(1) sem III – Stats II

Q 1. (a)

(i) Prob. of an event always lies between 0 and 1.

(ii) P(exactly 2 heads) = 3/8

(iii) $P(A \cup B) = 2/3$

(iv) $\Sigma P(x) = 1$

(v) $V(c) = 0$

(vi) $p = 3/5$

(vii) Poisson distribution

(b)

(i) Sample space – def^n ①

example ①

(ii) Exhaustive events – def^n – ②

(iii) $P(A^c) = \frac{b}{a+b}$

(iv) $E(3X-4) = 41$

(v) measure of skewness $\beta_1 = \mu_3^2 / \mu_2^3$

(vi) Prob. of success p is small, $p \to 0$, number of trials is large $n \to \infty$, but mean np is finite, binomial dist^n → Poisson dist^n.

(vii) Mean of Hypergeometric dist^n $= \frac{M_2}{N}$.

② marks each.

Q. 2. (a) Def^n – ② marks each

(b)

(i) $S = \{1, 2, 3, \cdots, 20\}$ – ①

$A = \{3, 6, 9, 12, 15, 18, 5, 10, 20\}$ – ①

$P(A) = \frac{m}{n} = \frac{9}{20}$ – ②

(ii) $P(A) = \frac{1}{2}$ $P(\bar{A}) = \frac{2}{}$

1. P(target remains unhit)

$= P(\bar{A} \cap \bar{B}) = \frac{2}{3} \cdot \frac{3}{4} = \frac{1}{2}$ — (1)

2. P(target is hit)

$= P(A \cup B)$

$= \frac{1}{3} + \frac{1}{4} - \frac{1}{3} \cdot \frac{1}{4} = \frac{1}{2}$ — (2)

3. P(only one of them hits the target)

$= P(A \cap \bar{B}) + P(\bar{A} \cap B)$

$= \frac{5}{12}$ — (2)

(c)

(i) Prob. of an event — explaination (1)
— definition (2)
— assumptions (2)

(ii) A card is drawn from a pack of 52 cards

(i) P(queen / face card) $= 4/12 = 1/3$ — (2)

(ii) P(queen / heart card) $= 1/13$ — (1)

(iii) P(queen / not a jack) $= 4/48 = 1/12$ — (2)

Q.3. (a)

(i) Def^n cumulative distn fun. — (2)

important properties any three — (3)

(ii) mean of $X = E(X) = \Sigma x \cdot p(x)$

$= 0.7$ — (2)

$E(X^2) = \Sigma x^2 \cdot p(x) = 1.3$ — (1)

$V(X) = E(X^2) - [E(X)]^2$

$= 0.81$ — (2)

(b) (i) Raw moment — (1)

Central moment — (1)

Relationship μ_1, μ_2, μ_3 — (1) mark each. (2)

Q. 3. (b)

(ii)

1. $E(4X + 2Y + 5) = 4(10) + 2(20) + 5 = 85$ — (2)

2. $V(3X + 2Y) = 9 \cdot V(X) + 4V(Y) + 2 \cdot 3 \cdot 2 \cdot 2$

$= 9(4) + 4(16) + 24$

$= 124$ — (2)

(c)

Definitions — (2) marks each

When do we say X and Y are indep. — (2)

effect of indep. on ~~cond~~ conditional distn — (2)

Q. 4 (a)

Defn — $X \sim$ Uniform — (2)

prob. distn of X denoting number on the uppermost face of a die — (3)

$E(X)$ — (2)

$V(X)$ — (3)

(b)(i) Bernoulli trials — (2)

Binomial prob. law — (2)

properties — (2)

(ii) mean $= np = 3$

15. $P(X=0) = 2 \cdot P(X=1)$

$q = 2/5 \quad p = 3/5 \quad n = 5$ — (2)

$P(X=5) = {}^5C_5 (3/5)^5 (2/5)^0 = 0.07776$ — (2)

(c)

(i) Hypergeometric distn — defn — (3)

Conditions

(ii) X : no. of calls received during an interval of 10 minutes

$X \sim P(m=1)$ — (1)

1. $P(X=0) = 0.36788$ — (2)

2. $P(X=2) = 0.18394$ — (2)

Q-5. (a)

(i) Multiplication thm^n — statement — (2)

— proof — (3)

(ii) A : fiction $P(A) = 0.40$ } — (1)

B : Biography $P(B) = 0.30$ }

$P(A \cap B) = 0.20$ — (1)

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ — (1)

$= 0.40 + 0.30 - 0.20$

$= 0.5$ — (2)

(b)

(i) $E(aX+b) = a\,E(X) + b$ — (2)

$V(aX+b) = a^2 V(X)$ — (3)

(ii) $F(x) = 0 \quad x < -3$

$= 0.1 \quad -3 \le x < -1$

$= 0.3 \quad -1 \le x < 0$

$= 0.45 \quad 0 \le x < 1$

$= 0.65 \quad 1 \le x < 2$

$= 0.75 \quad 2 \le x < 3$

$= 0.90 \quad 3 \le x < 5$

$= 0.95 \quad 5 \le x < 8$

$= 1 \quad x \ge 8$ — (4)

$P(-1 < X \le 2) = 0.45$ — (1)

(c) (i) Statement — recurrence relation — (1)

Proof — (4)

(ii) $n = 100, \quad p = 0.03$

$m = np = 3$ — (1)

X : no. of defectives $\sim P(m=3)$ — (2)

$P(X > 4) = 1 - P(X \le 4) = 0.1847$ — (2)