Name:- Utsav Acharya

Q.no.1

a Ans

Given,

$$Total\ student = 100$$
$$Juniors = 43$$
$$Male = 64$$
$$Male\ Junior = 24$$

If male, The probability the student is a junior

$$P(Junior\ |\ Male) = \frac{P(Junior\ and\ Male)}{P(Male)}$$

$$= \frac{24}{100} \times \frac{100}{64}$$

$$= \frac{24}{64}$$

$$= 0.375$$

Hence

$$Probability\ P\left(\frac{Junior}{Male}\right) = 0.375$$

b Ans

No, The event that the student is a junior and the event that the student is not independent

i.e

from Q.no.1 a

$$P(Junior\ |\ Male) = 0.375$$
$$P(Junior) = 0.43$$

Since,

$$0.375 \neq 0.43$$

So, it is not independent

Qno.2

Given,

10% of people fail on the first try

so,

Probability of fail $p = 0.10$

probability of passing $q = 1 - p$
$= 0.90$

Number of individual $n = 5$

a) Ans

when $x = 1$ where, $\sim (n = 5, p = 0.10)$

$P(x=1) = \begin{pmatrix} 5 \\ 1 \end{pmatrix} (0.10)^1 (0.90)^4 \qquad \left[P(x=k) = \begin{pmatrix} n \\ k \end{pmatrix} p^k q^{n-k} \right]$

$= 0.32805$

b) Ans

At least $(P x \geq 1)$

$1 - P(x=0)$

$P(x=0) = \begin{pmatrix} 5 \\ 0 \end{pmatrix} (0.10)^0 (0.90)^5$

$= 0.59049$

Now,

$P(x \geq 1) = 1 - 0.59049$

$= 0.40951$

Q.no-3

Soln,

Given,

Mean $\bar{x} = 315$

Standard deviation $s = 11$

a Ans

Probability of the speed more than 320

$x = 320$

So,

$$Z = \frac{320-315}{11} \quad \left(\frac{x-\bar{x}}{s}\right)$$

$$= 0.4545$$

Normal distribution in standard table,

$$P(z > 0.4545)$$
$$= 1 - P(z < 0.4545)$$
$$= 1 - 0.6736$$
$$= 0.3264$$

b Ans

between 305 and 320 z-score

So,

for 305, $Z = \frac{305-315}{11} = -0.90909091$

for 330, $Z = \frac{330-315}{11} = 1.36363636$

$$P(305 < x < 330)$$

So,

$$P(z < -0.9091) = 0.1814 \quad \begin{bmatrix} -0.91 \\ 1.36 \end{bmatrix}$$
$$P(z < 1.36364) = 0.9131$$

So,

$$= 0.9131 - 0.1814$$
$$= 0.7317$$

Q.no.3 ①

90%. greater

$P(x > 1) = 0.90$

$P(x < 1) = 0.10$

So,

$P(z < z) = 0.10$

$= -1.28$

So,

$x = \bar{x} + zs$

$= 315 + (-1.28)11$

$= 300.92$

Q.no.4

a Ans

$f(x = 27) = 0.30$

$f(x = 28) = 0.26$

$f(x = 29) = 0.38$

$f(x = 30) = 0.06$

b Ans

X and Y are not independent because

$f(27, 2.5) \neq f(x = 27) \cdot f(y = 2.5)$

Q.no.5

Mean $\bar{x} = 72.7$
Standard deviation $= 13.1$

a) Ans

Sample size $n = 38$

$\varepsilon_{\text{rot}} = S_x = \dfrac{S}{\sqrt{n}} = \dfrac{13.1}{\sqrt{38}} = 2.1266$

Sample distribution:
$$\bar{x} \sim N(72.7, \ 2.166)$$

b) Ans

betn 70 & 80 (Probability)

So,

$$z_1 = \dfrac{70 - 72.7}{2.166} = -1.25$$

$$z_2 = \dfrac{80 - 72.7}{2.166} = 3.37$$

$P(z < -1.25) = 0.1056$
$P(z < 3.37) = 0.9996$

$P(70 < \bar{x} < 80)$
$P(-1.25 < \bar{x} < 3.37)$
$= 0.9996 - 0.1056$
$= 0.894$

Q.no6

Mean $\bar{x} = 101.82$
Standard deviation $s = 1.2$
Sample size $n = 6$
Confidence level

for

a Ans

95% confidence level,
$$df = n-1$$
$$= 5$$

So,

$$t_{\frac{\alpha}{2}, 5} = 2.571$$

(Standard Error) $SE = \frac{s}{\sqrt{n}} = \frac{1.2}{\sqrt{6}} = 0.49$

Margin error $(ME) = t^* . SE$
$$= 2.571 \times 0.49$$
$$= 1.26$$

So,

Confidence interval

$$\bar{x} \pm ME$$
$$= (100.56, 103.08)$$

b Ans

If we increase confidence level the interval
will be wider

c Ans

The population must be distributed
normally.

Q.no.7

$\mu_0 = 15$

$\bar{x} = 16.46$

$s = 2.6$

$n = 20$

$\alpha = 0.05$

$H_0 \mu = 15$ Vs $H_1 \mu > 15$

So,

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{16.46 - 15}{2.6/\sqrt{20}} = 2.51$$

Degree of freedom

$$df = n - 1$$
$$= 19$$

Critical t-value,

$$df = 19 \quad \alpha = 0.05$$
$$t_{critical} = 1.729$$

So,

$$t = 2.51 > 1.73$$

Reject $H_0 \mu = 15$

Q.no. 8

Soln,

H_0 V_s H_1

$\mu_1 = \mu_2$ $\mu_1 \neq \mu_2$

Pooled ~~std~~ common variance $= \sqrt{\dfrac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$

$$sp = \sqrt{\dfrac{15(5\cdot7)^2 + 8(4\cdot3)^2}{16+9-2}}$$

$$= 5\cdot26$$

Test statistic

$$t = \dfrac{\bar{X}_1 - \bar{X}_2}{sp\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$$

$$= -1\cdot5$$

So,

Degree of freedom

$$df = n_1 + n_2 - 2$$
$$= 16 + 9 - 2$$
$$= 23$$

t critical $= \pm 2\cdot069$

Since,

$-1\cdot05\%$ is within the range
$-2\cdot069,$
     we fail to reject the
$H_0 = \mu_1 = \mu_2$

Q.no 9

Given,

a Ans $\hat{y} = 1.8 + 1.1 x$

The slope is '1.1' which means for every one-year increase in age by 1.1.

b Ans
$$\hat{y} = 1.8 + 1.1 (20)$$
$$= 23.8$$

c Ans

$H_0 : \beta_1 = 0$ Vs $H_a : \beta_1 \neq 0$

$p\text{-value} = 0.02$

$\alpha = 0.25$

which reject the null $H_0 = \beta_1 = 0$

d Ans
$$R^2 = 0.8123$$

Means, 81.23% of the variation in steriod level is explained by age.

Q no. 10

Given,

a Ans

$$p\text{- value} = 0.0159$$
$$\alpha = 0.05$$

$$p\text{-value} < 0.05$$

reject null hypothesis of equal means.

b Ans

Base on Turkey

M_1 & M_2 no significant

M_1 & M_3 no significant

M_2 & M_3 significant