

Assignment 1

AI1110: Probability and Random Variables
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10.13.3.40: Question. A lot consists of 48 mobile phones of which 42 are good, 3 have only minor defects and 3 have major defects. Varnika will buy a phone if it is good but the trader will only buy a mobile if it has no major defect. One phone is selected at random from the lot. What is the probability that it is

(i) acceptable to Varnika? (ii) acceptable to the trader?

Answer:

$$(i) \frac{7}{8}$$

$$(ii) \frac{15}{16}$$

Solution:

A = the event that the phone is good and acceptable to Varnika.

B = the event that the phone has no major defect and is acceptable to the trader

- Let us consider the moment generating functions(MGF) of the following as MA(t) and MB(t) respectively.
- The moment generating function defined as:

$$MX(t) = E(e^{tX}) \quad (1)$$

$$= \sum_{x=0}^{\infty} e^{tX} P(X = x) \quad (2)$$

- Using this formula, we can calculate the moment generating functions for A and B as follows:

$$MA(t) = E(e^{tA}) \quad (3)$$

$$= e^0(P(A = 0) + e^1(P(A = 1) \quad (4)$$

$$= \frac{1}{8} + \frac{7}{8}(e^1) \quad (5)$$

$$MB(t) = E(e^{tB}) \quad (6)$$

$$= e^0(P(B = 0) + e^1(P(B = 1) \quad (7)$$

$$= \frac{1}{16} + \frac{15}{16}(e^1) \quad (8)$$

(i) Probability that the phone is acceptable by Varnika:

$$P(A = 1) = MA(t = 1) \quad (9)$$

$$= \frac{1}{8} + \frac{7}{8}(e^1) \quad (10)$$

$$= \frac{7}{8} \quad (11)$$

$$(12)$$

- Therefore, the probability that the phone is acceptable by Varnika is 0.875.

(ii) Probability that the phone is acceptable to the trader:

$$P(B = 1) = MB(t = 0) \quad (13)$$

$$= \frac{1}{16} + \frac{15}{16}(e^0) \quad (14)$$

$$= \frac{15}{16} \quad (15)$$

$$(16)$$

- Therefore, the probability that the phone is acceptable to the trader is 0.938