AI1103 : Assignment 4

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1 GATE CS 2015 Set-1 Question No. 10

The probabilities that a student passes in Mathematics, Physics and Chemistry are m, p and c respectively.Of these subjects,the student has 75% chance of passing in at least one,a 50% chance of passing in at least two and a 40% chance of passing in exactly two. Following relations are drawn in m, p and c:

(i) $p + m + c = \frac{27}{20}$

(ii) $p + m + c = \frac{13}{20}$

(iii) $p \times m \times c = \frac{1}{10}$

1) Only relation (i) is true
2) Only relation (ii) is true
3) Relations (ii) and (iii) are true
4) Relations (i) and (iii) are true

2 Solution

p	Probability of passing in physics
m	Probability of passing in mathematics
c	probability of passing in chemistry

TABLE 4: Probabilty of passing

Let X be a Random variable that denotes number of subjects the student passes.
So, $X \in 0,1,2,3$
Given,

$$\Pr(X = 0) = 1 - \Pr(X \geq 1) = 1 - 0.75 \quad (1.1)$$

P(X ≥ 1)	0.75
P(X ≥ 2)	0.50
P(X = 2)	0.40

TABLE 4: P(X)

$$\implies \Pr(X = 0) = 0.25 = (1 - m)(1 - p)(1 - c) \quad (1.2)$$

$$\implies m + p + c + mpc - mp - cm - pc = 0.75 \quad (1.3)$$

$$\Pr(X = 2) = mp(1 - c) + pc(1 - m) + cm(1 - p) = 0.40 \quad (1.4)$$

$$\implies mp + pc + cm - 3mpc = 0.4 \quad (1.5)$$

$$\Pr(X \geq 2) = \Pr(X = 2) + \Pr(X = 3) = 0.5 \quad (1.6)$$

$$\implies \Pr(X = 3) = pmc = 0.1 = \frac{1}{10} \quad (1.7)$$

∴ **Relation (iii) is TRUE**
Substituting (1.7) in (1.5),

$$\implies mp + cm + pc = 0.7 \quad (1.8)$$

and substituting (1.8) and (1.7) in (1.3)

$$\implies m + p + c = 1.35 = \frac{27}{20} \quad (1.9)$$

∴ **Relation (i) is TRUE**
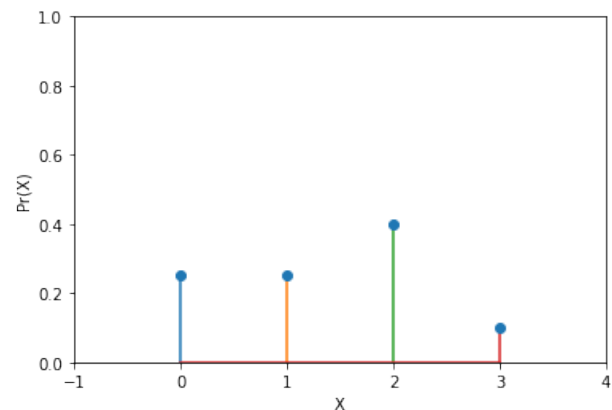From this, the final answer we get is **Option 4**

Fig. 4: Probability(P(X)) of passing X subjects