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DATA PROJECT 3: <u>SECTION 3.4 Q52</u>

DESCRIPTION OF THE APPLICATION: This binomial probability distribution is about the population of all students who have to buy a textbook for a particular course. In this distribution, it is mentioned that 30% of all students want a new copy of the book while the rest of the 70% want a used copy. The binomial distribution model allows us to compute the probability of observing a specified number of successes when the process is repeated a specific number of times, and the outcome is dichotomous, that is, in this situation, the outcome is either the student buys a used copy or a new copy. This application is important because this is what is happening today. A lot of students studying a particular course that requires a textbook would rather buy a used copy than a new one in order to save money as the cost of new books is expensive as compared to a used book.

DESCRIPTION OF THE DISTRIBUTION: This distribution consists of a number of purchasers, n, which is 25. The random variable X represents the number of students who want a used copy of the textbook for the particular course that requires a textbook. The probability of success (the number of students who want a used copy) is 0.7 whereas the probability of failure is 0.3. The trials are independent, that is, the outcome of one trial will not affect the outcome of any other trial.

Since the random variable is a binomial random variable, then the probability mass function is given by:

$P(X=x) = p(x) = \binom{n}{x}p^x(1-p)^{n-x}$

The expected value of a binomial random variable X is represented as $E(X) = \mu = np$ and its variance is represented as $Var(X) = \sigma^2 = np(1-p)$

PROBABILITY QUESTIONS:

1. Out of the sample of 25 students, what is the probability that exactly 20 students want a used copy of the textbook instead of a new copy? Also, calculate the expected number of students who wants a used copy of the textbook instead of the new copy.

    Answer: To find the probability, we use the formula $P(X=20) = p(20) = \binom{25}{20}p^{20}(1-p)^5$, and so we get the probability, p(20) = 0.1030

    The expected value is E(X) = 25*0.7 = 17.5

    So therefore, the probability that 20 students from a sample of 25 want a used copy of a textbook is 0.1030 and the expected value of students who want a used copy is 17.5.

2. (a) Out of the sample of 25 students, what is the probability that at least 5 students are more likely to buy a new copy of the textbook?
    (b) Also, what is the probability that between 13 and 17 students are more likely to buy a used copy of the textbook?

    Answer: (a) To find the probability, we use the formula P(X ≤ 5) = F(5) = 0.1935
    (b) To find the probability, we use the formula P(13 ≤ X ≤ 17) = F(17) − F(13) = 0.4439

    Therefore, the probability that at least 5 students are more likely to buy a new copy of the textbook is 0.1935 and the probability that between 13 and 17 students are more likely to buy a used copy of the textbook is 0.4439