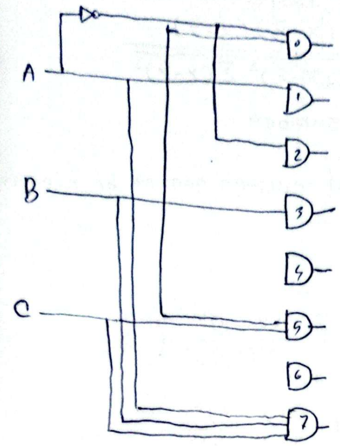
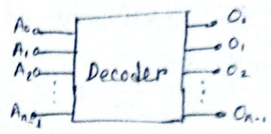
24/11/24 | D.S.D

Decoder

A decoder is a logic circuit that accepts a set of input that represents a binary number and activates only the output that corresponds to that input number.





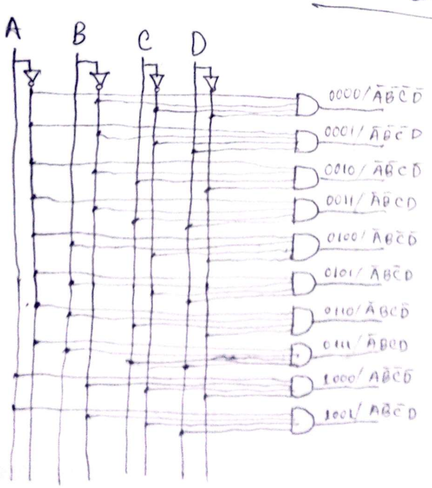
C	B	A	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0
0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	1	0	0	0	0	0	0	1	0	0
0	1	1	0	0	0	0	1	0	0	0
1	0	0	0	0	0	1	0	0	0	0
1	0	1	0	0	1	0	0	0	0	0
1	1	0	0	1	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0

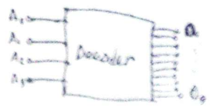
MSI Logic Ckt

MSI (Medium Scale Integration) Logic ckt is a circuit that have number of logic gate (12-99) that's called Medium scale int. log. ckt.

26/11/24

BCD to Decimal Decoder (4x10 line decoder)





D	C	B	A	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9

(7,5)

0111   0101

$\bar{A}BCD$ $\bar{A}B\bar{C}D$

24/11/24/ Statistics

CSE 22 4(b), CSE 18 5(b)

[Q] Show that the limit of correlation coefficient is -1 to 1.

[Proof] Let, the two variable x and y having n pairs of observations $(x_1, y_1), (x_2, y_2), \ldots (x_n, y_n)$ with their respective mean $\bar{x}$ and $\bar{y}$.

$\therefore$ the coefficient of correlation, $r = \dfrac{\Sigma(x-\bar{x})(y-\bar{y})}{\sqrt{\Sigma(x-\bar{x})^2 \, \Sigma(y-\bar{y})^2}}$

let, $\left(\dfrac{(x-\bar{x})}{\sqrt{\Sigma(x-\bar{x})^2}} \pm \dfrac{(y-\bar{y})}{\sqrt{\Sigma(y-\bar{y})^2}}\right)$ is a real number

we know, the sum of square of any real number cannot be negative

$$\therefore \Sigma\left\{\frac{(x-\bar{x})}{\sqrt{\Sigma(x-\bar{x})^2}} \pm \frac{(y-\bar{y})}{\sqrt{\Sigma(y-\bar{y})^2}}\right\}^2 \geq 0$$

$$\Rightarrow \Sigma\left\{\frac{(x-\bar{x})^2}{\Sigma(x-\bar{x})^2} \pm 2\frac{(x-\bar{x})}{\sqrt{\Sigma(x-\bar{x})^2}}\frac{(y-\bar{y})}{\sqrt{\Sigma(y-\bar{y})^2}} + \frac{(y-\bar{y})^2}{\Sigma(y-\bar{y})^2}\right\} \geq 0$$

$$\Rightarrow \frac{\Sigma(x-\bar{x})^2}{\Sigma(x-\bar{x})^2} \pm 2\frac{\Sigma(x-\bar{x})(y-\bar{y})}{\sqrt{\Sigma(x-\bar{x})^2\,\Sigma(y-\bar{y})^2}} + \frac{\Sigma(y-\bar{y})^2}{\Sigma(y-\bar{y})^2} \geq 0$$

$$\Rightarrow 1 \pm 2r + 1 \geq 0$$

$$\Rightarrow 2 \pm 2r \geq 0$$

$$\Rightarrow 2(1 \pm r) \geq 0$$

$$\Rightarrow 1 \pm r \geq 0 \quad \text{--- (i)}$$

taking +ve sign we get,

$1 + r \geq 0$

$r \geq -1$

$\therefore -1 \leq r$ --- (ii)

Taking −ve sign we get,

$1 - r \geq 0$

$r \geq 1$

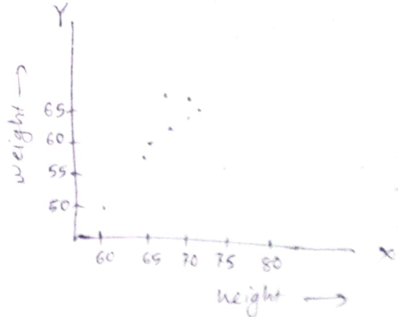
$\therefore r \leq 1$ --- (iii)

CSE 21 5(b)

Let us consider,

height (inch) = x

weight (kg) = y



$\therefore$ x and y are positively correlated

CSE21
6(c) Karl Pearson's coefficient of correlation

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left\{\sum x^2 - \frac{(\sum x)^2}{n}\right\}\left\{\sum y^2 - \frac{(\sum y)^2}{n}\right\}}}$$

table for calculation

x	y	xy	x^2	y^2
10	8	80	100	64
12	7	84	144	49
21	17	357	441	289
4	2	8	16	9
7	6	42	49	36
$\sum x = 54$	$\sum y = 40$	$\sum xy = 571$	$\sum x^2 = 750$	$\sum y^2 = 442$

$$= \frac{571 - \frac{54 \times 40}{5}}{\sqrt{\left\{750 - \frac{54^2}{5}\right\}\left\{442 - \frac{40^2}{5}\right\}}}$$

$= 0.97$

CSE 19
5(c) The correlation coefficient,

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left\{\sum x^2 - \frac{(\sum x)^2}{n}\right\}\left\{\sum y^2 - \frac{(\sum y)^2}{n}\right\}}}$$

Given, $\sum x = 56$, $\sum y = 40$, $\sum x^2 = 524$, $\sum y^2 = 256$, $\sum xy = 368$, $n = 8$

24/11/24 | Linear Algebra

(25) L.H.S. $= \begin{vmatrix} -1 & b & c & d \\ a & -1 & c & d \\ a & b & -1 & d \\ a & b & c & -1 \end{vmatrix}$ $\quad R_2' = R_2 - R_1,\ R_3' = R_3 - R_1,\ R_4' = R_4 - R_1$

$$= \begin{vmatrix} -1 & b & c & d \\ a+1 & -(b+1) & 0 & 0 \\ a+1 & 0 & -(c+1) & 0 \\ a+1 & 0 & 0 & -(d+1) \end{vmatrix}$$

$$= (a+1)(b+1)(c+1)(d+1) \begin{vmatrix} \frac{-1}{a+1} & \frac{b}{b+1} & \frac{c}{c+1} & \frac{d}{d+1} \\ 1 & -1 & 0 & 0 \\ 1 & 0 & -1 & 0 \\ 1 & 0 & 0 & -1 \end{vmatrix}$$

$$= (a+1)(b+1)(c+1)(d+1) \left\{ \frac{-1}{a+1} \begin{vmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{vmatrix} - \frac{b}{b+1} \begin{vmatrix} 1 & 0 & 0 \\ 1 & -1 & 0 \\ 1 & 0 & -1 \end{vmatrix} + \frac{c}{c+1} \begin{vmatrix} 1 & -1 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & -1 \end{vmatrix} - \frac{d}{d+1} \begin{vmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ 1 & 0 & 0 \end{vmatrix} \right.$$

$$= (a+1)(b+1)(c+1)(d+1) \left\{ \frac{1}{a+1} - \frac{b}{b+1} - \frac{c}{c+1} - \frac{d}{d+1} \right\}$$

$$= (a+1)(b+1)(c+1)(d+1) \left(\frac{a+1-a}{a+1} - \frac{b}{b+1} - \frac{c}{c+1} - \frac{d}{d+1} \right)$$

$$= (a+1)(b+1)(c+1)(d+1) \left(1 - \frac{a}{a+1} - \frac{b}{b+1} - \frac{c}{c+1} - \frac{d}{d+1} \right) =$$

