Assignment 6

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***Abstract*—This document contains 6th problem from exercise 2 of CBSE Class 12 (Probability) .**

Problem 1. ***Exercise 2 Problem 3****Let E and F be events with $P(E) = \frac{3}{5}$, $P(F) = \frac{3}{10}$ and $P(E \cap F) = \frac{1}{5}$. Are E and F independent?*

Solution: Let's denote the outcome of the experiment by a random variable $X \in \{0, 1\}$, where $X = 0$ denotes occurrence of event E and $X = 1$ denotes occurrence of event F.

$$\implies P(X = 0) = \frac{3}{5}, \tag{1}$$

$$P(X = 1) = \frac{3}{10} \text{ and} \tag{2}$$

$$P(X = 0, X = 1) = \frac{1}{5} \tag{3}$$

We know that two events A, B(say) are said to be independent if $P(A|B) = P(A)$

$$\implies P(A|B) = \frac{P(A \cap B)}{P(B)} = P(A) \tag{4}$$

$$\implies P(A) \times P(B) = P(A \cap B) \tag{5}$$

Let's check whether the above events are independent or not.
From (1),(2)

$$P(X = 0) \times P(X = 1) = \frac{3}{5} \times \frac{3}{10} \tag{6}$$

$$\implies P(X = 0) \times P(X = 1) = \frac{9}{50} \tag{7}$$

From (3) and (7) it's clear that

$$P(X = 0, X = 1) \neq P(X = 0) \times P(X = 1) \tag{8}$$

Which says that the events E and F are not independent.