Q1.

$\sigma = 8.50$ $\quad n = 200$

$\mu = 40.31$

Confidence level = 95%

$$\therefore \quad \bar{x} \pm Z\left(\frac{\sigma}{\sqrt{n}}\right)$$

$Z\ (95\%) = 1.960$

$$\therefore \quad 40.31 \pm 1.960\left(\frac{8.5}{\sqrt{200}}\right)$$

$$\therefore \quad 40.31 \pm 1.18$$

The range is 39.13 and 41.49.

Q2.

$n = 50$

$$\bar{X} = \frac{\Sigma x}{n} = 6.76$$

$$\therefore \text{ Sample standard deviation } (s) = \sqrt{\frac{\Sigma (x - \bar{x})^2}{(n-1)}}$$

$$= 2.55$$

The confidence level = 0.95

Significance level = 0.05 (α)

$\bar{x} = 6.76$

$s = 2.55$

$Df = n - 1 = 49$

$t_{critical} = t_{\alpha/2, df}$

$= t_{0.025, 49} = \pm 0.98$

$$\mu = \bar{x} \pm \frac{t \cdot s}{\sqrt{n}}$$

$$= 6.76 \pm \frac{2.011 \times 2.55}{\sqrt{50}}$$

$$\mu = 6.76 \pm 0.7249$$

$\therefore$ confidence interval $(6.41, 7.11)$

Q4. a) $H_0 : u = 2$ hrs
$H_a : u \neq 2$ hrs

$\alpha = 0.05$

b) $\bar{x}$-bar (mean) $= \frac{\Sigma x}{n} = 2.2$

c) Sample distribution (s) $= 0.51644$

d)

$t = (2.2 - 2) / [0.5164 / \text{sqrt}(10)]$

$= 1.2247$

p-value $= 2 * P(t > 1.2247 \text{ when } df = 9)$
$= 2 * t(1.224, 100, 9)$
$= 0.2518$

e) $\because$ The p-value is greater than 95%. do not reject H_0.

Q3. a) $H_0 : \mu = 39.2$ hrs
$H_a : \mu < > 39.2$ hrs

b) Sample mean = 38.5
$\sigma = 4.8$
$n = 112$
$\alpha = 0.05$

d) $z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{38.5 - 39.2}{4.8/\sqrt{112}} = -1.5452$

z for $(-2.5\text{-}1) = -1.96$
z for $(2.5\text{-}1.) = 1.96$

$\therefore$ $z = -1.5452$ lies between -1.96 to 1.96
So, Null hypothesis can't be rejected.

c) p-value approach $z = -1.5452 \approx -1.545$
p-value is 0.612 which is greater than α

$\therefore$ Therefore Can't reject null hypothesis

Q5. a) $H_0 : \mu <= 40$
$H_a : \mu > 40$

$\alpha = 0.05$

b) $n = 495$

$$\bar{p} = \frac{189}{425} = 44.5\%$$

$$\bar{q} = \frac{236}{425} = 55.5\%$$

$$SE = \sqrt{\frac{p \times q}{n}} = \sqrt{\frac{44.5 \times 55.5}{425}} = 0.0397 = 3.97\%$$

$$t\text{-statistics} \Rightarrow Z = \frac{44.5 - 40}{3.97} = 1.133$$

p-value for $z = 1.13$

$\therefore$ P-value $= 1 - 0.8708$

$= 0.1292 = 12.92\%$

$\therefore$ We can't reject H_0.