(26) L.H.S $= \begin{vmatrix} a+b+c & a+b & a & a \\ a+b & a+b+c & a & a \\ a & a & a+b+c & a+b \\ a & a & a+b & a+b+c \end{vmatrix}$ $\quad C_1' = C_1 - C_2,\ C_2' = C_2 - C_3,\ C_3' = C_3 - C_4$

$$= \begin{vmatrix} c & b & 0 & a \\ -c & b+c & 0 & a \\ 0 & -(b+c) & c & a+b \\ 0 & -b & -c & a+b+c \end{vmatrix}$$

$$= c \begin{vmatrix} b+c & 0 & a \\ -(b+c) & c & a+b \\ -b & -c & a+b+c \end{vmatrix} + c \begin{vmatrix} b & 0 & a \\ -(b+c) & c & a+b \\ -b & -c & a+b+c \end{vmatrix}$$

$[R_2' = R_2 + R_3]$ $\qquad [R_2' = R_2 + R_3]$

$$= c \begin{vmatrix} b+c & 0 & a \\ -(2b+c) & 0 & 2a+2b+c \\ -b & -c & a+b+c \end{vmatrix} + c \begin{vmatrix} b & 0 & a \\ -(2b+c) & 0 & 2a+2b+c \\ -b & -c & a+b+c \end{vmatrix}$$

$$= c^2 \begin{vmatrix} b+c & a \\ -(2b+c) & 2a+2b+c \end{vmatrix} + c^2 \begin{vmatrix} b & a \\ -(2b+c) & 2a+2b+c \end{vmatrix}$$

$$= c^2 \{(b+c)(2a+2b+c) + a(2b+c)\} + c^2 \{b(2a+2b+c) + a(2b+c)\}$$

$$= c^2 \{(b+c)(2b+c) + (b+c)2a + a(2b+c) + b(2b+c) + 2ab + a(2b+c)$$

$$= c^2 \{(b+c)(2b+c) + 2a(2b+c) + a(2b+c) + b(2b+c) + a(2b+c)\}$$

$$= c^2 (2b+c)(b+c+2a+a+b+a)$$

$$= c^2 (4a+2b+c)(2b+c)$$

25/11/24 - DM

4.6 Let $A=\{1,2,3\}$ and $B=\{2,2,3,4\}$ The relation $R_1=\{(1,1),(2,2),(3,3)\}$ and $R_2=\{(1,1),(1,2),(1,3),(1,4)\}$ what is the combining relation $R_1 \cup R_2$, $R_1 \cap R_2$, $R_1 - R_2$ and $R_2 - R_1$.

Soln | $\therefore R_1 \cup R_2 = \{(1,1),(2,2),(3,3)\} \cup \{(1,1),(1,2),(1,3),(1,4)\}$
$= \{(1,1),(1,2),(1,3),(1,4),(2,2),(3,3)\}$

$\therefore R_1 \cap R_2 = \{(1,1),(2,2),(3,3)\} \cap \{(1,1),(1,2),(1,3),(1,4)\}$
$= \{(1,1)\}$

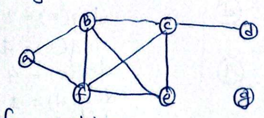
$\therefore R_1 - R_2 = \{(1,1),(2,2),(3,3)\} - \{(1,1),(1,2),(1,3),(1,4)\}$
$= \{(2,2),(3,3)\}$

$\therefore R_2 - R_1 = \{(1,1),(1,2),(1,3),(1,4)\} - \{(1,1),(2,2),(3,3)\}$
$= \{(1,2),(1,3),(1,4)\}$

※ $R_1=\{(1,1),(1,2),(2,2),(2,3),(3,3)\}$ & $R_2=\{(1,1),(2,2),(3,3),(4,4),(2,4)\}$
$\therefore R_1 \cup R_2 = \{(1,1),(1,2),(2,2),(2,3),(3,3)\} \cup \{(1,1),(2,2),(3,3),(4,4),(2,4)\}$
$= \{(1,1),(1,2),(2,2),(2,3),(2,4)$

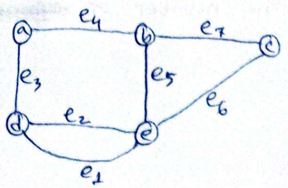
Graph

Graph: A simple graph $G=(V,E)$ consists of V, a non-empty set of vertices, and E, a set of unordered pairs of distinct elements of V called edges.

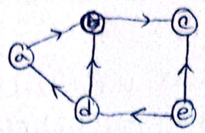


Here, set of vertices, $V=\{a,b,c,d,e,f,g\}$
set of edges, $E=\{(a,b),(a,f),(b,f),(b,c),(b,e),(c,d),(c,e),(c,f),(e,f)\}$

Multigraph: A multigraph $G=(V,E)$ two or more edges may connected the same pair of vertices. The edge e_1 and e_2 are called multiple edge if $f(e_1)=f(e_2)$

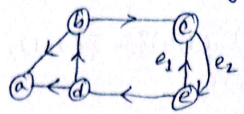


Directed graph: In a directed graph $G=(V,E)$ consists of a set of vertices V and a set of edges E that are ordered pairs of element of V.

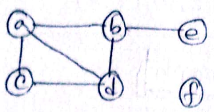


set of edges, $E = \{\{a,b\},\{b,c\},\{d,a\},\{d,b\},\{e,c\},\{e,d\}\}$.

Directed Multigraph: A directed multigraph $G=(V,E)$ consists of a set of vertices V and a set of edge E and the edge are ordered pair of vertices and in addition there may be multiple edges.

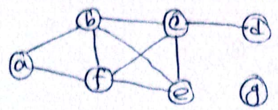


Degree of a vertex: The degree of a vertex in an undirected graph is the number of edges incident with it. Except that a loop at a vertex contributes twice of the degree of that vertex. The degree of vertex v is denoted by $\deg(v)$



$\deg(a) = 3$
$\deg(b) = 3$
$\deg(c) = 2$
$\deg(d) = 3$
$\deg(e) = 1$
$\deg(f) = 0$

Q: What is the degree of the vertices in the graph G



$\deg(a) = 2$
$\deg(b) = 4$
$\deg(c) = 4$
$\deg(d) = 1$
$\deg(e) = 3$
$\deg(f) = 4$
$\deg(g) = 0$

Handshaking theorem: Let $G=(V,E)$ be an an undirected graph G with edges of e, then $\sum_{v \in V} \deg(v) = 2e$

"The sum of the degrees over all the vertices is equal to the twice the number of edges."

