Assignment-2
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Problem 1(x):

If events A and B are independent such that $\mathrm{P}(A) = \frac{3}{5}$, $\mathrm{P}(B) = \frac{2}{3}$, find $\mathrm{P}(A \cup B)$.

Solution:

The given input probabilities and desired values are given in the Table 1,

Event	Probability	Value
A	$\mathrm{P}(A)$	$\frac{3}{5}$
B	$\mathrm{P}(B)$	$\frac{2}{3}$
$A \cup B$	$\mathrm{P}(A \cup B)$	?

Table 1:

It is also given that events A and B are independent which means,

$$\mathrm{P}(A \cap B) = \mathrm{P}(A) \cdot \mathrm{P}(B) \tag{1}$$

And from the general probability addition rule for the union of two events, we get,

$$\mathrm{P}(A \cup B) = \mathrm{P}(A) + \mathrm{P}(B) - \mathrm{P}(A \cap B) \tag{2}$$

Using the above two formulas, (1) and (2), we can use the modified probability addition rule for independent sets as,

$$\mathrm{P}(A \cup B) = \mathrm{P}(A) + \mathrm{P}(B) - \mathrm{P}(A) \cdot \mathrm{P}(B) \tag{3}$$

By substituting the respective values in (3), we get,

$$\begin{aligned} \mathrm{P}(A \cup B) &= \frac{3}{5} + \frac{2}{3} - \frac{3}{5} \cdot \frac{2}{3} \\ &= \frac{3}{5} + \frac{2}{3} - \frac{2}{5} \\ &= \frac{13}{15} \end{aligned}$$

So, the desired probability $\mathrm{P}(A \cup B)$ is found to be,

$$\mathrm{P}(A \cup B) = \frac{13}{15} = 0.8667$$