47 YASH SARANG - EM4 - ASSIGNMENT 5.

Q2. $P(x) = e^{-\lambda}\frac{(\lambda)^x}{x!}$ $\quad \lambda = \text{mean} = np = 0.001 \times 2000 = 2.$

$\therefore P(x) = e^{-2}\frac{2^x}{x!}$

i) exactly 3, $P(3) = \frac{e^{-2}\cdot 2^3}{3!} = 0.180$

ii) more than 2, $P(x>2) = 1 - P(x \le 2) = 1 - [P(0)+P(1)+P(2)]$
$= 1 - [e^{-2} + 2e^{-2} + 2e^{-2}]$
$= 1 - 5e^{-2} = 0.323.$

$P(x>2) = 0.323.$

Q8 Let mean & S.D be m & d respectively.
Let SNV for $x=35$ be z, $\therefore P(z<z_1) = 0.07.$

0.5 − Area between $z=0$ & $z=-z_1$ is 0.07.
$\therefore$ Area between $z=0$ & $z=-z_1$ is 0.43.
$\therefore z_1 = -1.475$, $\quad z = \frac{x-M}{d}$, $\quad \therefore -1.475 = \frac{35-m}{d}$

$\therefore m - 1.475d = 35$ — (1)
Similarly $m + 1.226d = 63$ — (2)
$\therefore m = 50.29$ and $d = 10.36$

Q16 $n_1 = 9$, $n_2 = 7$, $l < 30$ [small sample] $\bar{x}_1 = 196.42$, $\bar{x}_2 = 198.82$
$\Sigma (x_1 - \bar{x}_2)^2 = 26.94$ $\quad \Sigma (x_2 - \bar{x}_2)^2 = 18.73.$
H_0 & $\mu_1 = \mu_2$ (Samples drawn from same population)
$\therefore$ Degrees of freedom $= n_1 + n_2 - 2$, critical value $= 2.145.$

Since sample is small, $S_p = \sqrt{\frac{26.94 + 18.73}{14}} = 1.806.$

$S_t = S_p \sqrt{1/n_1 + 1/n_2} = 1.81 \times \sqrt{\frac{1}{8} + \frac{1}{2}} = 0.91.$

$t_{cal} = 196.42 - 198.82 / 0.91 = -2.63.$

as $|t_{cal}| > t_{oo}$, H_0 is rejected.

∴ Samples can't be considered from the same population.

Q18 Null Hypothesis (H_0) → no relation between sex and color.

Alternate " (H_1) → relationship "

Given freq table

Color	Male	Female	Total
Red	10	20	30
White	32	8	40
Green	4	26	30
Total	46	54	100

expected freq table

Color	Male	Female
Red	14	16
White	18	12
Green	14	16
Total	46	44

Calculation of $(O-t)^2/t$.

Observed (O)	Expected (t)	$(O-t)^2$	x^2
10	14	16	1.14
20	16	16	1
32	18	196	10.89
8	12	16	1.33
4	14	100	7.14
26	16	100	6.25
		total =	27.75

$x^2 = (O-t)^2/t$

L.O.S = $0.05 = \alpha$.

D.o.f = $(n-1)(c-1) = 2$.

critical values for $x^2_\alpha = 5.991$

as x^2 is much greater than x^2_α, Null hypothesis is rejected.

Hence we can say there is relationship between sex & color

Q-20.

Observed (O)	Expected (E)	$(O-E)^2$
15	22	49
20	22	4
25	22	9
15	22	49
29	22	49
28	22	36
	Total →	196

Null Hypothesis (H_0) → Die is unbiased.

$$\chi_{cal}^2 = \frac{\sum (O-E)^2}{E} = \frac{196}{22} = 8.91.$$

L.O.S = 0.05.

D.o.f = $n-1 = 5$.

Critical values = $(\chi_\alpha)^2 = 11.07$.

Since $(\chi_{cal})^2 < (\chi_\alpha)^2$

H_0 is accepted.

∴ The given die is unbiased.

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