$5 \times 4 = 20$
$3 \times 2 = 6$
$2 \times 1 = 2$

26/11/24 – Statistics / Let us consider, Rank by judge I = R_1
" " " II = R_2

2018 / 5(d)

Table for calculation

R_1	R_2	$d=R_1-R_2$	d^2
3	4	-1	1
5	6	-1	1
4	3	1	1
8	9	-1	1
9	10	-1	1
7	7	0	0
1	2	-1	1
2	1	1	1
6	5	1	1
10	8	2	4
			$\Sigma d^2 = 12$

The rank correlation coefficient

$$\rho = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

$$= 1 - \frac{6\times 12}{10(10^2-1)}$$

$$= 0.927$$

2010 / 4(c)
2020 / 5(d)

Table for calculation

x	y	Ranks of x (R_1)	Ranks of y (R_2)	$d=R_1-R_2$	d^2
50	11	9.5	10	-0.5	0.25
50	13	9.5	8	1.5	2.25
55	14	8	7	1	1
60	16	5.5	5	0.5	0.25
65	12	2	9	-7	49
65	19	2	2	0	0
65	20	2	1	1	1
60	15	5.5	6	-0.5	0.25
60	17	5.5	4	1.5	2.25
60	18	5.5	3	2.5	6.25
					$\Sigma d^2 = 62.5$

1, 2, 3: $\frac{1+2+3}{3} = 2$

4, 5, 6, 7: $\frac{4+5+6+7}{4} = 5.5$

∴ The rank correlation coefficient

$$\rho = 1 - \frac{6(\Sigma d^2 + T_x)}{n(n^2-1)}$$

$$= 1 - \frac{6(62.5+7.5)}{10(10^2-1)}$$

$$= 0.575$$

The number 65 repeated 3 times
∴ $m = 3$

$$\therefore T_{x_1} = \frac{m(m^2-1)}{12} = \frac{3(3^2-1)}{12} = 2$$

The num. 60 repeated 4 times
∴ $m = 4$

$$\therefore T_{x_2} = \frac{m(m^2-1)}{12} = \frac{4(4^2-1)}{12} = 5$$

The num. 50 repeated 2 times
∴ $m = 2$

$$\therefore T_{x_3} = \frac{m(m^2-1)}{12} = \frac{2(2^2-1)}{12} = 0.5$$

$$\therefore T_x = T_{x_1} + T_{x_2} + T_{x_3} = 2 + 5 + 0.5 = 7.5$$

2012|5(a)

Table for calculation

x	y	$R_1(x)$	$R_2(y)$	d	d^2
70	12	4	5	-1	1
72	13	3	4	-1	1
75	14	1.5	2	-0.5	0.25
75	14	1.5	2	-0.5	0.25
68	14	5	2	3	9
60	11	6	6	0	0

$\frac{1+2}{2}$

$\frac{1+2+3}{3}$

$\Sigma d^2 = 11.5$

$$\rho = 1 - \frac{6(\Sigma d^2 + T_x + T_y)}{n(n^2-1)}$$

$$= 1 - \frac{6(11.5+0.5+2)}{6(6^2-1)}$$

$$= 0.6$$

75 repeated 2 times

$\therefore m_{R_x} = 2$

$\therefore T_{x_x} = \frac{m(m^2-1)}{12}$

$= \frac{2(2^2-1)}{12}$

$= 0.5$

14 repeated 3 times

$\therefore m_y = 3$

$\therefore T_y = \frac{m(m^2-1)}{12}$

$= \frac{3(3^2-1)}{12}$

$= 2$

■ x: 10 12 21 4 7
y: 8 7 17 2 6

here $n = 5$
$r = ?$

x	y	xy	x^2	y^2
10	8	80	100	64
12	7	84	144	49
21	17	357	441	289
4	2	8	16	4
7	6	42	49	36
$\Sigma x=54$	$\Sigma y=40$	$\Sigma xy = 571$	$\Sigma x^2 = 750$	$\Sigma y^2 = 442$

$$\therefore r = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\sqrt{\left\{\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right\}\left\{\Sigma y^2 - \frac{(\Sigma y)^2}{n}\right\}}}$$

$$= \frac{571 - \frac{54\times 40}{5}}{\sqrt{\left\{750 - \frac{54^2}{5}\right\}\left\{442 - \frac{40^2}{5}\right\}}}$$

$$= 0.974$$

26/11/24 - L.A.

1(i)
$$\left.\begin{aligned} x_1 + 3x_2 + 2x_3 &= 5 \\ 2x_1 + x_2 + 3x_3 &= 1 \\ 3x_1 + 2x_2 + x_3 &= 4 \end{aligned}\right\} \text{(i)}$$

Equation (i) can be written in matrix form

$$Ax = B$$

$$x = A^{-1}B \quad \text{———— (ii)}$$

where $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 1 & 3 \\ 3 & 2 & 1 \end{bmatrix}$, $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$, $B = \begin{bmatrix} 5 \\ 1 \\ 4 \end{bmatrix}$

$$\therefore |A| = \begin{vmatrix} 1 & 3 & 2 \\ 2 & 1 & 3 \\ 3 & 2 & 1 \end{vmatrix} = 1(1-6) - 3(2-9) + 2(4-3) = 18$$

Now we have to find co-factor elements,

$A_{11} = -5$	$A_{21} = 1$	$A_{31} = 7$
$A_{12} = 7$	$A_{22} = -5$	$A_{32} = 1$
$A_{13} = 1$	$A_{23} = 7$	$A_{33} = -5$

$$\therefore \text{cofactor matrix, } M = \begin{bmatrix} -5 & 7 & 1 \\ 1 & -5 & 7 \\ 7 & 1 & -5 \end{bmatrix}$$

$$\therefore \text{adj } A = M^T = \begin{bmatrix} -5 & 1 & 7 \\ 7 & -5 & 1 \\ 1 & 7 & -5 \end{bmatrix}.$$

$$\therefore A^{-1} = \frac{\text{adj } A}{|A|} = \frac{1}{18}\begin{bmatrix} -5 & 1 & 7 \\ 7 & -5 & 1 \\ 1 & 7 & -5 \end{bmatrix}$$

from (ii) we get,

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \frac{1}{18}\begin{bmatrix} -5 & 1 & 7 \\ 7 & -5 & 1 \\ 1 & 7 & -5 \end{bmatrix}\begin{bmatrix} 5 \\ 1 \\ 4 \end{bmatrix}$$

$$= \frac{1}{18}\begin{bmatrix} -25+1+28 \\ 35-5+4 \\ 5+7-20 \end{bmatrix}$$

$$= \frac{1}{18}\begin{bmatrix} 4 \\ 34 \\ -8 \end{bmatrix}$$

$$= \begin{bmatrix} 2/3 \\ 17/9 \\ -4/9 \end{bmatrix}$$

1 (ii)

$$\left.\begin{aligned} x+2y+z&=2\\ 2x-y+2z&=-1\\ 3x-4y-3z&=-16 \end{aligned}\right\} \quad \text{--- (i)}$$

Eq (i) can be written as matrix form

$$Ax = B$$

$$\therefore x = A^{-1}B \quad \text{--- (ii)}$$

where $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & -1 & 2 \\ 3 & -4 & -3 \end{bmatrix}$, $x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$, $B = \begin{bmatrix} 2 \\ -1 \\ -16 \end{bmatrix}$

