Assignment-1

AI1110: Probability and Random Variables

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Question:12.13.2.15: One card is drawn at random from a well shuffled deck of 52 cards. In which of the following cases are the events E and F independent ? (i) E : 'the card drawn is a spade' F : 'the card drawn is an ace'

(ii) E : 'the card drawn is black' F : 'the card drawn is a king'

(iii) E : 'the card drawn is a king or queen' F : 'the card drawn is a queen or jack'.

Solution:

(i) E denotes the event that the card drawn is spade

$$P(E) = \frac{13}{52} = \frac{1}{4} \tag{1}$$

F denotes the event that card drawn is ace

$$P(F) = \frac{4}{52} = \frac{1}{13} \tag{2}$$

$$P(E \cap F) = \frac{1}{52} \tag{3}$$

$$P(E).P(F) = \frac{1}{4} \times \frac{1}{13} = \frac{1}{52} \tag{4}$$

$$\therefore \; P(E \cap F) = P(E).P(F) \tag{5}$$

$\therefore$ E and F are independent events.

(ii) E denotes the event that the card drawn is black

$$P(E) = \frac{26}{52} = \frac{1}{2} \tag{6}$$

F denotes the event that card drawn is a king

$$P(F) = \frac{4}{52} = \frac{1}{13} \tag{7}$$

$$P(E \cap F) = \frac{2}{52} = \frac{1}{26} \tag{8}$$

$$P(E).P(F) = \frac{1}{2} \times \frac{1}{13} = \frac{1}{26} \tag{9}$$

$$\therefore \; P(E \cap F) = P(E).P(F) \tag{10}$$

$\therefore$ E and F are independent events.

(iii) E denotes the event that the card drawn is king or queen

$$P(E) = \frac{8}{52} = \frac{2}{13} \tag{11}$$

F denotes the event that card drawn is a queen or jack

$$P(F) = \frac{8}{52} = \frac{2}{13} \tag{12}$$

$$P(E \cap F) = \frac{4}{52} = \frac{1}{13} \tag{13}$$

$$P(E).P(F) = \frac{2}{13} \times \frac{2}{13} = \frac{4}{169} \tag{14}$$

$$\therefore \; P(E \cap F) \neq P(E).P(F) \tag{15}$$

$\therefore$ E and F are not independent events.