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

$n = 18$

$x = 15$

$P_r = 85 = 0.85$

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

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

$$= 0.234 \Rightarrow 23.4\%$$

Z-test

In a population the Avg IQ. $\mu = 100$ with $\sigma = 15$ than 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.

Sol^n

$\mu > \bar{x}$

$\mu < \bar{x}$

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

$\bar{x} = 140$

$\alpha = 0.05$

Ztable $- 1 - 0.05 = 0.95$

$Z_\alpha = 1.6 + 0.05 = 1.65$

= Z-test

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

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

$$\boxed{Z = 14.65}$$

1.96

lower $\Rightarrow \quad \bar{X} - Z_\alpha \frac{\sigma}{\sqrt{n}}$

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

$\Rightarrow \quad 135.48$

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

$\Rightarrow \quad 144.51$

$\mu = 100$

135 —— 144

Conclusion – We reject null hypothesis and accept alternet hypothesis.

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%.

Sol^n

$\bar{x} = 520$

$n = 25$

$S = 80$

$C.I. = 95$

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

$= 0.05/2 = 0.025$

T-table = 0.025

Degree of freedom = $n-1$

$= 25-1$

$= 24$

value from T-table = 2.064

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

lower

$= 520 - 2.064 \left(\frac{80}{\sqrt{25}} \right)$

$= 487.61$

upper $= 520 + 2.064 \left(80/\sqrt{25} \right)$

$= 552.38$

487 — 552 560

480

520

We fail to reject null hypothesis.

we reject null hypothesis and accept alternet hypothesis.

✵ Descrete probability Dist.

③ poisson probability Dist.

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

euler number

Sol^n

$\mu = 12$

$x = 8$

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

$\Rightarrow \dfrac{12^8 \, e^{-12}}{8!}$

$\Rightarrow \dfrac{429981696 \times 0.00000614}{40320}$

$\Rightarrow \quad 0.0654$

$$\boxed{8 \Rightarrow \quad 6.54\ \%}$$

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

(a) Probability that business 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 business will recieve more than 6 calls in an hour.

① $\mu = 8$, $x = 7$

$$\Rightarrow \frac{8^{7} e^{-8}}{7!} \Rightarrow 0.139 = 13\%$$

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

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

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

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

$$\Rightarrow 1 - 0.31$$

$\boxed{\Rightarrow 68.6\%}$ more than 6 call.