$\therefore |A| = 1(3+8) - 2(-6-6) + 1(-8+3) = 30$

Now we have to find co-factor elements

$A_{11} = 11$	$A_{21} = 2$	$A_{31} = 5$
$A_{12} = 12$	$A_{22} = -6$	$A_{32} = 0$
$A_{13} = -5$	$A_{23} = 10$	$A_{33} = -5$

$$\therefore M = \begin{bmatrix} 11 & 12 & -5 \\ 2 & -6 & 10 \\ 5 & 0 & -5 \end{bmatrix}$$

$$\therefore \operatorname{adj} A = M^T = \begin{bmatrix} 11 & 2 & 5 \\ 12 & -6 & 0 \\ -5 & 10 & -5 \end{bmatrix}.$$

$$\therefore A^{-1} = \frac{\operatorname{adj} A}{|A|} = \frac{1}{30} \begin{bmatrix} 11 & 2 & 5 \\ 12 & -6 & 0 \\ -5 & 10 & -5 \end{bmatrix}$$

from (ii) we get,

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{30} \begin{bmatrix} 11 & 2 & 5 \\ 12 & -6 & 0 \\ -5 & 10 & -5 \end{bmatrix} \begin{bmatrix} 2 \\ -1 \\ -16 \end{bmatrix}$$

$$= \frac{1}{30} \begin{bmatrix} 22-2-80 \\ 24+6-0 \\ -10-10+80 \end{bmatrix}$$

$$= \frac{1}{30} \begin{bmatrix} -60 \\ 30 \\ 60 \end{bmatrix}$$

$$= \begin{bmatrix} -2 \\ 1 \\ 2 \end{bmatrix}$$

CamScanner

Prove $\rho = 1 - \frac{6\sum d^2}{n(n^2-1)}$

An analysis of co-variation of two qualitative variables is usually called rank correlation.

Proof: Let (x_i, y_i) denote the ranks of the ith individual in x and y respectively. Assuming that the number of the two individuals are awarded the same rank, each of the variables x and y takes the values $1, 2, 3, \ldots, n$.

$$\bar{x} = \bar{y} = \frac{n+1}{2}$$

$$\sigma^2 x = \sigma^2 y = \frac{n^2-1}{12}$$

Let us consider, $d = x - y$

$$\Rightarrow d = x - \bar{x} + \bar{x} - y$$

$$\Rightarrow d = x - \bar{x} + \bar{y} - y \quad [\because \bar{x} = \bar{y}]$$

$$\Rightarrow d = \{(x-\bar{x}) - (y-\bar{y})\}$$

$$\Rightarrow \frac{\sum d^2}{n} = \frac{\sum\{(x-\bar{x}) - (y-\bar{y})\}^2}{n}$$

$$\Rightarrow \frac{\sum d^2}{n} = \frac{\sum(x-\bar{x})^2}{n} - \frac{2\sum(x-\bar{x})(y-\bar{y})}{n} + \frac{\sum(y-\bar{y})^2}{n}$$

$$\Rightarrow \frac{\sum d^2}{n} = \sigma^2 x - 2\operatorname{cov}(xy) + \sigma^2 y$$

$$\Rightarrow \frac{\sum d^2}{n} = \frac{n^2-1}{12} - 2\operatorname{cov}(xy) + \frac{n^2-1}{12}$$

$$\Rightarrow \frac{\sum d^2}{n} = 2\,\frac{n^2-1}{12} - 2\operatorname{cov}(xy)$$

$$\Rightarrow 2\operatorname{cov}(xy) = 2\,\frac{n^2-1}{12} - \frac{\sum d^2}{n}$$

$$\Rightarrow \operatorname{cov}(xy) = \frac{n^2-1}{12} - \frac{\sum d^2}{2n}$$

Now, coefficient of correlation

$$r = \frac{\operatorname{cov}(xy)}{\sigma x\, \sigma y}$$

$$= \frac{\frac{n^2-1}{12} - \frac{\sum d^2}{2n}}{\sqrt{\frac{n^2-1}{12}}\sqrt{\frac{n^2-1}{12}}}$$

$\sigma^2 x = \sigma^2 y = \frac{n^2-1}{12}$

$\therefore \sigma x = \sigma y = \sqrt{\frac{n^2-1}{12}}$

$$= \frac{\frac{n^2-1}{12} - \frac{\sum d^2}{2n}}{\frac{n^2-1}{12}}$$

$$= 1 - \frac{\sum d^2}{2n} \times \frac{12}{n^2-1}$$

$$= 1 - \frac{6\sum d^2}{n(n^2-1)}$$

$\rho = 1 - \frac{6\sum d^2}{n(n^2-1)}$

When rank correlation coefficient follows (simple) correlation coefficient then

01/12/24 - Linear Algebra

③

$$\left.\begin{aligned} x+2y-3z&=0 \\ 2x+5y-2z&=0 \\ 3x-y-4z&=0 \end{aligned}\right\} \quad \begin{aligned} L_2' &= 2L_1 - L_2 \\ L_3' &= 3L_1 - L_3 \end{aligned}$$

$$\left.\begin{aligned} x+2y-3z&=0 \\ -y-4z&=0 \\ 7y-5z&=0 \end{aligned}\right\} \quad L_2' = 7L_2 + L_3$$

$$\left.\begin{aligned} x+2y-3z&=0 \\ -y-4z&=0 \\ -33z&=0 \end{aligned}\right\} \quad \Rightarrow z=0$$

and $-y-0=0$

$y=0$

also $x+0-0=0$

$x=0$

②(i)

$$\left.\begin{aligned} 2x+y-2z&=10 \\ 3x+2y+2z&=1 \\ 5x+4y+3z&=4 \end{aligned}\right\} \quad \begin{aligned} L_2' &= 3L_1 - 2L_2 \\ L_3' &= 5L_1 - 2L_2 \end{aligned}$$

$-6z-4z$

$$\left.\begin{aligned} 2x+y-2z&=10 \\ -y-10z&=28 \\ -3y-16z&=42 \end{aligned}\right\} \quad L_3' = 3L_2 - L_3$$

$5y-8y$

$-10z-6z$

$-30z+16z$

-14

$$\left.\begin{aligned} 2x+y-2z&=10 \\ -y-10z&=28 \\ -14z&=42 \end{aligned}\right\} \quad \Rightarrow z = \frac{42}{-14} = -3$$

and $-y+30=28$

$\Rightarrow y = 30-28 = 2$

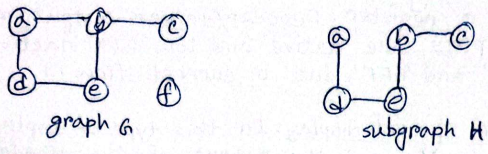
also, $2x+2+6=10$

$\Rightarrow x = \frac{10-2-6}{2}$

$= 1$

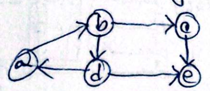
02/12/24 - D.M

Subgraph: A subgraph of a graph $G=(V,E)$ is a graph $H=(W,F)$ where $W \leq V$ and $F \leq E$



In-degree: In a graph with directed edges the in-degree of a vertex v denoted by $deg^-(v)$ is the number of edges with v on their terminal vertex.

Out-degree: The out-degree of a vertex v denoted by $deg^+(v)$ is the number of edges with v on their internal vertex.



