Assignment 1

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Download all python codes from

https://github.com/Nik123−cpp/Assignment−1/blob/main/assignment1.py

and latex-tikz codes from

https://github.com/Nik123−cpp/Assignment−1/blob/main/Assignment1.tex

1 Problem 3.4

The probability that a bulb produced by a factory will fuse after 150 days is 0.05.Find the probability that out of 5 such bulbs
(i) none
(ii) not more than one
(iii)more than one
(iv) atleast one
will fuse after 150 days of use.

Solution
Let X be random variable which denoting number of bulbs fuses after 150 days of use,among the 5 bulbs.Then by Binomial Distribution.

$$\Pr(X = k) = \binom{n}{k} p^k (1-p)^{n-k} \tag{1.0.1}$$

$$k = 0, \ldots, n \tag{1.0.2}$$

For given question n = 5 , p = 0.05,1-p = 0.95.

1) From (1.0.2)

$$\Pr(X = 0) = \binom{5}{0} (0.05)^0 (0.95)^5 = 0.77378094 \tag{1.0.3}$$

i.e the probability of all 5 bulbs working after 150 days of use

2) simillarly

$$\Pr(X \le 1) = \sum_{k=0}^{1} \Pr(X = k) \tag{1.0.4}$$

$$= \sum_{K=0}^{1} \binom{5}{k} (0.050^k (0.95)^{5-k} \tag{1.0.5}$$

$$= 0.9774075025 \tag{1.0.6}$$

i.e the probabity of either none of the bulbs or exactly one bulb will fuse after 150 days of use of 5 such bulbs.

3)

$$\Pr(X > 1) = \sum_{k=2}^{5} \Pr(X = k) \tag{1.0.7}$$

Which is complement of second case i.e case(ii),So we can write

$$\Pr(X > 1) = 1 - \Pr(X \le 1) \tag{1.0.8}$$

From (1.0.6)

$$\Pr(X > 1) = 1 - 0.9774075025 \tag{1.0.9}$$

$$= 0.0225924975 \tag{1.0.10}$$

4)

$$\Pr(X \ge 1) = \sum_{k=1}^{5} \Pr(X = k) \tag{1.0.11}$$

which is complement of first case i.e case(i),So we can write

$$\Pr(X \ge 1) = 1 - \Pr(X < 1) \tag{1.0.12}$$

From (1.0.3)

$$\Pr(X \ge 1) = 1 - 0.77378094 \tag{1.0.13}$$

$$= 0.22621906 \tag{1.0.14}$$