iii. The height of 10 males of a given locality are found to be 70,67,62,68,61,68,70,64,64 and 66 inches. Is it reasonable to believe that the average height is greater than 64 inches? **5**
Test at 5% level of significance assuming that for 9 degrees of freedom P(t>1.83)=.05.

******

Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No......................................

Faculty of Science

End Sem (Odd) Examination Dec-2022

CA3CO11 Mathematics III

Programme: BCA-MCA (Integrated) / BCA Branch/Specialisation: Computer Application

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The order of convergence of the Newton Raphson method is **1**
(a) Linear (b) Quadratic (c) Cubic (d) None of these

ii. $x - e^{-x} = 0$ is a ………..equation. **1**
(a) Algebraic (b) Transcendental
(c) Both (a) & (b) (d) None of these

iii. Newton's divided difference formula is used for ……. intervals. **1**
(a) Equal (b) Closed (c) Unequal (d) None of these

iv. If $x = 30, x_0 = 29$ and $h = 4$ then the value of u= **1**
(a) 0.75 (b)-0.25 (c) 0.25 (d) None of these

v. Weddle's rule is obtained by putting n=……. in Newton cote's quadrature formula. **1**
(a) 1 (b) 2 (c) 3 (d) None of these.

vi. The Runge-Kutta method of second order is also known as **1**
(a) Euler's method (b) Modified Euler's method
(c) Picard's method (d) None of these

vii. The mean deviation from mean of the normal distribution is **1**
(a) $\frac{4}{5}\sigma$ $(b)\frac{5}{4}\sigma$ $(c)\frac{2}{3}\sigma$ (d) None of these

viii. The variance of binomial distributions: **1**
$(a)\ np$ $(b)\sqrt{np}$ $(c)\ npq$ (d) None of these

ix. Chi-Square test is used as: **1**
(a) Test of goodness of fit
(b) Test of dependent of attributes
(c) Both (a) and (b)
(d) None of these

x. If n is the number of observations, then in Binomial distribution, degree of freedom is given by- **1**

$(a)\, n-1$ $(b) n-2$ $(c) n-3$ (d) None of these

Q.2 Attempt any two: **2**

i. Find a real root of $2x - log_{10}x = 7$ correct to 3 decimal places using iteration method. **5**

ii. By using Newton-Raphson method. Find the root of $x^4 - x - 10$ correct to 3 decimal places. **5**

iii. Solve the following by Gauss-Seidel method: **5**

10x+2y+z=9

-2x+3y+10z=22

x+10y-z=-22

Q.3 Attempt any two:

i. Using Newton's divided difference formula, Find f(8), f(9) and f(15). **5**

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

ii. Estimate the sale for 1966 using Newton-Gregory forward interpolation formula: **5**

Year	1931	1941	1951	1961	1971	1981
Sale in thousands	12	15	20	27	39	52

iii. The value of x and f(x) are given below: **5**

x	5	6	9	11
f(x)	12	13	14	16

Find the value of f(x) at x=10 by Lagrange's method.

Q.4 Attempt any two:

i. Evaluate $\int_4^{5.2} log_e x\, dx$ approximately by using Simpson's 1/3 rule and Weddle's rule. **5**

ii. Apply Runge-Kutta method to find an approximate value of y for x=0.2in step of 0.1, if $\frac{dy}{dx} = x + y^2$ given that y=1 when x=0. **5**

iii. Solve by Taylor's series method **5**

$\frac{dy}{dx} = 2y + 3e^x$ given that y (0) = 0 Find y at x=0.2

Q.5 Attempt any two:

i. A random variable X has the following probability function. **5**

X=x	0	1	2	3
P(x)	0	1/5	2/5	2/5

Determine the distributive function of x.

ii. The probability of entering students in chartered accountant will graduate is 0.5. Determine the probability that out of 10 students (i) none (ii) at least one will graduate. **5**

iii. The mean height of 500 students is 151 cm .and the standard deviation is 15 cm. Assuming that the heights are normally distributed, find how many students have heights between 120 and 155 cm.? **5**

Q.6 Attempt any two:

i. From the table given below, whether the colour of son's eyes is associated with that of father's eyes? Given that the value of Chi square for 1 dof at 5% level of significance is 3.841 **5**

Eye colour in son's

		Not light	Light
Eye colour in father's father's	Not light	230	148
	Light	151	471

ii. Random samples are drawn from two populations and the following results were obtained: **5**

Sample x	20	16	26	27	23	22	18	24	25	19		
Sample y	27	33	42	35	32	34	38	28	41	43	30	37

Find variance of two populations and test whether the two samples have same variance. (Given that $F_{0.05}$ for 11 and 9 dof is 3.112).

