

Questions should be —
WRITTEN IN LEGIBLE HANDWRITING IN BLACK INK.
SIGNS, SKETCHES OR FIGURES IF ANY BE DRAWN IN NEAT BLACK INK,
so as to avoid mistakes in the printed question papers.

Duration 3 Hours.

Total Marks assigned to the paper 80

OP code: 25856

Q. No.

Marks

N.B. :

$$1a) n = 10, \bar{x} = 119, s = 2.1$$

$$\bar{x} \pm t_{1-\alpha/2} \frac{s}{\sqrt{n}}$$

$$99\% = 119 \pm (3.2498) \frac{2.1}{\sqrt{10}}$$

$$= (116.842, 121.158)$$

$$95\% = 119 \pm (2.262) \frac{2.1}{\sqrt{10}}$$

$$= (117.5, 120.5)$$

$$90\% = 119 \pm (1.833) \frac{2.1}{\sqrt{10}} = (117.78, 120.217)$$

$$b) P(A) = 0.3, P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{19}{15} = \frac{2}{3}$$

$$P(A \cap B) = 0.15, P(\bar{B}) = 1 - 0.23 = 0.77$$

$$c) \int_0^{\infty} k x e^{-x/3} dx = 1 \text{ or } k = 1/9$$

$$E(x) = \int_0^{\infty} x f(x) dx = 6$$

$$P\{x > 6\} = \int_6^{\infty} f(x) dx = 3e^{-2} = 0.406$$

Q. No.

Marks

$$d) \bar{x} = \frac{620}{20} = 31, \text{ Median} = 31.5$$

$$\text{Mode} = 28, 35$$

$$\text{Variance} = \frac{224}{19} = 11.7895, s = 3.4336$$

$$\text{coefficient of variance} = \frac{s}{\bar{x}} \times 100 = 11.076$$

$$2a) i) H_0: \mu_1 = \mu_2 = \mu_3$$

H_A : not all μ 's are equal

$$SST = 72, SSA = 36, SSW = 36$$

Source	SS	d.f.	M.S.	V.R.
among samples	36	2	18	4.5
within samples	36	9	4	
Total	72	11		

$$ii) V.R. = 4.5$$

$$iii) \alpha = 0.05$$

$$iv) F_{0.05}(2, 9) = 4.26$$

$$v) 4.5 > 4.26 \text{ . Reject } H_0.$$

There is significant difference between the different types.

$$b) r = \frac{\sum xy}{\sqrt{\sum x^2 \cdot \sum y^2}}, b_{yx} = \frac{\sum xy}{\sum x^2}, b_{xy} = \frac{\sum xy}{\sum y^2}$$

$$y - \bar{y} = b_{yx}(x - \bar{x})$$

$$x - \bar{x} = b_{xy}(y - \bar{y})$$

Q. No.	High	Moderate	No.	Total	Marks
c)					
			64	250	
workers with cancer	102	84			
			159	250	
without cancer	31	60			
			223	500	
Total	133	144			

i) H_0 : 2 pops. homogeneous w.r.t. exposure levels

H_A : 2 pops. not homogeneous

ii) $\chi^2 = 82.37$

iii) $\alpha = 0.05$

iv) $\chi^2_{0.95} = 5.991$

v) $82.37 > 5.991$ Reject H_0

Persons working in jobs that expose
... have an increased risk of
contracting cancer.

3a) i) $H_0: \mu_1 - \mu_2 = 0$

$H_A: \mu_1 - \mu_2 \neq 0$

$s_p^2 = 1.28$

$s = 1.131$

ii) $t = \frac{\bar{x}_1 - \bar{x}_2 - (\mu_1 - \mu_2)}{s} = 2.51$

iii) $\alpha = 0.05$

iv) $t_{1-\alpha/2} = 2.0595$

v) $2.51 > 2.0595$ Reject H_0

Conclude that there is an indication
that 2 pop. means are not equal.

