AI1103: Assignment 1

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and latex-tikz codes from

Question-1.13
From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs.

Solution:
Given 30 bulbs which include 6 defectives and 4 bulbs are drawn at random with replacement.

Let us assume a random variable X:
X=Number of defective bulbs drawn

Binomial distribution:
$P(K) = {}^{n}C_{k} \times (p^{k}) \times (q^{n-k})$
Here,
$P(X) = {}^{n}C_{x} \times (p^{x}) \times (q^{n-x})$

Probability of drawing zero bulbs

$$P(0) = {}^{4}C_{0} \times \left(\frac{6}{30}\right)^{0} \times \left(\frac{24}{30}\right)^{4-0}$$
$$= 1 \times \frac{24^{4}}{30^{4}}$$

Probability of drawing one defective bulb

$$P(1) = {}^{4}C_{1} \times \left(\frac{6}{30}\right)^{1} \times \left(\frac{24}{30}\right)^{4-1}$$
$$= 4 \times \frac{6}{30} \times \frac{24^{3}}{30^{3}}$$

Probability of drawing two defective bulbs

$$P(2) = {}^{4}C_{2} \times \left(\frac{6}{30}\right)^{2} \times \left(\frac{24}{30}\right)^{4-2}$$
$$= 6 \times \frac{6^{2}}{30^{2}} \times \frac{24^{2}}{30^{2}}$$

Probability of drawing three defective bulbs

$$P(3) = {}^{4}C_{3} \times \left(\frac{6}{30}\right)^{3} \times \left(\frac{24}{30}\right)^{4-3}$$
$$= 6 \times \frac{6^{3}}{30^{3}} \times \frac{24}{30}$$

Probability of drawing four defective bulbs

$$P(4) = {}^{4}C_{4} \times \left(\frac{6}{30}\right)^{4} \times \left(\frac{24}{30}\right)^{4-4}$$
$$= 1 \times \frac{6^{4}}{30^{4}}$$

Probability distribution of the number of defective bulbs