Medi Caps University
Faculty of Science
End Sem (ODD) Examination, Dec-22

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No.		Marks
	CA3CO11, Mathematics - III.	
	Programme - BCA - MCA	
Q.1 MCQs.		
Ans (i)	(b) Quadratic	+1
Ans (ii)	(b) Transcendental	+1
Ans (iii)	(c) unequal	+1
Ans (iv)	(c) 0.25	+1
Ans (v)	(d) None of these	+1
Ans (vi)	(b) Modified Euler's Method	+1
Ans (vii)	(a) $\frac{4}{5}$ 6	+1
Ans (viii)	(c) npq	+1
Ans (ix)	(a) Test of goodness of fit	+1
Ans (x)	(a) (n-1)	+1

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No. | Marks

Q.2. Attempt any two:-

Ans 2(i) The given equation is

$$2x - \log_{10} x = 7$$

which can be written as

$$x = \frac{1}{2}\left[\log_{10} x + 7\right]$$ +1

Here, $\phi(x) = \frac{1}{2}\left(\log_{10} x + 7\right)$ —(1)

$f(3) = -1.4771$, $f(4) = 0.3979$, root lies betⁿ $(3,4)$ +1

Let $x_0 = 3.8$ in (1), we get

$$x_1 = \frac{1}{2}\left(\log_{10} 3.8 + 7\right) = 3.79$$

$$\boxed{x_1 = 3.79}$$ +1

Put $x = 3.79$ in equ (1), we get

$$x_2 = \frac{1}{2}\left(\log_{10} 3.79 + 7\right) = 3.7893$$

$$\boxed{x_2 = 3.7893}$$ +1

Again put $x = 3.7893$ in (1), we get

$$x_3 = \frac{1}{2}\left(\log_{10} 3.7893 + 7\right)$$

$$\boxed{x_3 = 3.7893}$$ +1

$\because x_2 = x_3$, the root of the given equⁿ is 3.7893 Ans.

No. | Marks

Ans 2 (ii) Here $f(x) = x^4 - x - 10$ —(1)

Then, $f(0) = -10 = (-)ve$

$f(1) = -10 = (-)ve$

$f(2) = 4 = (+)ve$

Clearly $f(1)$ and $f(2)$ are of opposite signs.

∴ root of equ (1) lies between 1 and 2. +½

Taking initial approximation

$$x_0 = 1.5$$

By Newton-Raphson Method

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}, \quad n = 0, 1, 2, \ldots$$ +1

$f(x) = x^4 - x - 10$, $f'(x) = 4x^3 - 1$ +½

$$x_{n+1} = x_n - \frac{(x_n^4 - x_n - 10)}{4x_n^3 - 1}$$

$$\boxed{x_{n+1} = \frac{3x_n^4 + 10}{4x_n^3 - 1}} \quad \text{—(2)}$$

Put $n = 0$ in (2), we get

I approx

$$x_1 = \frac{3x_0^4 + 10}{4x_0^3 - 1} = 2.015$$

Put $n = 1$ in (2), we get.

II approx

$$x_2 = \frac{3x_1^4 + 10}{4x_1^3 - 1} = 1.874.$$ +1

Marks

40. $n=2$ in equ ②, we get

III approx.

$$x_3 = \frac{3x_2^4+10}{4x_2^3-1} = 1.856$$ +1

Put $n=3$ in equ ②, we get

IV approx

$$x_4 = \frac{3x_3^4+10}{4x_3^3-1} = 1.856$$

$\because$ $x_3 = x_4$,

$\therefore$ the root of given equ^n is 1.856 Ans +1

Ans 2 (iii) $10x+2y+z=9$.

