CMR INSTITUTE OF TECHNOLOGY		**USN**							CMRIT

Internal Assessment Test – II January 2026

Sub:	Mathematics for Computer Science							**Code:**	BCS301	
Date:	06/01/2026	**Duration:**	90 mins	**Max Marks:**	50	**Sem:**	III	**Branch:**	AIML/AIDS / CSE/ISE/ CS DS/CS ML	

Question 1 is compulsory and Answer any 5 from the remaining questions.

		Marks	OBE CO	OBE RBT
1	Four doctors test four treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows: (see table below) Discuss the difference between doctors and treatments F at 5% level (3, 9) is 3.86.	[10]	CO5	L3
2	Before an increase in excise duty on tea, 800 people out of sample of 1000 were consumers of tea. After the increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is significant decrease in the consumption of tea after the increase in duty at 1%.	[8]	CO3	L3
3	The mean weight obtained from a random sample of size 100 is 64gms. The standard deviation of the weight distribution of the population is 3gms. Test the statement that the mean weight of the population is 67gms at 5% level of significance. Also set up 99% confidence limits of the mean weight of the population.	[8]	CO3	L3
4	Explain the following terms: Null hypothesis, Significance level, Critical region, Type I and II error.	[8]	CO3	L1
5	Two samples of sizes 9 and 8 give the sum of squares of deviations from their respective means equal to 160 inches and 91 inches respectively. Can these be required as drawn from the same normal population? (Given $F_{8,7} = 3.73$)	[8]	CO4	L2
6	Fit a poisson distribution for the following data and test the goodness of fit given that ($\chi^2_{0.05} = 7.815$ for 3 d.f) (see table below)	[8]	CO4	L3
7	Analyze and interpret the following statistics concerning output of wheat per field obtained as a result of experiment conducted to test four varieties of wheat viz., A, B, C and D under a Latin-Square design. (Given F [illegible] = 4.76) (see table below)	[8]	[illegible]	[illegible]

Question 1 table:

Treatment / Doctor	T1	T2	T3	T4
D1	10	14	19	20
D2	11	15	17	21
D3	9	12	16	19
D4	8	13	17	20

Question 6 table:

x	0	1	2	3	4
f	122	60	15	2	1

Question 7 table:

C 25	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

1)

	C1	C2	C3	C4	Total
R1	10 a_1	14 b_1	19 c_1	20 d_1	$T_5 = 68$
R2	11 a_2	15 b_2	17 c_2	21 d_2	$T_6 = 64$
R3	9 a_3	12 b_3	16 c_3	19 d_3	$T_7 = 56$
R4	8 a_4	13 b_4	17 c_4	20 d_4	$T_8 = 58$
Total	$T_1=38$	$T_2=54$	$T_3=69$	$T_4=80$	$T = 241$

Ho: Suppose there is no significance difference between the treatments and doctor (rows & column)

- $CF = \frac{T^2}{N} = \frac{(241)^2}{16} = 3630.0625$ $\quad N = n_1+n_2+n_3+n_4 = 4+4+4+4 = 16$

- $SSC = \left\{ \frac{T_1^2}{n_1} + \frac{T_2^2}{n_2} + \frac{T_3^2}{n_3} + \frac{T_4^2}{n_4} \right\} - CF$

$= \left\{ \frac{(38)^2}{4} + \frac{(54)^2}{4} + \frac{(69)^2}{4} + \frac{(80)^2}{4} \right\} - 3630.0625$

