Assignment 2 -Probability and Random Variable

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I. Problem Statement-Problem 1.10

There are 5 % defective items in a large bulk of items. What is the probability that a sample of 10 items will include not more than one defective item?

A. Solutions

Let X be the number of defective items available in bulk of items.
let n =10 (total no. of samples=10)
p=probability of getting defective item = 5% =5/100=1/20
therefore, q=1-p ,which is probability of getting a non defective item
q=1-(1/20)=19/20
From bernaulli's distribution, we know
$Pr(X = r) = {}^{n}C_r p^r q^{1-r}$
$X \sim Bin(n = 10, p = (1/20))$
We are required to find the probability that a sample of 10 items will not include more than 1 defective items
Therefore, the required probability is given by

$$\begin{aligned} Pr(Number\ of\ defective\ items\ is\ less\ than\ 1) &= Pr(X \leq 1) \\ &= Pr(X = 0) + Pr(X = 1) \\ &= {}^{10}C_0((1/20)^0)((19/20)^{10}) + {}^{10}C_1((1/20)^1))((19/20)^9) \\ &= (1 * 1 * ((19/20)^{10})) + 10 * (1/20) * ((19/20)^9) \\ &= ((19/20)^{10}) + ((19/20)^9) * (1/2) \\ &= (29/20) * (19/20)^9 \end{aligned}$$

Hence the desired probability is $(29/20) * (19/20)^9$
$=\frac{29}{20}\frac{19^9}{20^9}$