# 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.

**Sol^n** ① If the exp. being repeted - yes

② Are the trails independe - yes

$n = 18$

$x = 15$

$Pr = 85 = 0.85$

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

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

$$= 0.234 \implies 23.4\%$$

# 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 $\alpha$ is 0.05.

## Sol^n

$$\mu > \bar{X}$$
$$\mu < \bar{X}$$

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

$$\bar{x} = 140$$

$$\alpha = 0.05$$

z table $- 1 - 0.05 = 0.95$

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

= $\underline{\text{z - test}}$

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

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

$$\boxed{Z = 14.65}$$

$$1.96$$

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

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

$\Rightarrow$ 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.

# T-test

① On the verbal section of CAT sample of 25 test taken has a mean of <u>520</u> 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 = 2.391

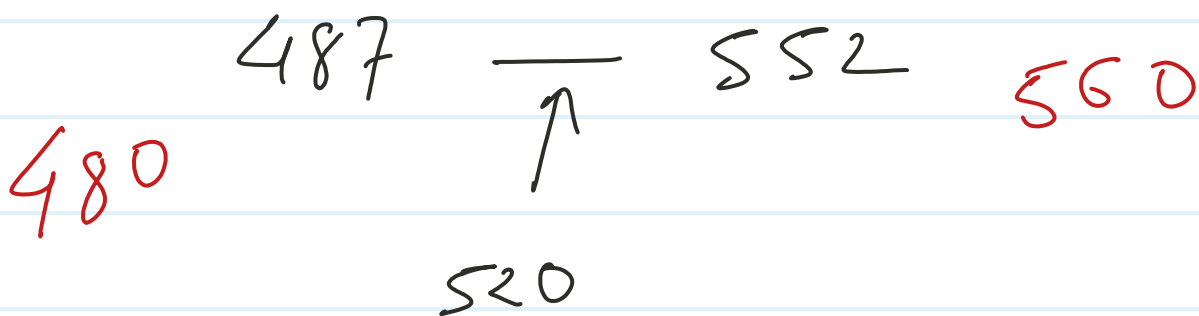$$T\text{-test}_{\text{lower}} = \overline{x} \pm t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$$

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

$$= 487.61$$

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

$$= 552.38$$

480   487  ↑  552  560

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 's the probability that the
busness will recieve exactly 8
customer.                    euler number

Soln    $\mu = 12$

        $x = 8$

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

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

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

$\Rightarrow$     0.0654

| 8 $\Rightarrow$     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)     $\mu = 8$     $P(X > 6)$

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

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

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

$$\Rightarrow 1 - 0.31$$

$$\boxed{\Rightarrow 68.6\%} \quad \text{more than 6 cell.}$$