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Section - AIML section 1

~~Q.1 Ans~~

Q.1
Answer

Given avg marks (mean) = 9
so, total marks = 9 × 6 = 54
given variance = 11.6666
sum of 4 students marks = 4 + 8 + 10 + 12 = 34
Lets consider unknown students marks x & y.
so, $x + y = 54 - 34 = 20$

$$x + y = 20 \quad \text{---(1)}$$

$$\text{variance} = \frac{\sum_{i=1}^{6} (x_i - \text{mean})^2}{N}$$

$$11.6666 = \frac{(4-9)^2 + (8-9)^2 + (10-9)^2 + (12-9)^2 + (x-9)^2 + (y-9)^2}{N = 6}$$

$$69.9996 = \frac{(-5)^2 + (-1)^2 + (1)^2 + (3)^2 + (x-9)^2 + (y-9)^2}{6}$$

$$= 25 + 1 + 1 + 9 + x^2 + 81 - 18x + y^2 + 81 - 18y$$

$$-128.0004 = x^2 + y^2 - 18(x + y)$$

from eq. 1 $\Rightarrow$ $x + y = 20$

$$-128.0004 = x^2 + y^2 - 360$$

$$231.9996 = x^2 + y^2 \quad \text{---(2)}$$

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from eq. 1 $\Rightarrow$ $y = 20 - x$

Lets put it into eq 2 and make quadric eq.

$$x^2 + (20 - x)^2 = 231.9996$$
$$x^2 + 400 + x^2 - 40x = 231.9996$$
$$x^2 - 20x + 84.0002 = 0$$

quadric formula $\Rightarrow$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

here, $a = 1$, $b = -20$ & $c = 84.0002$

so, $x = \frac{20 \pm \sqrt{400 - 4 \times 1 \times 84.0002}}{2}$

$$x = \frac{20 \pm \sqrt{63.9992}}{2}$$

$$= \frac{20 \pm 7.999}{2}$$

$x = 10 + 4$ & $10 - 4$

$x = 14, 6$

Two posible answer

$x = 14$, $y = 6$ or $x = 6$, $y = 14$

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Q.2 a)
Answer

$P(R) = 0.2$

$P(C) = 0.25$

$P(R \cup C) = P(R) + P(C) - P(R \cap C)$

$= P(R) + P(C) - (P(R) \times P(C))$

$= 0.2 + 0.25 - (0.2 * 0.25)$

$= 0.45 - 0.05 = 0.4$

so, the Answer is => false

2. b) $P(\frac{\bar{A}}{B}) = 1 - P(\frac{A}{B})$

Conditional probability $P(A|B) = \frac{P(A \cap B)}{P(B)}$

the sum of probabity of even & compliment = 1

so, $P(A) + P(\bar{A}) = 1$

$P(\bar{A}) = 1 - (PA)$

$P(\bar{A}|B) = \frac{P(\bar{A} \cap B)}{P(B)}$

$= \frac{P(B) - P(A \cap B)}{P(B)}$

$= 1 - \frac{P(A \cap B)}{P(B)}$ <= Apply conditional Probabitity

$P(\bar{A}|B) = 1 - P(A|B)$

Hance this statement is True.

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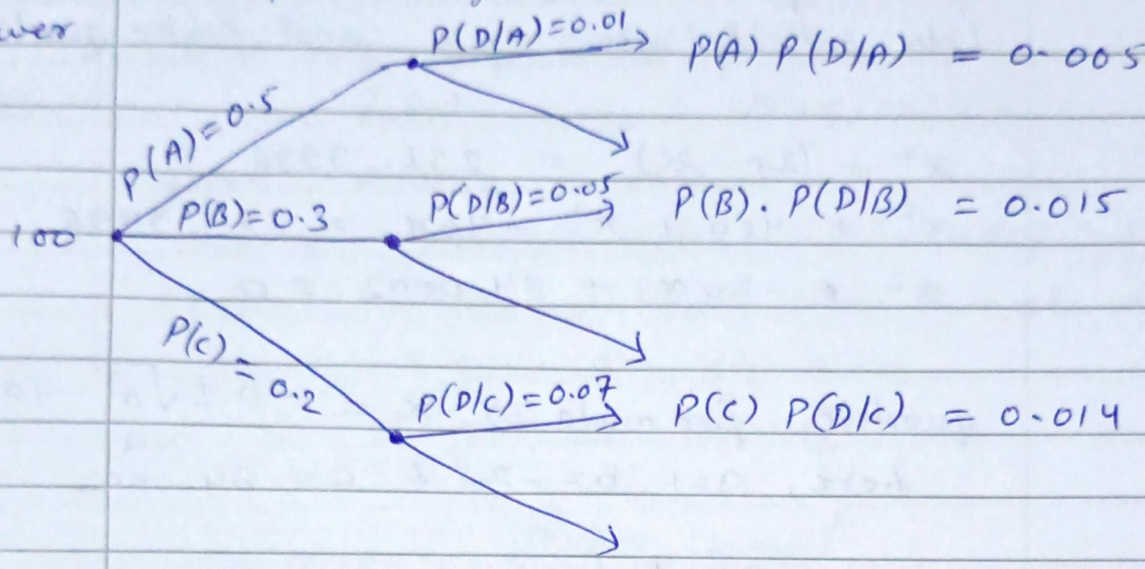
Q.3 Answer