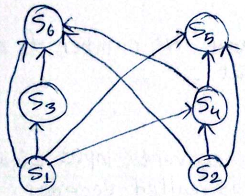
In-degree	out-degree
$deg^-(a)=1$	$deg^+(a)=1$
$deg^-(b)=1$	$deg^+(b)=2$
$deg^-(c)=1$	$deg^+(c)=1$
$deg^-(d)=1$	$deg^+(d)=2$
$deg^-(e)=2$	$deg^+(e)=0$
$\Sigma=6$	$\Sigma=6$

04/12/24

Draw the precendence graph for the following expressions:

S_1: a:=0 S_2: b:=1 S_3: c:=a+1 S_4: d:=b+a S_5: e:=d+1 S_6: e:=c+d

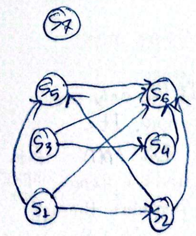
+ and compute degree



$deg^-(S_1)=0$	$deg^+(S_1)=4$
$deg^-(S_2)=0$	$deg^+(S_2)=3$
$deg^-(S_3)=1$	$deg^+(S_3)=1$
$deg^-(S_4)=2$	$deg^+(S_4)=2$
$deg^-(S_5)=3$	$deg^+(S_5)=0$
$deg^-(S_6)=4$	$deg^+(S_6)=0$

Ruff

S_1: a:=0 —
S_2: b:=1 —
S_3: c:=a+1 S_1
S_4: d:=b+a S_1, S_2
S_5: e:=d+1 S_4, S_1, S_2
S_6: e:=c+d S_3, S_4, S_1, S_2



S_1: x:=0 —
S_2: x:=x+1 S_1
S_3: y:=2 —
S_4: z:=y S_3
S_5: x:=x+2 S_1, S_2
S_6: y:=x+z S_1, S_2, S_5, S_4, S_3
S_7: z:=4 —

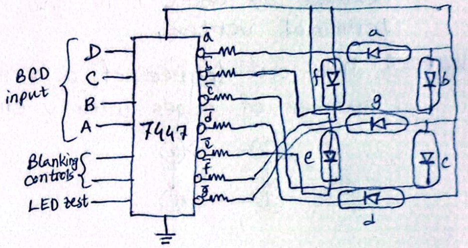
15 17 19 . . 22 24

03/12/24 - D.S.D.

BCD to 7 segment display

Common cathode seven segment display: In this case the cathode of each LED is connected to the ground and other ends are connected to the appropriate pin through a register. Decoder/driver output max is a time when a, b, c, d, e, f, g outputs are active and low are inactive and their associated LED will turn 'ON' and 'OFF' due to current flow.

Common anode seven segment display: In this type of display the anode of each LED is connected to Vcc and the output of the decoder/driver are active-low and perform the opposite function of the common cathode.



Diff. betn encoder & decoder

Encoder →

1. A circuit in which only one receiver is considered active at a time and the code word for the active receiver is generated on the emission line is called encoder.
2. Types of encoder are octal to binary encoder; priority encoder; decimal to BCD
3. An encoder has 'm' number of inputs and 'N' number of outupt ports
4. The number of output is less than input.

Decoder →

1. An electronic or logical circuit that convert input binary number or data into output equivalent decimal number is called decoder
2. Types of decoder are 3 to 8 decoder; decimal decoder; 4 to 16 decoder
3. Decoder has 'N' number of inputs and 'M' number of output ports
4. outputs are more than input.

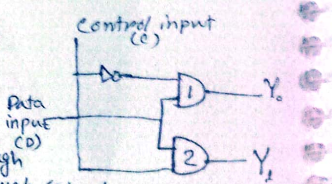
05/12/24

Multiplexer:

Demultiplexer:

Types of multiplexer:

1:2 Demultiplexer: It has only one input but output is two. It's basically consists of two 'AND' gates and a 'NOT' gate. Here the control signal is provided through 'C' and the data input provided through 'D', also output are provided by Y_0, Y_1 when the control input is low zero and data input D is provided both inputs of AND gate 1 are high so that Y_0 is available at the o/p. Again when the control input is high c=1 then Y_1 as both inputs of AND gate both are high. This input data is fed to two output through control signal.



C	o/p
0	Y_0
1	Y_1

03/12/24 - Statistics

The regression equation of y on x is

$y = a + bx$ —(i)   [x = independent variable, a, b = const]

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$a = \bar{y} - b\bar{x}$ $\bar{x} = \frac{\sum x}{n}$, $\bar{y} = \frac{\sum y}{n}$

The regression equation of x on y is

$x = a + by$ —(ii)

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum y^2 - \frac{(\sum y)^2}{n}}$$

$a = \bar{x} - b\bar{y}$

CSE 22, 5(b)

Let, the regression equation of y on x is

$y = a + bx$ —(i)

table for calculation

x	y	xy	x^2	y^2
5	10	50	25	100
4	5	20	16	25
3	3	9	9	9
4	8	32	16	64
5	7	35	25	49
21	33	146	91	247
$\sum x$	$\sum y$	$\sum xy$	$\sum x^2$	$\sum y^2$

computing a and b

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$= \frac{146 - \frac{21 \times 33}{5}}{91 - \frac{21^2}{5}}$$

$= 2.64$

$a = \bar{y} - b\bar{x}$

$= 6.6 - 2.64 \times 4.2$

$= -4.488$

$\bar{x} = \frac{\sum x}{n} = \frac{21}{5} = 4.2$

$\bar{y} = \frac{\sum y}{n} = \frac{33}{5} = 6.6$

from eq (i) we get,

$y = -4.488 + 2.64x$

Ans

RADIANT PHARMACEUTICALS

CSE 21
6(d)
18(b)(i)

Let, the regression equation of y on x is

$$12x - 15y + 99 = 0 \quad \text{--- (i)}$$

the regression equation of x on y is

$$60x - 27y - 321 = 0 \quad \text{--- (ii)}$$

from equation (i) and (ii) we get,

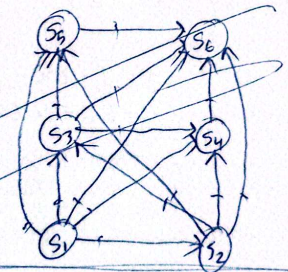
$$12\bar{x} - 15\bar{y} + 99 = 0 \quad \text{--- (iii)}$$
$$60\bar{x} - 27\bar{y} - 321 = 0 \quad \text{--- (iv)}$$

(iii)×5 − (iv) ⇒

$$60\bar{x} - 75\bar{y} + 495 = 0$$
$$\underset{(-)}{60\bar{x}} \underset{(+)}{-} 27\bar{y} \underset{(+)}{-} 321 = 0$$
$$-48\bar{y} + 816 = 0$$
$$\Rightarrow -48\bar{y} = -816$$
$$\Rightarrow \bar{y} = \frac{-816}{-48} = 17$$

Putting the value of $\bar{y}$ in equation (iv)

$$60\bar{x} - 27\times 17 - 321 = 0$$
$$\Rightarrow \bar{x} = \frac{27\times 17 + 321}{60} = 13$$



S_1 : a := 1
S_2 : b := a+2
S_3 : c := b+1
S_4 : d := a+c
S_5 : d := c
S_6 : e := d

S_1
S_2, S_1
S_1, S_3, S_2
S_3, S_2, S_1
S_5, S_4, S_1, S_2, S_3

(ii) From eq (i) we get,

$$15y = 99 + 12x$$
$$\Rightarrow y = \frac{99}{15} + \frac{12}{15}x$$
$$\Rightarrow y = 6.6 + 0.8x$$
$$\therefore b_{yx} = 0.8$$

From eq (ii) we get,

$$60x = 321 + 27y$$
$$\Rightarrow x = \frac{321}{60} + \frac{27}{60}y$$
$$\Rightarrow y = 5.35 + 0.45y$$
$$\therefore b_{xy} = 0.45$$

∴ correlation coefficient, $r = \sqrt{b_{yx}\, b_{xy}} = \sqrt{0.8 \times 0.45} = 0.6$ (Ans)

(iii) we know, $b_{yx} = r \cdot \frac{\sigma_y}{\sigma_x}$

$$\Rightarrow 0.8 = 0.6\, \frac{\sigma_y}{6}$$
$$\Rightarrow \sigma_y = \frac{0.8 \times 6}{0.6}$$
$$\Rightarrow \sigma_y = 8$$

05/12/24 - L.A.