$-2x+3y+10z=22$

$x+10y-z=-22$

In each of the equ^{n}s. One of the coefficient is larger than the other, satisfying the condition for Gauss-Seidel method, we write the equ^{n}s. in the following form +1

$$\left.\begin{aligned} x &= \frac{1}{10}\left[9-2y-z\right] \\ y &= \frac{1}{10}\left[-22-x+z\right] \\ z &= \frac{1}{10}\left[22+2x-3y\right] \end{aligned}\right\} \text{—①}$$

No. | Marks

We start with $y = z = 0$.

I iteration

$$x^{(1)} = 0.9$$

$$y^{(1)} = \frac{1}{10}(-22 - x^{(1)}) = -2.29$$

~~$z^{(1)} = 3.067$~~

$$z^{(1)} = \frac{1}{10}(22 + 2x^{(1)} - 3y^{(1)}) = 3.067$$

+1

II iteration

$$x^{(2)} = \frac{1}{10}[9 - 2y^{(1)} - z^{(1)}] = 1.0513$$

$$y^{(2)} = \frac{1}{10}[-22 - x^{(2)} + z^{(1)}] = -1.9984$$

+1

$$z^{(2)} = \frac{1}{10}[22 + 2x^{(2)} - 3y^{(2)}] = 3$$

Third iteration

$$x^{(3)} = \frac{1}{10}[9 - 2y^{(2)} - z^{(2)}] = 0.99968$$

$$y^{(3)} = \frac{1}{10}[-22 - x^{(3)} + z^{(2)}] = -1.9999$$

$$z^{(3)} = \frac{1}{10}[22 + 2x^{(3)} - 3y^{(3)}] = 2.999$$

+1

IV iteration

$$x^{(4)} = \frac{1}{10}[9 - 2y^{(3)} - z^{(3)}] = 1$$

$$y^{(4)} = \frac{1}{10}[-22 - x^{(4)} + z^{(3)}] = -2$$

$$z^{(4)} = \frac{1}{10}[22 + 2x^{(4)} - 3y^{(4)}] = 3$$

No. | Marks

V iteration

$$x^{(5)} = \frac{1}{10}[9-2(-2)-3] = 1$$

$$y^{(5)} = \frac{1}{10}[-22-1+3] = -2$$

$$z^{(5)} = \frac{1}{10}[22+2(1)-3(-2)] = 3.$$ +1

∴ The required solution is

$$x=1,\ y=-2,\ z=3$$

Ans

Q.3 Attempt any two:-

Ans 3(i) The divided difference table is

x	$y=f(x)$	$\Delta f(x)$	$\Delta^2 f x$	$\Delta^3 f(x)$	$\Delta^4 f(x)$
$x_0=4$	$y_0=48$	$\frac{100-48}{5-4}=52$	$\frac{97-52}{7-4}=15$	$\frac{21-15}{10-4}=1$	
					$\frac{1-1}{11-4}=0$
$x_1=5$	$y_1=100$	$\frac{294-100}{7-5}=97$	$\frac{202-97}{10-5}=21$	$\frac{27-21}{11-5}=1$	
$x_2=7$	$y_2=294$	$\frac{900-294}{10-7}=202$	$\frac{310-202}{11-7}=27$	$\frac{32-27}{13-7}=1$	$\frac{1-1}{13-5}=0$
$x_3=10$	$y_3=900$	$\frac{1210-900}{11-10}=310$	$\frac{409-310}{13-10}=33$		
$x_4=11$	$y_4=1210$	$\frac{2028-1210}{13-11}=409$			
$x_5=13$	$y_5=2028$				

+2

No. | Marks

$\therefore$ Newton's divided difference formula is given by

$$f(x) = f(x_0) + (x - x_0)\Delta f(x_0) + (x - x_0)(x - x_1)\Delta^2 f(x_0) + \cdots \quad \text{--- (1)}$$

+1

(i) at $x = 8$, equ (1) becomes.