Q6.

a) $H_0 : \mu \geq 75\%$

$H_a : \mu < 75\%$

$\alpha = 0.05$

$\bar{p} = 72\%$

$\bar{q} = (1 - \bar{p}) = 28\%$

$n = 300$

$$SE = \sqrt{\frac{p \times q}{n}} = \sqrt{\frac{0.72 \times 0.28}{300}} = 2.59\%$$

test statistic $\Rightarrow Z = \frac{72.75}{2.59} = -1.158 \approx -1.68$

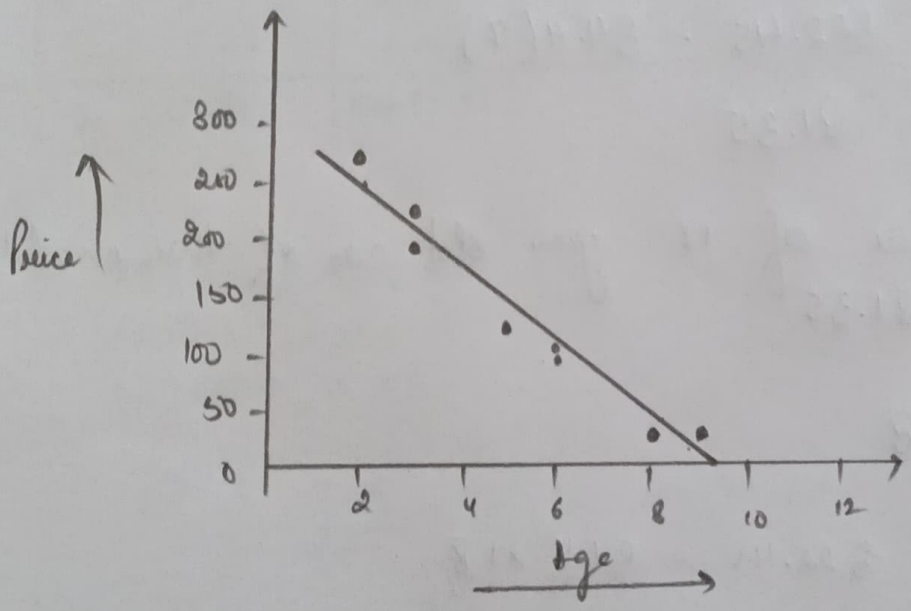
P-value $(z) = -1.16$

$= 0.1230 = 12.30\%$

$\therefore$ We fail to reject H_0.

Q7.

Age	8	3	6	9	2	5	6	3
Price	45	210	100	33	267	134	109	235



x^2	64	9	36	81	4	25	36	9	= 284
y^2	2025	44100	10000	1089	71289	17956	11881	55225	= 213565
xy	360	630	600	297	534	670	654	705	= 4450

$\Sigma x = 42 \qquad \Sigma y = 1133$

$\bar{x} = \frac{42}{8} = 5.25 \qquad \bar{y} = \frac{1133}{8} = 141.625$

$SS_{xx} = 284 - \frac{42^2}{8} = 43.5$

$S_y = 213565 - (1133)^2/8 = 53103.875$

$$S_{xy} = 4450 - \frac{42 \times 1133}{8} = -1498.23$$

$$\text{Slope} = \frac{S_{xy}}{S_x} = \frac{-1498.23}{43.5} = -34.44$$

$$\text{Intercept} = 141.625 + -34.44 \times 5.25$$
$$= 322.49$$

$\therefore$ equation $Y = 322.45 - 34.4x$

e) $x = 7$

$$y = 322.45 - 34.4(7)$$
$$= 81.35$$

The price of 7 year old car of this model will be 81.35

f) $a = 18$

$$y = 322.45 - 34.4 \times 18$$
$$= -297.52$$

A 18-years old cars of the model does not exist.

Q8.

Time (x)	GPA (y)	$\hat{y}$	d	$(y-\bar{y})^2$	$(\hat{y}-\bar{y})^2$	d^2
4.4	3.22	2.85	0.37	1055.6	1074.75	0.14
6.2	2.21	2.37	-0.16	1122.2	1111.77	0.02
4.2	3.13	2.90	0.23	1061.4	1076.2	0.05
1.6	3.69	3.60	0.09	1041.2	1030.8	0.01
4.7	2.7	2.77	-0.07	1089.6	1085.06	0.00
5.4	2.2	2.58	-0.38	1122.9	1097.4	0.15
1.3	3.69	3.68	0.01	1041.2	1025.7	0.00
2.1	3.25	3.47	-0.22	1053.6	1039.52	0.05
6.1	2.66	2.39	0.27	1092.3	1109.98	0.07
3.3	2.89	3.15	-0.26	1077.15	1060.4	0.07
4.4	2.71	2.85	-0.14	1089	1079.75	0.07
3.5	3.36	3.09	0.27	1046.5	1063.92	0.07
Σ = 42.2	35.71	35.71		12861.08	12860.43	0.65

