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Branch :- Computer Science & Engineering, Semester :- 3rd

Date :- 30/10/2021

CIE -1

1) Soln :- Given,

Total no. of red balls = 6

Total no. of black balls = 4

Let, E = event of drawing 5 balls (3 red, 2 black)

$\therefore S = {}^{10}C_5$

$\therefore P(E) = \frac{{}^{6}C_3 \times {}^{4}C_2}{{}^{10}C_5} = \frac{\frac{6\times5\times4}{3\times2\times1} \times \frac{4\times3}{2\times1}}{\frac{10\times9\times8\times7\times6}{5\times4\times3\times2\times1}}$

$= \frac{5\times4\times2\times3}{9\times2\times7\times2}$

$= \frac{10}{21}$

2) Soln :- Here,

p = probability of getting head = $1/2$

q = probability of getting tail = $1/2$

X	1	2	3	4	5	6
Outcome	H	TH	TTH	TTTH	TTTTH	TTTTT
Probability	p	qp	q^2p	q^3p	q^4p	q^5

∴ Expected no. of tosses is given by,

$$E(x) = \sum x_i p_i$$

$$= 1 \cdot p + 2 \cdot qp + 3 \cdot q^2 p + 4 \cdot q^3 p + 5 \cdot q^4 p + 6 \cdot q^5$$

$$= 1 \cdot \frac{1}{2} + 2 \cdot \frac{1}{2} \times \frac{1}{2} + 3 \cdot \left(\frac{1}{2}\right)^2 \cdot \frac{1}{2} + 4 \cdot \left(\frac{1}{2}\right)^3 \cdot \frac{1}{2} + 5 \cdot \left(\frac{1}{2}\right)^4 \cdot \frac{1}{2} + 6 \cdot \left(\frac{1}{2}\right)^5$$

$$= \frac{1}{2} + \frac{1}{2} + \frac{3}{8} + 2 \cdot \frac{1}{8} + 5 \cdot \frac{1}{16} \cdot \frac{1}{2} + 6 \cdot \frac{1}{32}$$

$$= \frac{16 + 16 + 12 + 8 + 5 + 6}{32}$$

$$= \frac{32 + 20 + 11}{32}$$

$$= \frac{52 + 11}{32}$$

$$= \frac{63}{32} \quad //$$

3) Soln → Let,

M = event that the selected person is a man

W = event that the selected person is a woman

Gr = event the the selected person has grey hair.

To find: $P(M/Gr)$

Now,

$P(M) = \frac{1}{2} = 0.5$ [∵ there are equal no. of men and women]

$P(W) = \frac{1}{2} = 0.5$ ["]

And, given,

$P(Gr/M)$ = Probability a selected man has grey hair

$\therefore P(C_1/M) = 5\% = \frac{5}{100} = 0.05$

Also, $P(C_1/W) = 0.25\% = \frac{0.25}{100} = 0.0025$

Now using Bayes theorem,

$$P(M/C_1) = \frac{P(M) \cdot P(C_1/M)}{P(M) \cdot P(C_1/M) + P(W) \cdot P(C_1/W)}$$

$$= \frac{0.5 \times 0.05}{0.5 \times 0.05 + 0.5 \times 0.0025}$$

$$= \frac{0.5 \times 0.05}{0.5[0.05 + 0.0025]}$$

$$= \frac{0.05}{0.0525}$$

$$= \frac{500}{525}$$

$$= \frac{100}{105}$$

$$= \frac{20}{21}$$

4) (i) Sol: Given,

Mean $= 6 = np$

& Standard deviation $= 3 = \sqrt{npq}$.

$\therefore np = 6$

& $npq = 9$

$\therefore \frac{npq}{np} = \frac{9}{6} = \frac{3}{2}$

$\Rightarrow q = 3/2 > 1$

$\therefore q$ cannot be greater than 1

$\therefore$ Given statement is false

4. (ii) Soln:- Given,

mean = 3 = np

& variance = 2 = npq

$\therefore \frac{npq}{np} = \frac{2}{3}$

$\Rightarrow q = \frac{2}{3} < 1$

Using $q = \frac{2}{3}$ in $np = 3$ we get

$p = \frac{3}{2}$

$\therefore p = 1 - q = \frac{1}{3}$

$\therefore p, q > 0$ & $p, q < 1$

$\therefore$ The given statement is true.

5) Soln:-

Class	Midvalues (x)	Freq. (f)	c.f.	$u = \frac{x-105}{10}$	fu	fu^2
70-80	75	12	12	-3	-36	108
80-90	85	18	30	-2	-36	72
90-100	95	35	65	-1	-35	35
100-110	105	42	107	0	0	0
110-120	115	50	157	1	50	50
120-130	125	45	202	2	90	180
130-140	135	20	222	3	60	180
140-150	145	8	230	4	32	128
		230			= 125	= 753

Now, Mean $(\bar{x}) = a + h \cdot \frac{\Sigma fu}{N}$

$= 105 + 10 \times \frac{125}{230}$

$= 105 + \frac{125}{23}$

$= 105 + 5.4$

$\bar{x} = 110.4$

The greatest freq. lies in the class 110-120.

Modal class = 110-120

$f_m = 50$,

$f_1 = 42$

$f_2 = 45$

$l = 110$

$h = 10$

Mode, $M_o = l + \frac{f_m - f_1}{2f_m - f_1 - f_2} \times h$

$= 110 + \frac{50 - 42}{100 - 42 - 45} \times 10$

$= 110 + \frac{8}{13} \times 10$

$= 110 + \frac{80}{13}$

$= 110 + 6.2$

Mode = 116.2

Now,

Standard deviation $(\sigma) = h \sqrt{\frac{1}{N}\Sigma fu^2 - \left(\frac{1}{N}\Sigma fu\right)^2}$

$= 10 \sqrt{\frac{753}{230} - \left(\frac{125}{230}\right)^2}$

$= 10 \sqrt{3.2 - 0.3}$

$\Rightarrow \sigma = 10\sqrt{2.9}$

$= 10 \times 1.7$

$\boxed{\sigma = 17}$

Coeff. of dispersion $= \frac{\sigma}{\bar{x}} = \frac{17}{110.4} = 0.154$

Measure of skewness $= \frac{\bar{x} - M_0}{\sigma}$

$= \frac{110.4 - 116.2}{17}$

$= \frac{-5.8}{17}$

$= -0.34$