$$f(8) = 48 + (8-4)(52) + (8-4)(8-5)(15) + (8-4)(8-5)(8-7)(1) + 0.$$

$$f(8) = 48 + 208 + 180 + 12$$

$$\underline{f(8) = 448}$$ +1

(ii) at $x = 9$, then (1) becomes

$$f(9) = 48 + (9-4)(52) + (9-4)(9-5)15 + (9-4)(9-5)(9-7)(1) + 0$$

$$f(9) = 48 + 260 + 300 + 40$$

$$\underline{f(9) = 648}$$ +1

(iii) at $x = 15$, then (1) becomes

$$f(15) = 48 + (15-4)52 + (15-4)(15-5)(15) + (15-4)(15-5)(15-7)(1) + 0$$

$$f(15) = 48 + 572 + 1650 + 880$$ +1

$$\underline{f(15) = 3150}$$

No. Ans 3 (ii) The forward difference table. Marks

Year	Sale(y)	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$	$\Delta^5 y$
1931	12	3	2	0	3	−10
1941	15	5	2	3	−7	
1951	20	7	5	−4		
1961	27	12	1			
1971	39	13				
1981	52					

+2

Here, the given interval is equal and

$h = 10$

Newton-Forward Interpolation is given by

$$y_x = f(x) = y_0 + \frac{u}{\lfloor 1}\Delta y_0 + \frac{u(u-1)}{\lfloor 2}\Delta^2 y_0 + \cdots$$ +1

Where $u = \frac{x - x_0}{h}$

At, $x = 1966$, taking $x_0 = 1931$, $h = 10$.

$$u = \frac{1966 - 1931}{10} = \underline{3.5}$$ +1

$$y_{1966} = f(1966) = 12 + (3.5)\times 3 + \frac{(3.5)(2.5)}{\lfloor 2}\times 2$$

$$+ \frac{(3.5)(2.5)(1.5)}{\lfloor 3}\times 0 + \frac{(3.5)(2.5)(1.5)(.5)}{\lfloor 4}\times 3$$

$$+ \frac{(3.5)(2.5)(1.5)(.5)(-.5)}{\lfloor 5}\times(-10)$$

$$y_{1966} = 12 + 10.5 + 8.75 + 0.6203 + 0.2734$$ +1

$$\boxed{y_{1966} = 32.34 \text{ thousands}}$$

No. Ans Q3 (iii) | Marks

Lagrange's interpolation formula is given by

$$f(x) = \frac{(x-x_1)(x-x_2)(x-x_3)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)} \cdot f(x_0) + \frac{(x-x_0)(x-x_2)(x-x_3)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)} \times f(x_1) + \frac{(x-x_0)(x-x_1)(x-x_3)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)} \times f(x_2) + \frac{(x-x_0)(x-x_1)(x-x_2)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)} \times f(x_3) \quad \text{--- (1)}$$

+2

x	5 x_0	6 x_1	9 x_2	11 x_3
$f(x)$	12 y_0	13 y_1	14 y_2	16 y_3

$x = 10$

Putting these values in (1), we get

$$f(10) = \frac{(10-6)(10-9)(10-11)}{(5-6)(5-9)(5-11)} \times 12 + \frac{(10-5)(10-9)(10-11)}{(6-5)(6-9)(6-11)} \times 13$$

+1

$$+ \frac{(10-5)(10-6)(10-11)}{(9-5)(9-6)(9-11)} \times 14 + \frac{(10-5)(10-6)(10-9)}{(11-5)(11-6)(11-9)} \times 16$$

$$= 2 - \frac{13}{3} + \frac{35}{3} + \frac{16}{3}$$

+1

$$\boxed{f(10) = 14\frac{2}{3} = 14.666} \text{ Ans}$$

+1

No. **Q.4 Attempt any two! -** Marks

Ans 4 (i) $\int_{4}^{5.2} \log_e x \, dx$

Suppose we divide the interval $(4, 5.2)$ into 6 equal parts by taking
$h = \frac{5.2-4}{6} = 0.2$. +1

Now, the values of given fun^n $y = \log_e x$ are as follows:-

x	$y = \log_e x$
$x_0 = 4$	$y_0 = 1.3862944$
$x_1 = 4.2$	$y_1 = 1.4350845$
$x_2 = 4.4$	$y_2 = 1.4816045$
$x_3 = 4.6$	$y_3 = 1.5260563$
$x_4 = 4.8$	$y_4 = 1.5686159$
$x_5 = 5.0$	$y_5 = 1.6094379$
$x_6 = 5.2$	$y_6 = 1.6486586$