$SST = 12861.08$
$SSR = 12860.4$
$SSE = 0.65$

Slope = -0.268
Intercept = 4.032

$$R^2 = \frac{SSR}{SST} = 0.99994388$$
$$= 0.999$$

$$r = (\text{Sign of } b_1)\sqrt{R^2}$$

$$r = -\sqrt{0.999} = -0.999$$

Q9.

50°C	60°C	70°C
34	30	23
24	31	28
36	34	28
31	23	30
32	27	31

Mean	33	29	28
Variance	32	17.5	9.5
n	5	5	5

$$f\text{-value} = (\text{mean}(m_1) + m_2 + m_3)/3 = 33+29+28/3 = 30$$

$$df_n = \text{no. of column} - 1 = 3 - 1 = 2$$

$$df_N = \text{no. of values} - \text{no. of column} = 15 - 3 = 12$$

$\therefore$

$$SSTR = \sum_{j=1}^{3} \frac{(\bar{x}_i - f\text{value})^2}{n}$$

$$= \frac{(33-30)^2}{5} + \frac{(29-30)^2}{5} + \frac{(28-30)^2}{5}$$

$$SSTR = \sum_{i=1}^{3} (x_i - f\text{value})^2 * n$$

$$= (33-30)^2 \times 5 + (29-30)^2 \times 5 + (28-30)^2 \times 5$$

$$= 70$$

$$SSE = \sum_{i=1}^{3} (n-1) * \text{Variance}_i = 4 \times 32 + 4 \times 17.5 + 4 \times 9.5$$

$$= 236$$

Q10.

Paint 1	Paint 2	Paint 3	Paint 4
128	144	133	150
137	133	143	142
135	142	137	1358
124	146	136	140
141	130	131	153
Sum = 665	695	680	720

$n = 5+5+5+5$

$\boxed{n = 20}$

$$\bar{x} = \frac{1}{n} \sum_{j=1}^{k} \sum_{i=1}^{n_j} x_{ij}$$

$$= \frac{1}{20} (665 + 695 + 680 + 720)$$

$$= 138$$

$$\bar{x}_1 = \frac{1}{n_j} \sum_{i=1}^{n_j} x_{ij} = \frac{1}{5} \times 665 = 133$$

$$\bar{x}_2 = \frac{1}{5} \times 695 = 139$$

$$\bar{x}_3 = \frac{1}{5} \times 680 = 136$$

$$\bar{x}_4 = \frac{1}{5} \times 720 = 144$$

$$SSB = \sum_{j=1}^{k} \sum_{i=1}^{n_j} (\bar{x}_j - \bar{x})^2$$

$$= [(128-138)^2 + (137-138)^2 + \dots + (140-138)^2 + (153-138)^2]$$

$$= 1022$$

$df = n-1 = 19$

$SSW = TSS - SST$
$= 1022 - 880$
$= 692$

$df_{within} = (n-1) - (k-1)$
$= 19 - 3 = 16$

$MS_{bg} = \frac{SSB}{df_{bg}} = \frac{880}{3} = 110$

$MS_{within} = \frac{SSW}{df_{within}} = \frac{692}{16} = 43.25$

$f = \frac{MS_{between}}{MS_{within}} = \frac{110}{43.25} = 2.543$

H_0 : $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$ (means are equal)

H_1 : means are not equal

$\alpha = 0.05$

$\therefore f_{test} = \{f : f > 3.289\}$

$f = \frac{MS_{between}}{MS_{within}} = 2.543$

$\therefore 2.543 < 3.289$

$\therefore$ Null hypothesis is not to be rejected.