System of linear equation with condition

$x+2y+3z=2$
$4x+5y+6z=4$
$7x+8y+9z=6$

the linear equations can be written in matrix form

$$Ax = B \quad \text{——— (i)}$$

where,

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}, \quad x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad B = \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix}$$

Now the augmented matrix

$$A/B = \left[\begin{array}{ccc|c} 1 & 2 & 3 & 2 \\ 4 & 5 & 6 & 4 \\ 7 & 8 & 9 & 6 \end{array}\right]$$

Reduce it to echelon form

$$\xrightarrow[\substack{R_1 = R_2 \\ R_2' = 4R_1 - R_2 \\ R_3 = 7R_1 - R_3}]{} \left[\begin{array}{ccc|c} 1 & 2 & 3 & 2 \\ 0 & 3 & 6 & 4 \\ 0 & 6 & 12 & 8 \end{array}\right]$$

$$\xrightarrow[\substack{R_1 = R_2 \\ R_2 = R_2 \\ R_3 = 2R_2 - R_3}]{} \left[\begin{array}{ccc|c} 1 & 2 & 3 & 2 \\ 0 & 3 & 6 & 4 \\ 0 & 0 & 0 & 0 \end{array}\right]$$

Here, the rank of coefficient matrix $R(A) = 2$ and the rank of augmented matrix $R(A/B) = 2$. So the given system of linear equation is consistance.

from eq (i) we get,

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 3 & 6 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \\ 0 \end{bmatrix}$$

$\therefore x + 2y + 3z = 2$ ——— (ii)

$3y + 6z = 4$ ——— (iii)

Here the number of variables is 3 and the number of equation is 2. So the system of equation has many solution.

Let, $z = 1$ then from (iii)

$3y + 6 \times 1 = 4$

$\Rightarrow 3y = 4 - 6 = -2$

$\Rightarrow y = -\frac{2}{3}$

from (i) we get,

$x + 2\left(-\frac{2}{3}\right) + 3 = 2$

$\Rightarrow x = 2 - 3 + \frac{4}{3} = \frac{1}{3}$

$\therefore$ Required Solution $(x, y, z) = \left(\frac{1}{3}, -\frac{2}{3}, 1\right)$

RADIANT PHARMACEUTICALS

2019 6(b) The regression coefficient of y on x is

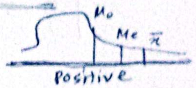
$$b_{yx} = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$= \frac{1364 - \frac{156 \times 140}{18}}{1524 - \frac{(156)^2}{18}}$$

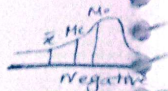
$$= 0.876$$

15/12/24 - Stat.

Symmetrical distribution



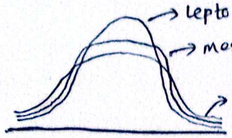
$\bar{x} > M_e > M_o$



$\bar{x} < M_e < M_o$

Skewness (বক্রিমতা): (i) Positive skewness
(ii) Negative skewness

Kurtosis (সূঁচলতা):



→ leptokurtic (অতিসূঁচাল)
→ mesokurtic (মধ্যম সূঁচাল)
→ Platykurtic (অনতিসূঁচাল)

Central moments from Raw moments:

1. $\mu_1 = 0$
2. 2nd central moments, $\mu_2 = \mu_2' - (\mu_1')^2$
3. $\mu_3 = \mu_3' - 3\mu_2'\mu_1' + 2(\mu_1')^3$
4. $\mu_4 = \mu_4' - 4\mu_3'\mu_1' + 6\mu_2'(\mu_1')^2 - 3(\mu_1')^4$

Central moments from data:

rth central moments:

$$\mu_r = \frac{\sum (x - \bar{x})^r}{n}$$

(where, $r = 1, 2, 3, 4$)

Measures of skewness:

$$\sqrt{\beta_1} = \frac{\mu_3}{\sqrt{\mu_2^3}}$$

Measures of kurtosis:

$$\beta_2 = \frac{\mu_4}{\mu_2^2}$$

$\beta_2 = 3$ meso
$\beta_2 > 3$ lepto
$\beta_2 < 3$ platy

19/4(c) Given that,

$a = 5$

$\mu_1' = 2$, $\mu_2' = 20$, $\mu_3' = 40$, $\mu_4' = 50$

1st central moments, $\mu_1 = 0$

2nd central moments, $\mu_2 = \mu_2' - (\mu_1')^2 = 20 - 2^2 = 20 - 4 = 16$

3rd central moments, $\mu_3 = \mu_3' - 3\mu_2'\mu_1' + 2(\mu_1')^3 = 40 - 3\times 20\times 2 + 2\times 2^3 = -64$

4th central moments, $\mu_4 = \mu_4' - 4\mu_3'\mu_1' + 6\mu_2'(\mu_1')^2 - 3(\mu_1')^4 = 50 - 4\times 40\times 2 + 6\times 20\times 2^2 - 3\times 2^4 = 162$

$\sqrt{\beta_1} = \frac{\mu_3}{\sqrt{\mu_2^3}} = \frac{-64}{\sqrt{16^3}} = -1$

$\cancel{\Rightarrow \beta_1 = \frac{\mu_3^2}{\mu_2^3} = \frac{(-64)^2}{(16)^3} = 1}$

∴ the distribution is negatively skewed.

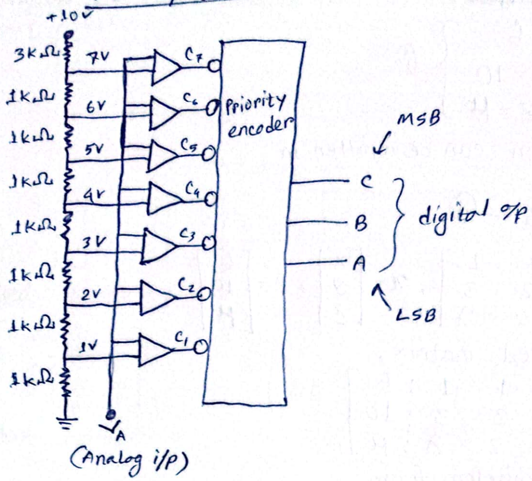
$\beta_2 = \frac{\mu_4}{\mu_2^2} = \frac{162}{(16)^2} = 0.63$

∴ the distribution is platykurtic.

15/12/24 - D.S.D.

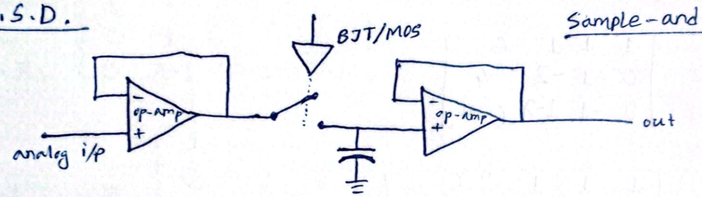
Flash/Parallel ADC

3 bit flash ADC:-

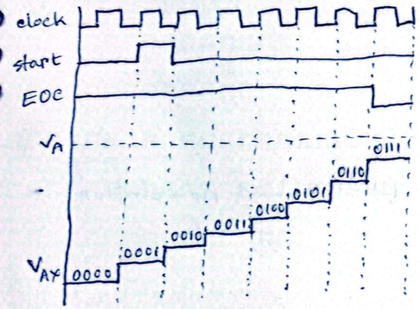


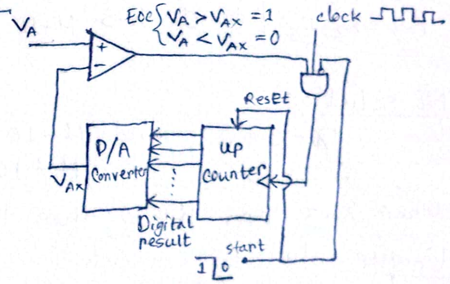
17/12/24 - D.S.D.

Sample-and-hold circuit



19/12/24 - D.S.D: Digital Ramp/ADC type counter





15/12/24 – Lin. Alg.

