A1110 Assignment 7

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Outline

Question

Exercise 13.2 Q14: Probability of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that

(i) the problem is solved

(ii) exactly one of them solves the problem

Given Information

Solution:

Let E and F be two events such that:

Event	Description	Probability
E	A solved the problem	$\Pr(E) = \frac{1}{2}$
F	B solved the problem	$\Pr(F) = \frac{1}{3}$

Table

Required Formulae

E and F are independent events

$$\therefore \Pr(EF) = \Pr(E)\Pr(F) \tag{1}$$
$$\Pr(EF') = \Pr(E)\Pr(F') \tag{2}$$
$$\Pr(E'F) = \Pr(E')\Pr(F) \tag{3}$$

Also, for any event X we can write,

$$\Pr(X') = 1 - \Pr(X) \tag{4}$$

Solution of (i)

Now,

(i) Probability that problem is solved $=$

$$\Pr(E+F) = \Pr(E) + \Pr(F) - \Pr(EF) \tag{5}$$

$$\Pr(E+F) = \Pr(E) + \Pr(F) - \Pr(E)\Pr(F) \tag{6}$$

$$= \frac{1}{2} + \frac{1}{3} - \frac{1}{2} \times \frac{1}{3} \tag{7}$$

$$= \frac{4}{6} \tag{8}$$

$$= \boxed{\frac{2}{3}} \tag{9}$$

Solution of (ii)

(ii) Probability that exactly one of them solves the problem $=$

$$\Pr\left(EF'\right)+\Pr\left(E'F\right)=\Pr\left(E\right)\Pr\left(F'\right)+\Pr\left(E'\right)\Pr\left(F\right) \tag{10}$$

By (4),

$$\Pr\left(E\right)\Pr\left(F'\right)+\Pr\left(E'\right)\Pr\left(F\right)=\Pr\left(E\right)\left(1-\Pr\left(F\right)\right)+\left(1-\Pr\left(E\right)\right)\Pr\left(F\right) \tag{11}$$

$$=\frac{1}{2}\times\left(1-\frac{1}{3}\right)+\left(1-\frac{1}{2}\right)\times\frac{1}{3} \tag{12}$$

$$=\frac{1}{2}\times\frac{2}{3}+\frac{1}{2}\times\frac{1}{3} \tag{13}$$

$$=\frac{1}{3}+\frac{1}{6} \tag{14}$$

$$=\frac{3}{6}=\boxed{\frac{1}{2}} \tag{15}$$