# Assignment - 1
## AI1110: Probability and Random Variables

K Anuraga Chandan, AI22BTECH11011

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**12.13.2.7**
Given that the events A and B are such that P(A) = $\frac{1}{2}$, P(A U B) = $\frac{3}{5}$ and P(B) = $p$. Find $p$ if they are (i) mutually exclusive (ii) independent.

**Solution:**

Given,
P(A) = $\frac{1}{2}$
P(A + B) = $\frac{3}{5}$

P(B) = $p$ = ?

(i) A and B are *mutually exclusive* events
AB = 0
(A + B) = (A) + (B) - (AB)
(A + B) = (A) + (B)
P(A + B) = P(A) + P(B)
P(B) = P(A + B) - P(A)
P(B) = $\frac{3}{5}$ - $\frac{1}{2}$ = $\frac{6-5}{10}$
P(B) = $\frac{1}{10}$

(ii) A and B are *independent* events
P(AB) = P(A)P(B)
P(A+B) = P(A) + P(B) - P(AB)
P(A+B) = P(A) + P(B) - P(A)P(B)
P(A+B) - P(A) = P(B)[1 - P(A)]
P(B) = $\frac{P(A+B)-P(A)}{1-P(A)}$
P(B) = $\frac{\frac{3}{5}-\frac{1}{2}}{1-\frac{1}{2}}$ = $\frac{\frac{6-5}{10}}{\frac{1}{2}}$ = $\frac{\frac{1}{10}}{\frac{1}{2}}$
P(B) = $\frac{2}{10}$