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

$n = 18$

$x = 15$

$P_r = 85 = 0.85$

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

$$= {}^{18}C_{15}\, 0.85 (1-0.8)^{18-15}$$

$$= 0.234 \Rightarrow 23.4\%$$

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

$$\mu = \bar{X} = H_0$$

$$\mu \neq \bar{X} = H_1$$

$$\alpha = 0.05/2$$
$$= 0.025$$

z-table = $1 - 0.025 \Rightarrow 0.975$

z-table value = 1.96

$$\left.\begin{array}{l} < -1.96 \\ > 1.96 \end{array}\right\}$$

<u>Z-test</u>

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

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

$$\boxed{Z = 14.65}$$

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

$140 - 1.96 \times \frac{15}{\sqrt{30}}$

$\Rightarrow 134.63$

Hight $\Rightarrow$ $140 + 1.96 \times 15/\sqrt{30}$

$\Rightarrow 145.36$

134 —— 145

$\mu = 100$ —— Is it in range

134 —— 145

Conclusion – We reject null hypothesis and accept alternet hypothesis.

Case = II

$$\alpha = 0.1/2 = 0.05$$

$$C.I = 1 - 0.05 = 0.95$$

$$z\text{-table} = 1.65$$

$$\text{lower limit} = 140 - 1.65 \times 15/\sqrt{30}$$
$$= 135$$

$$\text{Higher limit} = 140 + 1.65 \times 15/\sqrt{30}$$
$$= 144.51$$

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%.

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

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

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

$= 487.61$

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

$= 552.38$

487 —— 552

↑

520

We fail to reject null hypothesis.

Descrete probability Dist.

③ poisson probability Dist.

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

Soln

$\mu = 12$

$x = 8$

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

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

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

$\Rightarrow \quad 0.0654$

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

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 $\mu = 8 \quad p(x>6)$

$$p(x>6) = 1 - p(x<6)$$

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

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

$$\Rightarrow 1 - 0.686$$

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