+1

(1) Simpson's $\frac{1}{3}$ rule, for $n = 6$.

$$\int_{x_0}^{x_6} y \, dx = \frac{h}{3}\left[(y_0+y_6) + 4(y_1+y_3+y_5) + 2(y_2+y_4)\right]$$ +1

$$\therefore \int_{4}^{5.2} \log_e x \, dx = \frac{0.2}{3}\left[27.417706\right]$$

$$= 1.8278 \text{ Ans}$$ +1/2

No. Marks

(ii) Weddle's Rule

$$\int_{x_0}^{x_6} y\,dx = \frac{3h}{10}\left[y_0 + 5y_1 + y_2 + 6y_3 + y_4 + 5y_5 + y_6\right]$$ +1

$\cancel{\int_4^{5.2} \log_e x\,dx =}$

$$\int_4^{5.2} \log_e x\,dx = 1.827847 \text{ Ans}$$ +½

Ans 4 (ii) $\frac{dy}{dx} = x + y^2$

Here, $f(x,y) = x + y^2$, $x_0 = 0$, $y_0 = 1$, taking $h = 0.1$

Then $x_1 = x_0 + h = 0.1$, and $x_2 = x_0 + 2h = 0.2$ +1

Step 1:- Starting from (x_0, y_0)

$K_1 = h f(x_0, y_0) = 0.1\, f(0,1) = \boxed{0.1}$

$K_2 = h f\left(x_0 + \frac{h}{2}, y_0 + \frac{K_1}{2}\right) = (0.1)\, f(0.05, 1.05)$

$\boxed{K_2 = 0.115525}$

$K_3 = h f\left(x_0 + \frac{h}{2}, y_0 + \frac{K_2}{2}\right) = (0.1)\, f(0.05, 1.057625)$

$\boxed{K_3 = 0.11686}$

$K_4 = h f(x_0 + h, y_0 + K_3) = (0.1)\, f(0.1, 1.11686)$

$K_4 = 0.1347$

No. | Marks

$\cancel{y_1 = y_0 + k}$ $K = \frac{1}{6}[K_1 + 2K_2 + 2K_3 + K_4]$

$K = 0.1165$

Hence,

$y_1 = y_0 + K$

$\boxed{y(0.1) = 1.1165}$ +2

Step 2:-

Starting (x_1, y_1), here

$x_1 = 0.1$, $y_1 = 1.1165$, $h = 0.1$

$K_1 = hf(x_1, y_1) = 0.13466$.

$K_2 = hf\left(x_1 + \frac{h}{2}, y_1 + \frac{K_1}{2}\right) = 0.15514$

$K_3 = hf\left(x_1 + \frac{h}{2}, y_1 + \frac{K_2}{2}\right) = 0.15758$

$K_4 = hf(x_1 + h, y_1 + K_3) = 0.18233$

$K = \frac{1}{6}[K_1 + 2K_2 + 2K_3 + K_4]$.

$K = 0.1571$

$y_2 = y_1 + K$ +2

$\boxed{y(0.2) = 1.2736}$

No. Ans 4 (iii) | Marks

Given $\frac{dy}{dx} = 2y + 3e^x$, $x_0 = 0$, $y_0 = 0$

$y' = 2y + 3e^x \qquad y_0' = 3$

$y'' = 2y' + 3e^x \qquad y_0'' = 9$

$y''' = 2y'' + 3e^x \qquad y_0''' = 21$ +2

$y^{iv} = 2y''' + 3e^x \qquad y_0^{iv} = 45$

Taylor's series is given by

$y(x) = y_0 + (x - x_0)y_0' + \frac{(x - x_0)^2}{\underline{|2}} y_0'' + \cdots$ +1

$y(x) = 3x + \frac{9x^2}{2} + \frac{7x^3}{2} + \frac{15x^4}{8} + \cdots$ +1

when $x = 0.2$ then

$y(0.2) = 3(0.2) + \frac{9(0.2)^2}{2} + \frac{7(0.2)^3}{2} + \frac{15(0.2)^4}{8} + \cdots$

