Binomial Dist.

E.g. In the recent survey it was found that 85% of household in USA have a high speed internet. If you take the sample of 18 household. what is the probability that exactly 15 will have high internet.

Soln ① If the exp. being repeted - yes

② Are the trails independe - yes

$n = 18$

$x = 15$

$P_r = 85 = 0.85$

$$P(x=15) = {}^{n}C_{x}\, p^{x} (1-p)^{n-x}$$

$$= {}^{18}C_{15}\, 0.85^{18-15} (1-0.85)$$

$$= 0.234 \Rightarrow 23.4\%$$

Z-test

In a population the Avg IQ. $\mu = 100$ with $\sigma = 15$ then the doctor tested a new medication to find out it increase the IQ or decrease the IQ

After medication

$> IQ$

$< IQ$

After one month sample of 30 participant were taken and 30 participant had mean is 140

Did this medication effect intelligence given is significant value α is 0.05.

Soln $\mu > \bar{x}$

$\mu < \bar{x}$

$\mu = 100$, $\sigma = 15$, $n = 30$

$\bar{x} = 140$

$\alpha = 0.05$

$z_{table} - 1 - 0.05 = 0.95$

$z_{\alpha} = 1.6 + 0.05 = 1.65$

$=$ z-test

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$= \frac{140 - 100}{15/\sqrt{30}}$$

$$z = 14.65$$

1.96

lower $\Rightarrow$ $\bar{x} \pm z_\alpha \frac{\sigma}{\sqrt{n}}$

$140 - 1.65 \times \frac{15}{\sqrt{30}}$

$\Rightarrow$ 135.48

Hight $\Rightarrow$ $140 + 1.65 \times 15/\sqrt{30}$

$\Rightarrow$ 144.51

$\mu = 100$

135 —— 144

Conclusion – We reject null hypothesis and accept alternet hypothesis.

Case = II

$\alpha = 0.1/2 = 0.05$

$C.I = 1 - 0.05 = 0.95$

Z-table $= 1.65$

Lower limit $= 140 - 1.65 \times 15/\sqrt{30}$

$= 135$

Higher limit $= 140 + 1.65 \times 15/\sqrt{30}$

$= 144.51$

Z-test

$Z = 14.65$

$-1.65 \quad - \quad 1.65$

T-test

① On the verbal section of CAT sample of 25 test taken has a mean of 520 with standard Deviation of sample is 80. CI = 95%.

Soln

$\bar{x} = 520$

$n = 25$

$S = 80$

C.I. = 95

$\alpha = 100 - 95 = 5\%$

$= 0.05/2 = 0.025$

T-table = 0.025

Degree of freedom = $n - 1$

$= 25 - 1$

$= 24$

value from T-table = 2.064

T-test lows $= \bar{x} \pm t_{\alpha/2} \left(\frac{s}{\sqrt{n}}\right)$

$= 520 - 2.064 \left(\frac{80}{\sqrt{525}}\right)$

$= 487.61$

upper $= 520 + 2.064 \left(\frac{80}{\sqrt{525}}\right)$

$= 552.38$

487 — 552

480 520 560

We fail to reject null hypothesis.

we reject null hypothesis and accept alternet hypothesis.

✡ Descrete probability Dist.

↓

③ poisson probability Dist.

Ex: A small business recieve an average 12 customer per day. what is the probability that the busmess will recieve exactly 8 customer.

euler number

Soln $\mu = 12$

$x = 8$

formula $P_r(X = x) = \frac{\mu^x e^{-\mu}}{x!}$

$\Rightarrow \frac{12^8 e^{-12}}{8!}$

$\Rightarrow \frac{429981696 \times 0.000000614}{40320}$

$\Rightarrow \quad 0.0654$

$8 \Rightarrow \quad 6.54\ \%$

e.g. A small business recieve on average 8 calls per hour.

(a) Probability that bussnes recieve exactly 7 calls in an hour.

(b) probability that the business will recieve at most 5 call in an hour.

(c) Probability that the bussness will recieve more than 6 calls in an hour.

① $\mu = 8$, $x = 7$

$$\Rightarrow \frac{8^7 e^{-8}}{7!} \Rightarrow 0.139 = 13.9\%$$

② $\mu = 8$ $P(x \leq 5)$

$$P(x \leq 5) = P(x=0) + P(1) + P(2) + P(3) + P(4) + P(5)$$

$$P(x=x) = \frac{\mu^x e^{-\mu}}{x!} = e^{-\mu}\left[\frac{\mu^x}{x!}\right]$$

$$\Rightarrow e^{-8}\left[\frac{8^0}{0!} + \frac{8^1}{1!} + \frac{8^2}{2!} + \frac{8^3}{3!} + \frac{8^4}{4!} + \frac{8^5}{5!}\right]$$

$$P(x \leq 5) = 0.1917 = 19.17\%$$

(3) $\mu = 8 \quad P(X>6)$

$P(X>6) = 1 - P(X<6)$

$\Rightarrow 1 - [P(0)+P(1)+P(2)+P(3)+P(4)+P(5)+P(6)]$

$\Rightarrow 1 - e^{-8}\left[\frac{8^0}{0!} + \frac{8^1}{1!} + \frac{8^2}{2!} + \frac{8^3}{3!} + \frac{8^4}{4!} + \frac{8^5}{5!} + \frac{8^6}{6!}\right]$

$\Rightarrow 1 - 0.31$

$\Rightarrow$ 68.6 % more than 6 calls.

$\Rightarrow \left[\frac{8^0}{0!} + \frac{8^1}{1} + \frac{8^2}{2}\right.$

$1 - e^{-8}[1 + 8 + 32 + 85 + 170 + 273 + 364]$

$\Rightarrow 1 - 0.31$

$\Rightarrow 0.69 = 69\ \%$