Probability

ASSERTION AND REASON BASED MCQs (1 Mark each)

Directions : In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is NOT the correct explanation of A

(C) A is true but R is false

(D) A is false but R is True

Q. 1. Assertion (A): Let A and B be two events such that $P(A) = \frac{1}{5}$, while $P(A \text{ or } B) = \frac{1}{2}$. Let $P(B) = P$, then for $P = \frac{3}{8}$, A and B independent.

Reason (R) : For independent events,

$$\begin{aligned} P(A \cap B) &= P(A)\,P(B) \\ P(A \cup B) &= P(A) + P(B) - P(A \cap B) \\ &= P(A) + P(B) - P(A)\,P(B) \\ &= \frac{1}{5} + P - \left(\frac{1}{5}\right)P \end{aligned}$$

$$\Rightarrow \quad \frac{1}{2} = \frac{1}{5} + \frac{4}{5}P$$

$$\Rightarrow \quad P = \frac{3}{8}.$$

Ans. Option (A) is correct.

Explanation: Assertion (A) and Reason (R) both are correct and Reason (R) is the correct explanation of Assertion (A).

Q. 2. Assertion (A) : If A and B are two mutually exclusive events with $P(\bar{A}) = \frac{5}{6}$ and $P(B) = \frac{1}{3}$. Then $P(A/\bar{B})$ is equal to $\frac{1}{4}$.

Reason (R) : If A and B are two events such that $P(A) = 0.2$, $P(B) = 0.6$ and $P(A|B) = 0.2$ then the value of $P(A|\overline{B})$ is 0.2.

Ans. Option (B) is correct.

Explanation: Assertion (A) is correct.

$$P(A|\overline{B}) = \frac{P(A \cap \overline{B})}{P(\overline{B})}$$

$$P(A|\overline{B}) = \frac{P(A)}{P(\overline{B})}$$

[since, given A and B are two mutually exclusive events]

$$P\left(\frac{A}{\overline{B}}\right) = \frac{\left(1-\frac{5}{6}\right).}{\left(1-\frac{1}{3}\right)}$$

$$= \frac{\frac{1}{6}}{\frac{2}{3}}$$

$$= \frac{1}{4}$$

Reason (R) is also correct.

For independent events,

$$P(A|\overline{B}) = P(A)$$
$$= 0.2.$$

Q. 3. Assertion (A) : Let A and B be two events such that the occurrence of A implies occurrence of B, but not vice-versa, then the correct relation between $P(A)$ and $P(B)$ is $P(B) \geq P(A)$.

Reason (R) : Here, according to the given statement

$$A \subseteq B$$

$$P(B) = P(A \cup (A \cap B)) \quad (\because A \cap B = A)$$

$$= P(A) + P(A \cap B)$$

Therefore, $\quad P(B) \geq P(A)$

Ans. Option (A) is correct.

Explanation: Assertion (A) and Reason (R) both are correct and Reason (R) is the correct explanation of Assertion (A).

Q. 4. Assertion (A) : If $A \subset B$ and $B \subset A$ then, $P(A) = P(B)$.

Reason (R) : If $A \subset B$ then $P(\overline{A}) \leq P(\overline{B})$.

Ans. Option (C) is correct.

Explanation : Assertion (A) is correct.

$A \subset B$ and $B \subset A \Rightarrow A = B$

Hence, $P(A) = P(B)$.

But (R) is wrong.

$$A \subset B \Rightarrow \overline{B} \subset \overline{A}$$

Therefore, $\quad P(\overline{A}) \geq P(\overline{B})$

Q. 5. Assertion (A) : The probability of an impossible event is 1.

Reason (R) : If A is a perfect subset of B and $P(A) < P(B)$, then $P(B - A)$ is equal to $P(B) - P(A)$.

Ans. Option (D) is correct.

Explanation : Assertion (A) is wrong.

If the probability of an event is 0, then it is called as an impossible event.

But Reason (R) is correct.

From Basic Theorem of Probability,

$P(B - A) = P(B) - P(A)$, this is true only if the condition given in the question is true.

Q. 6. Assertion (A) : If $A = A_1 \cup A_2 \ldots \cup A_n$, where $A_1 \ldots A_n$ are mutually exclusive events then

$$\sum_{i=1}^{n} P(A_i) = P(A)$$

Reason (R) :

Given, $\quad A = A_1 \cup A_2 \ldots \cup A_n$

Since $A_1 \ldots A_n$ are mutually exclusive

$$P(A) = P(A_1) + P(A_2) + \ldots + P(A_n)$$

Therefore $P(A) = \sum_{i=1}^{n} P(A_i)$

Ans. Option (B) is correct.

Explanation: Assertion (A) and Reason (R) both are correct and Reason (R) is the correct explanation of Assertion (A).