(2)
$$\left.\begin{aligned} x+y+z&=6 \\ x+2y+3z&=10 \\ x+2y+\lambda z&=\mu \end{aligned}\right\} \text{(i)}$$

The linear equation can be written in matrix form.

$$Ax=B \quad \text{— (ii)}$$

where,

$$A=\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 2 & \lambda \end{bmatrix},\ x=\begin{bmatrix} x \\ y \\ z \end{bmatrix},\ B=\begin{bmatrix} 6 \\ 10 \\ \mu \end{bmatrix}$$

Now, the augmented matrix,

$$A/B = \left[\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 1 & 2 & 3 & 10 \\ 1 & 2 & \lambda & \mu \end{array}\right]$$

Reduce it to echelon form

$$\begin{array}{l} R_1=R_1 \\ R_2=R_1-R_2 \\ R_3=R_1-R_3 \end{array} \left[\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & -1 & -2 & -4 \\ 0 & -1 & 1-\lambda & 6-\mu \end{array}\right]$$

$$\longrightarrow$$

$$\begin{array}{l} R_1=R_1 \\ R_2=R_2 \\ R_3=R_2-R_3 \end{array} \left[\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & -1 & -2 & -4 \\ 0 & 0 & \lambda-3 & \mu-10 \end{array}\right]$$

$$\longrightarrow$$

(i) No solution:

$\lambda-3=0$ and $\mu-10\neq 0$

$\therefore \lambda=3$ " $\mu\neq 10$

when $\lambda=3$ and $\mu\neq 10$ then the system of equation has no-solution

(ii) Unique solution:

$\lambda-3\neq 0$ and $\mu-10\neq 0$

$\therefore \lambda\neq 3$ " $\mu\neq 10$

when $\lambda\neq 3$ and $\mu\neq 10$ then the system of equation has unique solution

(iii) Many solution:

$\lambda-3=0$ and $\mu-10=0$

$\therefore \lambda=3$ " $\mu=10$

when $\lambda=3$ and $\mu=10$ then the system of equation has many solution.

④ $$\left.\begin{aligned} x+y+4z&=1\\ x+2y-2z&=1\\ \lambda x+y+z&=1 \end{aligned}\right\} \text{(i)}$$

The linear equation can be written in matrix form,

$$Ax = B \text{ —— (ii)}$$

where,

$$A=\begin{bmatrix}1 & 1 & 4\\ 1 & 2 & -2\\ \lambda & 1 & 1\end{bmatrix},\ X=\begin{bmatrix}x\\ y\\ z\end{bmatrix},\ B=\begin{bmatrix}1\\ 1\\ 1\end{bmatrix}$$

Now the augmented matrix,

$$A/B = \left[\begin{array}{ccc:c}1 & 1 & 4 & 1\\ 1 & 2 & -2 & 1\\ \lambda & 1 & 1 & 1\end{array}\right]$$

Reduce it to echelon form

$$\begin{aligned} R_1&=R_1\\ R_2&=R_1-R_2\\ R_3&=\lambda R_1-R_3 \end{aligned} \longrightarrow \left[\begin{array}{ccc:c}1 & 1 & 4 & 1\\ 0 & -1 & 6 & 0\\ 0 & \lambda-1 & 4\lambda-1 & \lambda-1\end{array}\right]$$

$$\begin{aligned} R_1&=R_1\\ R_2&=R_2\\ R_3&=(\lambda-1)R_2+R_3 \end{aligned} \longrightarrow \left[\begin{array}{ccc:c}1 & 1 & 4 & 1\\ 0 & -1 & 6 & 0\\ 0 & 0 & 10\lambda-7 & \lambda-1\end{array}\right]$$

(i) No solution:

$10\lambda-7=0$ and $\lambda-1\neq 0$

$\therefore \lambda=\frac{7}{10}$ " $\therefore \lambda\neq 1$

(ii) unique solution:

$10\lambda-7\neq 0$ and $\lambda-1\neq 0$

$\therefore \lambda\neq\frac{7}{10}$ " $\therefore \lambda\neq 1$

(iii) Many solution:

$10\lambda-7=0$ and $\lambda-1=0$

$\therefore \lambda=\frac{7}{10}$ $\therefore \lambda=1$

there is no common value of λ. so the system of eq has no many solution

RADIANT PHARMACEUTICALS

CamScanner

17/12/24 - S&P

Chi-square test (χ^2 test): The quantity describe the magnitude of the difference between the observed set of observations and expected set of observations under an appropriate null hypothesis.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

O = Observed frequency
E = Expected frequency

19
6(c) Let us consider the null hypothesis there is no relation between skilled fathers and skilled boys.

Table for calculation

		Boys		Total
		Intelligent	Un-intelligent	
Father	Skilled	40 E_{11}	30 E_{12}	$70 = R_1$
	Unskilled	70 E_{21}	54 E_{22}	$124 = R_2$
Total		110 (C_1)	84 (C_2)	N=194

The expected frequencies computed are as follows,

$$E_{11} = \frac{R_1 \times C_1}{N} = \frac{70 \times 110}{194} = 39.69 \qquad E_{12} = \frac{R_1 \times C_2}{N} = \frac{70 \times 84}{194} = 30.31$$

$$E_{21} = \frac{R_2 \times C_1}{N} = \frac{124 \times 110}{194} = 70.31 \qquad E_{22} = \frac{R_2 \times C_2}{N} = \frac{124 \times 84}{194} = 53.70$$

Table for calculation

O	E	$(O-E)^2$	$(O-E)^2/E$
40	39.69	0.096	0.00241
70	70.31	0.096	0.00136
30	30.31	0.096	0.00316
54	53.70	0.096	0.00178

(3)
$$\left.\begin{aligned} 2x-3y+6z&=3 \\ y-4z&=1 \\ 4x-5y+8z&=k \end{aligned}\right\} \text{(i)}$$

The linear equation can be written in matrix form,

$$Ax=B \text{ —— (ii)}$$

where $A=\begin{bmatrix} 2 & -3 & 6 \\ 0 & 1 & -4 \\ 4 & -5 & 8 \end{bmatrix}, x=\begin{bmatrix} x \\ y \\ z \end{bmatrix}, B=\begin{bmatrix} 3 \\ 1 \\ k \end{bmatrix}$

Augmented matrix,

$$A/B = \left[\begin{array}{ccc:c} 2 & -3 & 6 & 3 \\ 0 & 1 & -4 & 1 \\ 4 & -5 & 8 & k \end{array}\right]$$

Reduce it to echelon form,

$R_1=R_1$
$R_2=R_2$
$R_3=2R_1-R_3$
$$\left[\begin{array}{ccc:c} 2 & -3 & 6 & 3 \\ 0 & 1 & -4 & 1 \\ 0 & -1 & 4 & 6-k \end{array}\right]$$

$R_1=R_1$
$R_2=R_2$
$R_3=R_2+R_3$
$$\left[\begin{array}{ccc:c} 2 & -3 & 6 & 3 \\ 0 & 1 & -4 & 1 \\ 0 & 0 & 0 & 7-k \end{array}\right]$$

(i) No solution:

$7-k\neq 0$
$\Rightarrow k\neq 0$

(ii) Unique solution:

no unique solution

(iii) Many solution:

$7-k=0$
$\Rightarrow k=7$

(5)
$$\left.\begin{aligned} 3x-y+4z&=3 \\ x+2y-3z&=-2 \\ 6x+5y+\lambda z&=-3 \end{aligned}\right\} \text{(i)}$$

The linear equation can be written in matrix form, $Ax=B$ —— (ii)

where, $A=\begin{bmatrix} 3 & -1 & 4 \\ 1 & 2 & -3 \\ 6 & 5 & \lambda \end{bmatrix}, x=\begin{bmatrix} x \\ y \\ z \end{bmatrix}, B=\begin{bmatrix} 3 \\ -2 \\ -3 \end{bmatrix}$