$\boxed{SSC = 250.1875}$

- $MSC = \frac{SSC}{C-1} = \frac{250.1875}{3} = 83.395.$ $\quad C=4$, $R=4$

$\boxed{MSC = 83.395}$

$$SSR = \left\{ \frac{T_5^2}{m_1} + \frac{T_6^2}{m_2} + \frac{T_7^2}{m_3} + \frac{T_8^2}{m_4} \right\} - CF$$

$$= \left\{ \frac{(63)^2}{4} + \frac{(64)^2}{4} + \frac{(56)^2}{4} + \frac{(58)^2}{4} \right\} - 3630.0625$$

$$\boxed{SSR = 11.1875}$$

$$MSR = \frac{SSR}{R-1} = \frac{11.1875}{3} = \underline{\underline{3.729}}$$

$$SST = \left\{ \Sigma a_i^2 + \Sigma b_i^2 + \Sigma c_i^2 + \Sigma d_i^2 \right\} - CF.$$

$$= \{ 366 + 734 + 1195 + 1602 \} - 3630.0625$$

$$\boxed{SST = 266.9375}$$

$$SSE = SST - \{ SSR + SSC \}$$

$$= 266.9375 - \{ 11.1875 + 250.1875 \}$$

$$\boxed{SSE = 5.5625}$$

$$MSE = \frac{SSE}{(C-1)(R-1)} = \frac{5.5625}{3 \times 3} = \frac{5.5625}{9}$$

$$\boxed{MSE = 0.6180}$$

$$\therefore F_C = \frac{MSC}{MSE} = \frac{83.395}{0.618} = 134.94.$$

$$\therefore F_T = \frac{MSR}{MSE} = \frac{3.729}{0.618} = 6.033$$

source of variation	sum of square	degree of freedom	mean square	F-ratio
Between Columns	SSC = 250.1875	$c-1=3$	MSC = 83.395	$F_c = 134.94$
Between rows	SSR = 11.1875	$R-1=3$	MSR = 3.729	$F_r = 6.033$
R.E	SSE = 5.5625	$(c-1)(r-1) = 9$	MSE = 0.618	
total	SST = 266.9375	$N-1 = 15$		

$\therefore$ $f_{0.05} = 3.86$ at d.f $(3,9)$

$\therefore$ $f_c = 134.94 > f_{0.05}$ at d.f $(3,9)$.

$\therefore$ Ho is Rejected

$\therefore$ $f_r = 6.033 > f_{0.05} = 3.86$ at d.f $(3,9)$.

Ho is Rejected.

$\therefore$ Hypothesis Ho is Rejected for both rows and colums.

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2) given :- $n_1 = 1000$, $x_1 = 800$

$n_2 = 1200$, $x_2 = 800$.

$$z = \frac{P_1 - P_2}{\sqrt{pq\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$$, $P_1 = \frac{x_1}{n_1} = \frac{800}{1000} = 0.8$

$\boxed{P_1 = 0.8}$

$p_2 = \frac{x_2}{n_2} = \frac{800}{1200} = 0.67$

$\therefore \quad P = \frac{P_1 n_1 + P_2 n_2}{n_1 + n_2} = \frac{0.8(1000) + 0.67(1200)}{1000 + 1200}$

$\boxed{P = 0.727}$

$\therefore \quad q = 1 - P = 1 - 0.727 = 0.273$

$\therefore \quad z = \frac{0.8 - 0.67}{\sqrt{(0.727)(0.273)\left(\frac{1}{1000} + \frac{1}{1200}\right)}}$

$\boxed{z = 6.815}$

H_0: suppose there is no significance difference between the proportions (decrease in consumpt of tea after duty increase).

$z_{0.01} = 2.58$

$\therefore \quad z = 6.815 > z_{0.01} = 2.58$ at 1% sig level,

Ho is Rejected

$\therefore$ The hypothesis Ho is Rejected.

3) given :- $n_1 = 100$, $\bar{x} = 64$, $\sigma = 3$ (sam.

$\mu = 67$

$$|z| = \left| \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} \right| = \left| \frac{64 - 67}{\frac{3}{\sqrt{100}}} \right| = \left| \frac{3}{0.3} \right| = 10$$ //.

H_0: Suppose there is no significance difference b/w mean weight.

$z = 10$. , $z_{0.05} = 1.96$.

$\therefore$ $z = 10 > z_{0.05} = 1.96$, H_0 is Rejected.

