A1110 Assignment 7

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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

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 1

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,

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

Now,

(i) Probability that problem is solved =

$$\Pr(E+F) = \Pr(E) + \Pr(F) - \Pr(EF) \tag{5}$$
$$\Pr(E+F) = \Pr(E) + \Pr(F) - \Pr(E)\Pr(F) \tag{6}$$
$$= \frac{1}{2} + \frac{1}{3} - \frac{1}{2} \times \frac{1}{3} \tag{7}$$
$$= \frac{4}{6} \tag{8}$$
$$= \boxed{\frac{2}{3}} \tag{9}$$

(ii) Probability that exactly one of them solves the problem = $\Pr(EF') + \Pr(E'F)$

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

By (4),

$$= \Pr(E)(1 - \Pr(F)) + (1 - \Pr(E))\Pr(F) \tag{11}$$
$$= \frac{1}{2} \times \left(1 - \frac{1}{3}\right) + \left(1 - \frac{1}{2}\right) \times \frac{1}{3} \tag{12}$$
$$= \frac{1}{2} \times \frac{2}{3} + \frac{1}{2} \times \frac{1}{3} \tag{13}$$
$$= \frac{1}{3} + \frac{1}{6} \tag{14}$$
$$= \frac{3}{6} \tag{15}$$
$$= \boxed{\frac{1}{2}} \tag{16}$$