Augmented matrix,

$$A/B = \left[\begin{array}{ccc:c} 3 & -1 & 4 & 3 \\ 1 & 2 & -3 & -2 \\ 6 & 5 & \lambda & -3 \end{array}\right]$$

Reduce it to echelon form,

$R_1=R_1$
$R_2=R_1-3R_2$
$R_3=2R_1-R_3$
$$\left[\begin{array}{ccc:c} 3 & -1 & 4 & 3 \\ 0 & -7 & 13 & 9 \\ 0 & -7 & 8-\lambda & 9 \end{array}\right]$$

$R_1=R_1$
$R_2=R_2$
$R_3=R_2-R_3$
$$\left[\begin{array}{ccc:c} 3 & -1 & 4 & 3 \\ 0 & -7 & 13 & 9 \\ 0 & 0 & 5+\lambda & 0 \end{array}\right]$$

(i) No solution:

no no solution

(ii) Unique solution:

$5+\lambda\neq 0$
$\Rightarrow \lambda\neq -5$

(iii) Many solution:

$5+\lambda=0$
$\Rightarrow \lambda=-5$

(8)
$$\left.\begin{aligned} x+y-z&=1 \\ 2x+3y+\lambda z&=3 \\ x+\lambda y+3z&=2 \end{aligned}\right\} \text{(i)}$$

The linear equation can be written in matrix form, $Ax=B$ —— (ii)

where, $A=\begin{bmatrix} 1 & 1 & -1 \\ 2 & 3 & \lambda \\ 1 & \lambda & 3 \end{bmatrix}, x=\begin{bmatrix} x \\ y \\ z \end{bmatrix}, B=\begin{bmatrix} 1 \\ 3 \\ 2 \end{bmatrix}$

Augmented matrix,

$$A/B = \left[\begin{array}{ccc:c} 1 & 1 & -1 & 1 \\ 2 & 3 & \lambda & 3 \\ 1 & \lambda & 3 & 2 \end{array}\right]$$

Reduce it to echelon form,

$R_1=R_1$
$R_2=2R_1-R_2$
$R_3=R_1-R_2$
$$\left[\begin{array}{ccc:c} 1 & 1 & -1 & 1 \\ 0 & -1 & -2-\lambda & -1 \\ 0 & 1-\lambda & -4 & -1 \end{array}\right]$$

$R_1=R_1$
$R_2=R_2$
$R_3=$

RADIANT PHARMACEUTICALS

$(1-\lambda)(-2-\lambda) - 4$
$=$

22/12/24 - D.S.D.

Memory Device

Semiconductor memories: The basic component for semiconductor memory is flip-flop. A flip-flop can hold a binary bit, that's why a flip-flop is called a memory cell.

Any memory system is made up of such a large number of cells. A register is formed by combining many cell's memory location called memory address.

Types of memory:-

(i) Primary memory → RAM
(ii) Storage memory → ROM

Memory classification:

- Memory
  - Main memory
    - RAM
      - Dynamic RAM (DRAM)
      - Static RAM (SRAM)
    - ROM
      - permanent
        - masked
        - Programmable Rom (PROM)
      - erasable
        - EEROM
        - EPROM
  - Storage memory
    - Magnetic
      - tape
      - hard disk
      - floppy disk
    - optic
      - WORM
      - CD
      - DVD

22/12/24 - S.P

Prob (64): Given, Let us consider, the null hypothesis there is no association between inoculation and absence of attack from typhoid.

	Attacked	Not-attacked	Total
Inoculated	30 E_{11}	470 E_{12}	500 R_1
Not-inoculated	70 E_{21}	630 E_{22}	700 R_2
Total	100 C_1	1100 C_2	1200 N

Expected frequencies.

$E_{11} = \frac{R_1 \times C_1}{N} = \frac{500 \times 100}{1200} = 41.67$ | $E_{12} = \frac{R_1 \times C_2}{N} = \frac{500 \times 1100}{1200} = 458.33$

$E_{21} = \frac{R_2 \times C_1}{N} = \frac{700 \times 100}{1200} = 58.33$ | $E_{22} = \frac{R_2 \times C_2}{N} = \frac{700 \times 1100}{1200} = 641.67$

Table for calculation

O	E	$(O-E)^2$	$(O-E)^2/E$
30	41.67	136.1889	3.268
70	58.33	136.1889	2.334
470	458.33	136.1889	0.297
630	641.67	136.1889	0.212

$\sum \frac{(O-E)^2}{E} = 6.111$

$\chi^2 = \sum \frac{(O-E)^2}{E} = 6.111$

num of rows, num of cols

d.f $= (r-1)(c-1) = (2-1)(2-1) = 1$

$\chi^2_{0.05,1} = 3.84$. our computed value of x^2 is 6.111. we may reject the null hypothesis. Hence there is an association . . . .

22/12/24 - LA

Homogeneous linear equation

(1)
$$\left.\begin{aligned} 2x+y+2z&=0 \\ x+y+3z&=0 \\ 4x+3y+\lambda z&=0 \end{aligned}\right\} \text{(i)}$$

The linear eq. can be written in matrix form: $Ax = 0$ — (ii)

where, $A = \begin{bmatrix} 2 & 1 & 2 \\ 1 & 1 & 3 \\ 4 & 3 & 7 \end{bmatrix}$, $x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

Matrix A reduce to echelon form

$R_1 = R_1$
$R_2 = R_1 - 2R_2$
$R_3 = 2R_2 - R_3$
$\longrightarrow \begin{bmatrix} 2 & 1 & 2 \\ 0 & -1 & -4 \\ 0 & -1 & 4-\lambda \end{bmatrix}$

$R_1 = R_1$
$R_2 = R_2$
$R_3 = R_2 - R_3$
$\longrightarrow \begin{bmatrix} 2 & 1 & 2 \\ 0 & -1 & -4 \\ 0 & 0 & \lambda-8 \end{bmatrix}$

By the condition of non zero solution $\lambda - 8 = 0$

$\Rightarrow \lambda = 8$

Ans

(2)
$$\left.\begin{aligned} x+ky+3z&=0 \\ 4x+3y+kz&=0 \\ 2x+y+2z&=0 \end{aligned}\right\} \text{(i)}$$

The linear eq. can be written in matrix form: $Ax = 0$ — (ii)

where, $A = \begin{bmatrix} 1 & k & 3 \\ 4 & 3 & k \\ 2 & 1 & 2 \end{bmatrix}$, $x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

Matrix A reduce to echelon form

$R_1 = R_2$
$R_2 = 4R_2 - R_2$
$R_3 =$
$\begin{bmatrix} 1 & k & 3 \\ 0 & 1 & k-4 \\ & & \end{bmatrix}$

(3)
$$\left.\begin{aligned} 2x+3y-2z&=0 \\ 3x-y+3z&=0 \\ 7x+ky-z&=0 \end{aligned}\right\} \text{(i)}$$

The linear eq. can be written in matrix form: $Ax = 0$ — (ii)

where, $A = \begin{bmatrix} 2 & 3 & -2 \\ 3 & -1 & 3 \\ 7 & k & -1 \end{bmatrix}$, $x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

Matrix A reduce to echelon form

$R_1 = R_1$
$R_2 = 3R_1 - 2R_2$
$R_3 = 7R_1 - 2R_3$
$\longrightarrow \begin{bmatrix} 2 & 3 & -2 \\ 0 & 11 & -12 \\ 0 & 21-2k & -12 \end{bmatrix}$

$R_1 = R_1$
$R_2 = R_2$
$R_3 = (21-2k)R_2 + 11R_3$
$\begin{bmatrix} 2 & 3 & -2 \\ 0 & 11 & -12 \\ 0 & 0 & \end{bmatrix}$