$y(0.2) = 0.6 + 0.18 + 0.028 + 0.003$

$\boxed{y(0.2) = 0.8110}$ Ans. +1

No. | Marks

Ans 5 (i)

$X=x$	0	1	2	3
$p(x)$	0	$1/5$	$2/5$	$2/5$

we know that distributive fun^n

$$F(x) = P(X \le x) = \sum_{x_i \le x} p_i$$ +1

$$F(0) = P(X \le 0) = p(0) = 0$$ +1

$$F(1) = P(X \le 1) = p(0) + p(1) = \frac{1}{5}$$ +1

$$F(2) = P(X \le 2) = 0 + \frac{1}{5} + \frac{2}{5} = \frac{3}{5}$$ +1

$$F(3) = P(X \le 3) = 0 + \frac{1}{5} + \frac{2}{5} + \frac{2}{5} = 1$$ +1

Ans 5 (ii) Given.

the prob. of entering Student in Chartered accountant will graduate is

$$p = 0.5, \; q = 0.5, \; n = 10.$$ +1

Binomial Distribution is given by

$$P(r) = {}^nC_r \, q^{n-r} \, p^r$$ +1

(i) none

$$P(r=0) = {}^{10}C_0 (0.5)^{10-0} (0.5)^0$$ +1

$$P(r=0) = 0.000976 = \left(\frac{1}{2^{10}}\right)$$ +1/2

No. | | Marks

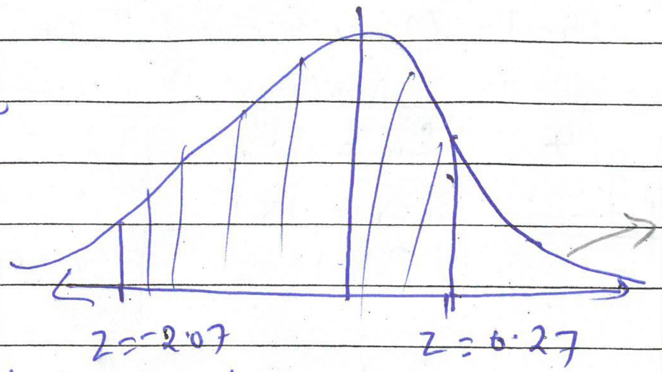
(ii) atleast one will graduate

$= P(r \geq 1)$ +1

$= 1 - [P(r=0)]$

$= 1 - \frac{1}{2^{10}} = \underline{\underline{0.99}}$ Ans +1/2

Ans 5 (iii)



No. of Students = 500,

$N = 500$,

Mean $(\mu) = 151$ cm

$\sigma = 15$ cm +1

By Standard Normal Variate

$$Z = \frac{x - \mu}{\sigma}$$ +1

when $x = 120$ cm

$$z = \frac{120 - 151}{15} = \frac{-31}{15} = \underline{-2.07}$$ +1/2

when $x = 155$ cm

$$z = \frac{155 - 151}{15} = \frac{4}{15} = 0.27$$ +1/2

$\therefore P(120 < x < 155) = P(-2.07 < z < 0.27)$ +1

$= P(-2.07 \leq z \leq 0) + P(0 \leq z \leq 0.27)$

$= P(0 \leq z \leq 2.07) + P(0 \leq z \leq 0.27)$ +1

$= 0.4808 + 0.1085$

$= \underline{\underline{0.5892}}$

No. | Marks

Ans 6 (i)

Step 1 :- Null Hypothesis (H_0) –
The colour of the son's eyes is not associated with the colour of father's eyes. +1

Step 2 :- Calculation of expected frequencies
Observed frequencies f_o are

	Not light	light	Total
Not light	$f_{o11} = 230$	$f_{o12} = 148$	378
Light	$f_{o21} = 151$	$f_{o22} = 471$	622
	381	619	$N = 1000$

The expected frequencies will be

	Not light	light
Not light	$f_{e11} = \frac{378 \times 381}{1000} = 144$	234
Light	237	385

+1

Step 3 :- Calculation of χ^2-statistic

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$ +1

+1

$$\chi^2 = 51.36 + 31.61 + 31.21 + 19.21$$

$$\boxed{\chi^2 = 133.29}$$ +1

No. | Marks

and d.o.f

$v = (m-1)(n-1) = 1$

Step 4 The calculated value of χ^2 at 5% level of significance and for 1 dof is 3.841

Step 5:- Decision

Calculated value > tabulated value

$\Rightarrow$ Null hypothesis is rejected.