Confidence limit,

$$\bar{x} \pm z_{0.01} \left(\frac{\sigma}{\sqrt{n}} \right)$$

$$= 64 \pm 2.58 \left(\frac{3}{\sqrt{100}} \right)$$

$$= 64 \pm 2.58 (0.3)$$

$$= 64 \pm 0.774$$

$= 64 + 0.774$ and $64 - 0.774$

$= \underline{64.774}$ and $\underline{63.226}$.

$\therefore$ Confidence limit at 99% of mean weight is 64.774 and 63.226 //.

5) given :- $n_1 = 9$, $n_2 = 8$.
$(x_i - \bar{x})^2 = 160$, $(y_j - \bar{y})^2 = 91$

H_0 : There is no significance difference b/w normal population

$$S_1 = \frac{1}{n_1 - 1}\left\{\Sigma (x_i - \bar{x})^2\right\}$$

$$= \frac{1}{9-1}\{160\} = \frac{1}{8} \times 160 = 20.$$

$$\boxed{S_1 = 20}$$

$$S_2 = \frac{1}{n_2 - 1} \times \Sigma (y_j - \bar{y})^2 = \frac{1}{8-1} \times 91$$

$$\boxed{S_2 = 13}$$

$\therefore S_1 > S_2$.

$$\therefore \boxed{f = \frac{S_1}{S_2} = \frac{20}{13} = 1.538}$$

$\therefore$ d.f $v_1 = n_1 - 1 = 8$
$v_2 = n_2 - 1 = 7$.

$f_{(8,7)} = 3.73$.

$\therefore f = 1.538 < f_{(8,7)} = 3.73$, H_0 is accepted.

$\therefore$ H_0 is accepted.

6)

x	0	1	2	3	4
f	122	60	15	2	1

$n = 5$

H_0: It follows poisson distribution

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

$$P(x) = \frac{m^x e^{-m}}{x!}$$

$$m = \mu = \frac{\sum f x}{\sum f} = \frac{0(122) + 1(60) + 2(15) + 3(2) + 4}{122 + 60 + 2 + 1 + 15}$$

$$= \frac{0 + 60 + 30 + 6 + 4}{200} = \frac{100}{200} = 0.5$$

$$\boxed{m = 0.5}$$

$$f(x) = 200 \times P(x)$$

$$P(x) = \frac{(0.5)^x e^{-0.5}}{x!} = \frac{0.6 (0.5)^x}{x!}$$

$$f(x) = 200 \times \left(\frac{0.6 (0.5)^x}{x!} \right)$$

$$f(x) = \frac{120 (0.5)^x}{x!}$$

$a^m a^n$
a^{m+n}

$$f(0) = \frac{120 (0.5)^0}{0!} = 120$$

$f(1) = 60$

$f(2) = 15$

$f(3) = 2.5$

$f(4) = 0.3125$

Excepted values are 120, 60, 15, 2.5, 0.3125.

$\therefore \quad \chi^2 = \sum_{i=1}^{5} \frac{(O_i - E_i)^2}{E_i}$

$= \frac{(122 - 120)^2}{120} + \frac{(60 - 60)^2}{60} + \frac{(15 - 15)^2}{15} +$

$\frac{(2 - 2.5)^2}{2.5} + \frac{(1 - 0.3125)^2}{0.3125}$

$= 0.03 + 0 + 0 + 0.1 + 1.5125$

$\boxed{\chi^2 = 1.6425}$

~~d.f = n - 1 = 5.~~

$\chi^2_{0.05} = 7.815$

$\chi^2 = 1.6425 < \chi^2_{0.05} = 7.815$

$\therefore$ H_0 is accepted.

7) Using coding method subtract the values by 20.