Let put the given data into tree and calculate



Total probability of defective items

$$P(D) = P(A) \cdot P(D/A) + P(B) P(D/B) + P(C) P(D/C)$$

$$= 0.005 + 0.015 + 0.014$$

$$P(D) = 0.034$$

Let's calculate probablity of defective item by each machine

$$P(A/D) = \frac{P(A) \cdot P(D/A)}{P(D)} = \frac{0.5 \times 0.01}{0.034}$$

$$= 0.147$$

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$$P(B|D) = \frac{P(B).\ P(D|B)}{P(D)} = \frac{0.3 \times 0.05}{0.034}$$

$$= 0.441$$

$$P(C|D) = \frac{P(C).\ P(D|C)}{P(D)} = \frac{0.2 \times 0.07}{0.034}$$

$$= 0.411$$

Observations:
→ The most accurate/efficient operator is A
→ The most defective items are produced by B

Q. 4 Answer

Given, $P(A) = 0.38$, $P(B) = 0.63$
$P(A \cup B) = 0.78$

$$P(A \cap B) = P(A) + P(B) - P(A \cup B)$$
$$P(A \cap B) = 0.38 + 0.63 - 0.78$$
$$P(A \cap B) = 0.23$$

i) $$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.23}{0.63}$$

$$P(A|B) = 0.365$$

Note: In this Q4, $P(A) + P(B) > 1$, $0.38 + 0.63 = 1.01$
I am considering this approx value ≈ 1
I hope this is not a trick question

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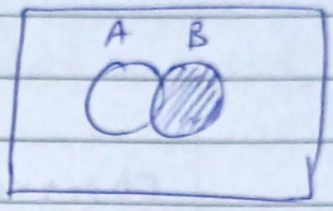
ii) $P(B|\bar{A}) = \frac{P(B \cap \bar{A})}{P(\bar{A})}$

$P(\bar{A}) = 1 - P(A) = 1 - 0.38$

$P(\bar{A}) = 0.62$

$P(B \cap \bar{A}) = P(B) - P(A \cap B)$



$P(B \cap \bar{A}) = 0.63 - 0.23$

$= 0.4$

So, $P(B|\bar{A}) = \frac{0.4}{0.62} = 0.645$

iii) $P(A \cap \bar{B}) = P(A) - P(A \cap B)$

$= 0.38 - 0.23$

$P(A \cap \bar{B}) = 0.15$

iv) $P(\bar{A} \cup \bar{B}) = 1 - P(A \cap B)$

$= 1 - 0.23$

$= 0.77$

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Q.5 Answer

Given, no. of families with 2 boys = 325
" 1 boy = 761
" 0 boy = 214

When chosen a family at random,

$$P(\text{2 boys}) = \frac{\text{no. of families with 2 boys}}{\text{total families}}$$

$$= \frac{325}{1300} = 0.25$$

$$P(\text{1 boy}) = \frac{\text{no. of families with 1 boy}}{\text{total families}}$$

$$= \frac{761}{1300} = 0.585$$

$$P(\text{0 boy}) = \frac{\text{no. of families with 0 boy}}{\text{total families}}$$

$$= \frac{214}{1300} = 0.165$$

Sum of propability $= 0.25 + 0.585 + 0.165$

$= 1$