$\Rightarrow$ there is an association betn the colours of eyes of son's and colours of eyes of father's. +1

Ans 6 (ii) Given that

$n_1 = 10, n_2 = 12$

d.o.f $v_1 = n_1 - 1 = 9, \quad v_2 = n_2 - 1 = 11$ $+\frac{1}{2}$

Step 1:- Null hypothesis (H_0)

Let $\sigma_1^2 = \sigma_2^2$, $+\frac{1}{2}$

ie the two samples have the same variance.

Step 2:- Calculation of F-statistics

we have to find S_1^2 & S_2^2

No. | Marks

Sample X

x	$x-\bar{x}$	$(x-\bar{x})^2$
20	-2	4
16	-6	36
26	4	16
27	5	25
23	1	1
22	0	0
18	-4	16
24	2	4
25	3	9
19	-3	9
$\Sigma x =$ 220	0	120

Sample Y

y	$(y-\bar{y})$	$(y-\bar{y})^2$
27	-8	64
33	-2	4
42	7	49
35	0	0
32	-3	9
34	-1	1
38	3	9
28	-7	49
41	6	36
43	8	64
30	-5	25
37	2	4
$\Sigma y = 420$	0	314

+2

Here,

$n_1 = 10$

$\bar{x} = \frac{\Sigma x}{n_1} = \frac{220}{10} = 22,$

$n_2 = 12$

$\bar{y} = \frac{\Sigma y}{n_2} = \frac{420}{12} = 35$

+1

$\therefore s_1^2 = \frac{\Sigma(x-\bar{x})^2}{n_1 - 1} = 13.3$

$\therefore s_1^2 = \frac{\Sigma(y-\bar{y})^2}{n_2 - 1} = 28.5$

Hence, $F = \frac{s_2^2}{s_1^2} = 2.14.$

Step 3 tabulated Value is 3.112

Step 4. Decision.

Calculated value < tabulated Value. +1

$\Rightarrow$ Null hypothesis Ho is accepted.

$\Rightarrow$ two samples have the same variance.

No.		Marks

Ans 6 (iii) Given $n = 10$ (Small Samples)

mean $(\mu) = 64$, variance is not known.

d.o.f $= n-1 = 10-1 = 9$ +1/2

~~Step1:- Null hypothesis~~
~~There is no difference bet. the mean~~
~~height of Sample and~~

Step1:- Null hypothesis
The average height is equal to
64 inches.   +1/2

Step2:- Calculation of t- Statistic

$$t = \frac{\bar{x} - \mu}{S}\sqrt{n}.$$ +1/2

where, $S^2 = \frac{\sum(x-\bar{x})^2}{n-1}$, $\bar{x} = \frac{\sum x}{n} = \frac{660}{10} = 66$ +1

x	$x - \bar{x}$ $(x-66)$	$(x-\bar{x})^2$
70	4	16
67	1	1
62	−4	16
68	2	4
61	−5	25
68	2	4
70	4	16
64	−2	4
64	−2	4
66	0	0
$\sum x = 660$		90

+1

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Marks

40.

$$s^2 = \frac{90}{9} = \underline{\underline{10}} \Rightarrow s = \sqrt{10}.$$

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

$$t = \frac{66 - 64}{\sqrt{10}} \sqrt{10}$$

$$\boxed{t = 2}$$ +1

$d.o.f = v = n - 1 = \underline{9}$

Step3 tabulated value ~~is 0.05~~
$P(t > 1.83) = 0.05$

Step4 $\because$ Calculated value > tabulated value

$\therefore$ Null hypothesis is rejected +1

i.e. the average height is not equal to 64 inches.