	C1	C2	C3	C4	Total
R_1	(C) 5	(B) 3	(A) 0	(D) 0	$T_5 = 8$
R_2	(A) −1	(D) −1	(C) 1	(B) −2	$T_6 = -3$
R_3	(B) −1	(A) −6	(D) −3	(C) 0	$T_7 = -10$
R_4	(D) −3	(C) 0	(B) 1	(A) −5	$T_8 =$ −7
Total	$T_1 = 0$	$T_2 = -4$	$T_3 = -1$	$T_4 = -7$	$T = -12$

- $CF = \frac{T^2}{N} = \frac{(-12)^2}{16} = 9$ $\quad N = n_1 + n_2 + n_3 + n_4 = 16$

- $SSC = \left\{ \frac{T_1^2}{n_1} + \frac{T_2^2}{n_2} + \frac{T_3^2}{n_3} + \frac{T_4^2}{n_4} \right\} - CF$

$= \left\{ \frac{0 + (-4)^2 + (-1)^2 + (-7)^2}{4} \right\} - 9$

$\boxed{SSC = 7.5}$

- $MSC = \frac{SSC}{C-1} = \frac{7.5}{3} = 2.5 \quad \therefore \boxed{MSC = 2.5}$

- $SSR = \left\{ \frac{T_4^2}{m_1} + \frac{T_5^2}{m_2} + \frac{T_6^2}{m_3} + \frac{T_7^2}{m_4} \right\} - CF$

$= \left\{ \frac{(8)^2 + (-3)^2 + (-10)^2 + (-7)^2}{4} \right\} - 9$

$\boxed{SSR = 46.5}$

- $MSR = \frac{SSR}{R-1} = \frac{46.5}{3} = \underline{15.5}$.

- $SST = \{ \Sigma a_i^2 + \Sigma b_i^2 + \Sigma c_i^2 + d_i^2 \} - CF$

$= \{ 36 + 46 + 11 + 29 \} - 9$

$\boxed{SST = 113}$.

- $SSL = \left\{ \frac{(\Sigma A)^2 + (\Sigma B)^2 + (\Sigma C)^2 + (\Sigma D)^2}{k} \right\} - CF$ $\quad k=4$

$= \left\{ \frac{(-12)^2 + (1)^2 + (6)^2 + (-7)^2}{4} \right\} - 9$.

$\boxed{SSL = 48.5}$

- $MSL = \frac{SSL}{k-1} = \frac{48.5}{3} = \underline{16.17}$.

- $SSE = SST - \{ SSC + SSR + SSL \}$

$= 113 - \{ 7.5 + 46.5 + 48.5 \}$.

$\boxed{SSE = 10.5}$

- $MSE = \frac{SSE}{(C-1)(C-2)} = \frac{10.5}{3 \times 2} = \frac{10.5}{6} = 1.75$ //.

Source of variation	sum of square	D.F	Mean square	F-ratio
B/W columns	SSC = 7.5	C-1 = 3	MSC = 2.5	F_c = 1.428
B/W rows	SSR = 46.5	R-1 = 3	MSR = 15.5	F_r = 8.857
B/W Letters	SSL = 48.5	k-1 = 3	= MSL = 16.17	F_L = 9.24
R.E	SSE = 10.5	(C-1)(C-2) = 6	MSE = 1.75	
Total	SST = 113	N-1 = 15		

Ho:- suppose there is no significance diff b/w rows columns, & letters

$$F_c = \frac{MSC}{MSE} = \frac{2.5}{1.75} = 1.428$$

$$F_r = \frac{MSR}{MSE} = \frac{15.5}{1.75} = 8.857$$

$$F_L = \frac{MSL}{MSE} = \frac{16.17}{1.75} = 9.24$$

$\therefore$ $f_{(3,6)} = 3.73$.

$f_c = 1.428 < f_{(3,6)}$, Ho is accepted

$f_r = 8.857 > F_{(3,6)}$, Ho is rejected

$F_L = 9.24 > F_{(3,6)}$, Ho is rejected

$\therefore$ Only for f_c Ho is accepted and for f_r and f_L Ho is Rejected.