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Assignment 4

Sol 1 $\quad {}^5C_1 (p)^1 (q)^{(5-1)} = {}^5C_1 (p)^1 q^4$

$5 \times p \times (1-p)^4 = 0.4096 \quad \ldots (1)$

${}^5C_2 (p)^2 (q)^{5-2} = 0.2048 \ldots$

$10 p^2 (1-p)^3 = 0.2048.$

$\dfrac{\cancel{5} p (1-p)^4}{\cancel{10}_2 p^2 (1-p)^3} = 2$

$\cancel{p} (1-p)^{\cancel{4}} = 4 p^{\cancel{2}} \cancel{(1-p)^3}$

$1 - p = 4p \qquad 5p = 1 \qquad \boxed{p = 0.2}$ Ans

Sol 2 $\quad 9 \times {}^6C_4 (p)^4 (q)^2 = {}^6C_{x+2} (p)^{x+2} (q)^{6-x-2}$

$9 \times 15\, p^4 (1-p)^2 = {}^6C_{x+2} (p)^2 (p)^x \dfrac{(q)^4}{q^x}$

I think question is wrong it should be $x = 2$

So

$9 \times {}^6C_4\, p^4 q^2 = {}^6C_2 \times p^2 q^4$

$9 \times \cancel{15} \times p^4 q^2 = \cancel{15} \times p^2 q^4$

$9p^2 = q^2$

$9p^2 = \cancel{1 - 2p + p^2} \qquad 8p^2 + 2p - 1 = 0$

$$p = \frac{-2 \pm \sqrt{4 \mp 4(8)(-1)}}{16} = \frac{-2 \pm 6}{16}$$

p cannot be negative so $p = \frac{-2+6}{16} = \frac{4}{16} = \boxed{\frac{1}{4}}$

Ans

~~3. Q no 3 solved using Python~~

4. Possion distribution is limiting case of binomial distribution

when $n \to \infty$ $p \to 0$.

So the case where $n \to$ finite trials (fine)

$p \to 0$ and only two outcomes

3. I will not only fit data but will will check goodness of fit also.

$$\lambda = \frac{\sum x_i N_i}{\sum N_i} = \frac{0 \times 109 + 1 \times 65 + 2 \times 22 + 3 \times 3 + 4 \times 1}{200}$$

$$= \frac{65 + 44 + 9 + 4}{200} = \frac{122}{200} = 0.61$$

$$\text{Pmf} = \frac{e^{-\lambda} \lambda^{x}}{x!}$$

Pmf × theoretical value = theoretical figure

for 0. $\frac{e^{-\lambda}\lambda^{0}}{0!} \times N$ for 1 $\frac{e^{-\lambda}\lambda^{1}}{1!}$

x	0	1	2	3	4
f	109	65	22	3	1
T	108.67	66.2887	20.21	4.11	1.25

Now check whether this is a good fit.

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(109-108.67)^2}{108.67} + \frac{(65-66.2887)^2}{66.2887}$$

$$+ \frac{(22-20.21)^2}{20.21} + \frac{(3-4.11)^2}{4.11} + \frac{(1-1.25)^2}{1.25}$$

$= 0.001 + 0.02505 + 0.1585 + 0.29978 + 0.05$

$= 0.53433$

χ^2 critical at 0.05 significance level for $(n-1)$ degree of freedom $=(5-1)=4$

$\chi^2_{\text{critical}} = 0.711$

Since $\chi^2 < \chi^2_{\text{critical}}$ we cannot reject the null hypothesis we accept the null hypothesis.

poisson is a good distribution

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