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57:022 Principles of Design II

Quiz #1, January 31, 2002

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The foreman of a casting section in a certain factory finds that on the average, 1 in every 5 castings that are made is defective, and that the quality of a casting is independent of whether a defect was found in the previous casting.

Let

X_i = 1 if the ith casting is defective, 0 otherwise

N_i = # of defective castings among the first *i* castings which are produced.

T_k = number of the kth defective casting.

••

Suppose that 10 castings are made, with quality:

"++d+d++++d" where "+" indicates OK, and "d" indicates a defect.

Indicate the numerical values of the random variables in this case:

___ 1. N_5 ___ 2. X_5 ___ 3. T_1 ___ 4. T_2

••

Select the answer to #5-8 from the options below:

___ 5. If the section makes 8 castings a day, the probability distribution of the number of defective castings is …

___ 6. The probability dist'n of the number of castings before the first defective one is produced (i.e., T_1) is…

___ 7. The probability distribution of the number of castings before the second defective one (i.e., T_2) is….

___ 8. The probability distribution of $T_2 - T_1$, i.e., the number of additional castings after the first defect until the second defect is found, is …

a. Bernouilli b. Random c. Binomial

d. Poisson e. Geometric f. Normal

g. Exponential h. Erlang i. Pascal j. none of above

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Choose an expression below for each quantity in #5-7

___ 9. If the section makes 10 castings, what is the probability that exactly 2 of these will be defective?

___ 10. What is the expected value of X_{10}?

___ 11. What is the expected value of N_{10}?

___ 12. What is the probability that the first two castings are both defective?

___ 13. What is the probability that the fifth casting is the first one which is defective?

a. $\frac{10!}{2!}\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^{10}$ b. $\frac{10!}{8!}\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^8$ c. $\frac{10!}{2!8!}\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^8$

d. $\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)^4$ e. $\left(\frac{1}{5}\right)^4\left(\frac{4}{5}\right)$ f. $\frac{1}{5}$

g. $\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)$ h. $\left(\frac{1}{5}\right)+\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)$ i. $\frac{1}{5}\times 10$

j. $\left(\frac{1}{5}\right)^2$ k. $\left(\frac{1}{5}\right)^{10}$ l. None of the above

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Indicate + = "true", o = "false"

___ 14. The sequence $\{N_1, N_2, N_3, N_4, \ldots\}$ is a stochastic process.

___ 15. The sequence $\{X_1, X_2, X_3, X_4, \ldots\}$ is a Bernouilli process.

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