Binomial Distribution Quiz

1. In a certain region, 94 percent of the people have a certain characteristic in their blood. Suppose a group of 45 people from the region are selected at random. Let the random variable  $B$  represent the number of people in the sample without the characteristic. Random variable  $B$  follows a binomial distribution with a mean of 2.7 people. Which of the following is the best interpretation of the mean?

(A) For all groups of 45 people, the average number of people without the characteristic is 2.7. ✓

(B) Every group of 45 people will have 2.7 people with the characteristic.

(C) Every group of 45 people will have 2.7 people without the characteristic.

(D) On average, 2.7 people are selected until finding someone with the characteristic.

(E) On average, 2.7 people are selected until finding someone without the characteristic.

### Answer A

Correct. For the random variable  $B$ , the mean number of people without the characteristic is equal to 2.7 for all possible groups of 45 people.

2. A company that ships crystal bowls claims that bowls arrive undamaged in 95 percent of the shipments. Let the random variable  $G$  represent the number of shipments with undamaged bowls in 25 randomly selected shipments. Random variable  $G$  follows a binomial distribution with a mean of 23.75 shipments and a standard deviation of approximately 1.09 shipments. Which of the following is the best interpretation of the mean?

(A) Every shipment of 25 bowls will have 23.75 undamaged bowls.

(B) Every shipment of 25 bowls will have 23.75 damaged bowls.

(C) On average, the company receives 23.75 shipments before receiving the first shipment with a damaged bowl.

(D) For all possible shipments of size 25, the average number of damaged shipments is equal to 23.75.

(E) For all possible shipments of size 25, the average number of undamaged shipments is equal to 23.75. ✓

### Answer E

Correct. For the random variable  $G$ , the mean number of undamaged bowls is equal to 23.75 for all possible shipments of size 25.

3. According to 2015 census data, 42.7 percent of Colorado residents were born in Colorado. If a sample of 250 Colorado residents is selected at random, what is the standard deviation of the number of residents in the sample who were born in Colorado?

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(A) 6.75

(B) 7.82

(C) 10.33

(D) 11.97

(E) 61.17

**Answer B**

Correct. Let random variable  $C$  represent the number of people from a sample of 250 who were born in Colorado. The random variable has a binomial distribution. The standard deviation of a binomial random variable is  $\sqrt{np(1-p)} = \sqrt{250(0.427)(0.573)} \approx 7.82$

4. A certain factory that manufactures office chairs has a quality control process to identify defective chairs. The binomial random variable  $D$  represents the number of chairs in a sample of chairs that are defective. The mean of  $D$  is 10 chairs and the standard deviation is 3 chairs. Based on the distribution of  $D$ , which of the following would be an accurate interpretation of the value 0.1 ?

(A) The total number of defective chairs made

(B) The total number of non-defective chairs made

(C) The relative frequency of the sample size to the population of chairs

(D) The probability of identifying a non-defective chair

(E) The probability of identifying a defective chair

**Answer E**

Correct. The mean of 10 indicates  $np = 10$ , and the standard deviation of 3 indicates  $\sqrt{np(1-p)} = \sqrt{10(1-p)} = 3$ . Solving for  $p$  gives  $p = 0.1$ , which is the probability of success, that is, identifying a defective chair.

5. In 2014, 85 percent of households in the United States had a computer. For a randomly selected sample of 200 households in 2014, let the random variable  $C$  represent the number of households in the sample that had a computer. What are the mean and standard deviation of  $C$  ?

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- (A) The mean is 85 households, and the standard deviation is 0.36 household.
- (B) The mean is 144.5 households, and the standard deviation is 5.05 households.
- (C) The mean is 144.5 households, and the standard deviation is 13.04 households.
- (D) The mean is 170 households, and the standard deviation is 5.05 households. ✓
- (E) The mean is 170 households, and the standard deviation is 0.36 household.

**Answer D**

Correct. Random variable  $C$  has a binomial distribution. The mean of the random variable is  $np = 200(0.85)$ , and the standard deviation of the random variable is  $\sqrt{np(1-p)} = \sqrt{200(0.85)(0.15)}$ .

6. According to a survey about how workers get to work in Wyoming, 77 percent of workers get to work by driving alone, 11 percent get to work by carpooling, 4 percent get to work by walking, and 8 percent get to work by other means of transportation. Suppose a sample of 200 Wyoming workers is selected at random. Let the random variable  $D$  represent the number of workers in the sample who get to work by driving alone. What is the expected value of  $D$ ?
- (A) 8
  - (B) 16
  - (C) 22
  - (D) 46
  - (E) 154 ✓

**Answer E**

Correct. The expected value of a random variable is the mean of the distribution.  $D$  is a binomial random variable whose mean is  $np = 200(0.77)$ , or 154 workers.