Q. No.

$$\mu = 140, \sigma = 50, Z = \frac{x - \mu}{\sigma}$$

$$\begin{aligned} \text{b) i) } P\{X > 200\} &= 1 - P\{X < 200\} \\ &= 1 - P\{Z < 1.2\} \\ &= 0.1151 \end{aligned}$$

$$\text{ii) } P\{X < 100\} = P\{Z < -0.8\} = 0.2119$$

$$\begin{aligned} \text{iii) } P\{100 < X < 200\} &= P\{-0.8 < Z < 1.2\} \\ &= 0.673 \end{aligned}$$

$$\text{iv) } P\{200 < X < 250\} = P\{1.2 < Z < 2.2\} = 0.1012$$

c) source	SS	d.f.	M.S.	V.R.
Treatments	2.82	3	0.94	
Blocks	13.68	2	6.84	6.2371
Residual	6.58	6	1.0966	
Total	23.08	11		

$$\text{i) } H_0: \mu_A = \mu_B = \mu_C$$

H_A : not all μ 's are equal

$$\text{ii) } V.R. = 6.2371$$

$$\text{iii) } \alpha = 0.01$$

$$\text{iv) } F_{0.01}(2, 6) = 10.92$$

v) $6.2371 < 10.92$ cannot reject H_0 .
conclude no significant difference
in yield due to fertilizers.

Q. No.

$$\hat{p} = 0.66, n = 670$$

4 a) i) $H_0: p \leq 0.6$

$$H_A: p > 0.6$$

ii) $Z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} = 3.17$

iii) $\alpha = 0.05$

iv) $Z_{1-\alpha} = 1.645$

v) $3.17 > 1.645$ Reject H_0

conclude that pop. proportion ... 76%.

b) i) H_0 : Business provides AIDS education, is independent of the size of business

H_A : not independent

ii) $\chi^2 = 14.8807$

iii) $\alpha = 0.05$

iv) $\chi^2_{0.95} = 5.991$

v) $14.8807 > 5.991$ Reject H_0

conclude \rightarrow not independent

c) Theory

5 a) $\frac{s_1^2/s_2^2}{F_{1-\alpha/2}} < \frac{\sigma_1^2}{\sigma_2^2} < \frac{s_1^2/s_2^2}{F_{\alpha/2}}$

$$\frac{1.75}{1.94} < \frac{\sigma_1^2}{\sigma_2^2} < \frac{1.75}{0.4975}$$

$$0.9021 < \frac{\sigma_1^2}{\sigma_2^2} < 3.5176$$

Q. No.

b)

Baye's theorem

T - event tails

H - event tails

B - event both balls

black

$$P(B/T) = \frac{{}^7C_2}{{}^8C_2} = \frac{3}{4}$$

$$P(B/H) = \frac{{}^3C_2}{{}^8C_2} = \frac{3}{28}$$

$$P\left(\frac{H}{B}\right) = \frac{P(B/H) \cdot P(H)}{P(B/H) \cdot P(H) + P(B/T) \cdot P(T)} = \frac{\frac{3}{28} \times \frac{1}{2}}{\frac{3}{28} \times \frac{1}{2} + \frac{3}{4} \times \frac{1}{2}} = \frac{1}{8}$$

c)

$$P\{x=2\} = {}^n C_x p^x q^{n-x}$$

i) H_0 : Sampled pop. has a binomial dist H_A : Sampled pop does not follow binomial dist.

$$i) \chi^2 = 3.4386$$

$$ii) \alpha = 0.1$$

$$iii) \chi^2_{.9} = 9.236$$

$$iv) 3.4386 < 9.236 \text{ cannot reject } H_0$$

v) conclude that no. of erroneous entries may follow a binomial dist.

$$6a) \sum x = 48, \sum x^2 = 474, \sum xy = 236$$

$$\sum y = 42, \sum y^2 = 434, \sum xz = 1818$$

$$\sum z = 300, \sum z^2 = 19008, \sum yz = 2820$$

$$z = a + bx + cy \text{ Eqs. are}$$

$$300 = 6a + 48b + 42c$$

$$1818 = 48a + 474b + 236c$$

$$2820 = 42a + 236b + 434c$$

Q. No.

$$a = 61.4, b = -3.65, c = 2.54$$

$$z = 61.4 - 3.65x + 2.54y$$

$$b) z = 40.14 \text{ at } x = 10 \text{ \& } y = 6$$

b) Paired comparisons

Marks