DISCRETE MATHS

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HND COMPUTING IDM

Contents

List of figure

List of tables

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Pearson BTEC

PART1

A.

Question 1

$$\left(\overline{a}.\overline{b}+c\right)(\mathrm{a}+\mathrm{b})\left(\overline{\overline{b}+ac}\right)=cb(a+b)(\overline{a}+\overline{c})$$

Question 1 Answer

L.H.S

$$R=(\overline{a}.\overline{b}+c)(\mathrm{a}+\mathrm{b})(\overline{\overline{b}+ac})$$

Apply de Morgan's theorem $a.b=\overline{\overline{a}+\overline{b}}$

$$\mathrm{R}=(\overline{\overline{\overline{a}}+\overline{\overline{b}}}+c)(\mathrm{a}+\mathrm{b})(\overline{\overline{b}+ac})$$

Apply the double negation (involution) law $\overline{\overline{a}}=a$

$$\mathrm{R}=(\overline{a+b}+c)(\mathrm{a}+\mathrm{b})(\overline{\overline{b}+ac})$$

Apply the commutative law

$$\mathrm{R}=(\mathrm{a}+\mathrm{b})(\overline{a+b}+c)(\overline{\overline{b}+ac})$$

Apply the redundancy law $a(\overline{a}+b)=a.b$

$$\mathrm{R}=((\mathrm{a}+\mathrm{b}).\mathrm{c})(\overline{\overline{b}+ac})$$

Apply de Morgan's theorem $\overline{a+b}=\overline{a}.\overline{b}$

$$\mathrm{R}=((\mathrm{a}+\mathrm{b}).\mathrm{c})(\overline{\overline{b}}.\overline{ac})$$

Apply the commutative law

$$\mathrm{R}=(\mathrm{b}.(\mathrm{b}+\mathrm{a}).\mathrm{c}.\overline{a.c}$$

Apply the absorption law $a.(a+b)=a$

$$\mathrm{R}=\mathrm{b}.\mathrm{c}.\overline{a.c}$$

Apply de Morgan's theorem $\overline{a.b} = \overline{a} + \overline{b}$

R $= b.c.(\overline{a} + \overline{c})$

Apply the redundancy law $a(\overline{a} + b) = a.b$

R = $b.c.\overline{a}$

L.H.S Answer = $b.c.\overline{a}$

R.H.S

$F = cb(a + b)(\overline{a} + \overline{c})$

Apply the absorption law $a.(a + b) = a$

$F = c.b(\overline{a} + \overline{c})$

Apply the commutative law

$F = c.(\overline{c} + \overline{a}).b$

Apply the redundancy law $a(\overline{a} + b) = a.b$

$F = c.(\overline{a}).b$

Apply the commutative law

$F = b.c.\overline{a}$

R.H.S Answer = $b.c.\overline{a}$

$\therefore$ L.H.S = R.H.S

Question 2

$$R = \left(\overline{\overline{AB} + \overline{A} + AB}\right) = 0$$

Question 2 Answer

Apply the commutative law

$$R = \left(\overline{(AB) + \overline{AB} + \overline{A}}\right)$$

Apply the complement law $A + \overline{A} = 1$

$$R = \left(\overline{1 + \overline{A}}\right)$$

Apply the commutative law

$$R = \left(\overline{\overline{A} + 1}\right)$$

Apply the dominant (null, annulment) law $A + 1 = 1$

$$R = \left(\overline{1}\right)$$

Apply negation law $\overline{1} = 0$

$$R = (0)$$

$\therefore$ Answer is 0

B.

Question 1

$Y = \overline{AC} + B\overline{C} + ABC$

Question 1 Answer

Apply de Morgan's theorem $\overline{a.b} = \overline{a} + \overline{b}$

$\text{Y} = (\overline{\text{A}} + \overline{\text{C}}) + (B.\overline{C}) + (A.B.C)$

Apply the commutative law

$\text{Y} = \overline{A} + \overline{C} + (\overline{C}.B) + (A.B.C)$

Apply the absorption law $a.(a + b) = a$

$\text{Y} = \overline{A} + \overline{C} + (A.B.C)$

Apply the commutative law

$\text{Y} = \overline{A} + (A.B.C) + \overline{C}$

Apply the redundancy law $a(\overline{a} + b) = a.b$

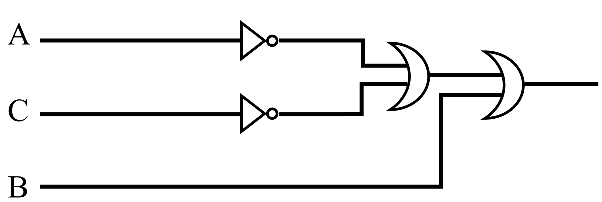
$\text{Y} = \overline{A} + (B.C) + \overline{C}$

Apply the commutative law

$\text{Y} = \overline{A} + \overline{C}(C.B)$

Apply the redundancy law $a(\overline{a} + b) = a.b$

$\text{Y} = \overline{A} + \overline{C} + B$

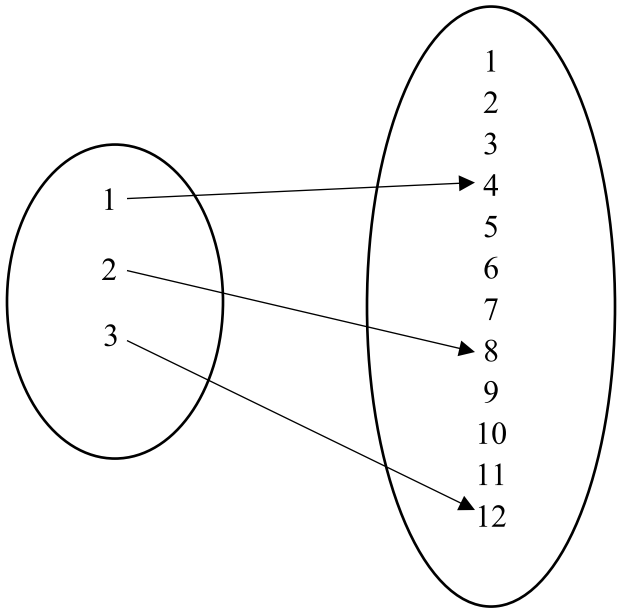


C.

Question 1

$f: R - \{-4\} \to R$

So $f(x) = 4x$



Domain: {1,2,3}

Co domain: {1,2,3,4,5,6,7,8,9,10,11,12}

Range: {4,8,12}

Domain and Range values are equal So this function is **One to One function.**

Question 2

$$f(x) = \frac{(x-3)}{(x+4)}$$

$$f'(x) = -\frac{(x-3)}{(x+4)^2} + \frac{1}{(x+4)}$$

Assume $f'(x) = 0$

$$\frac{1}{(x+4)} = \frac{(x+3)}{(x+4)^2}$$

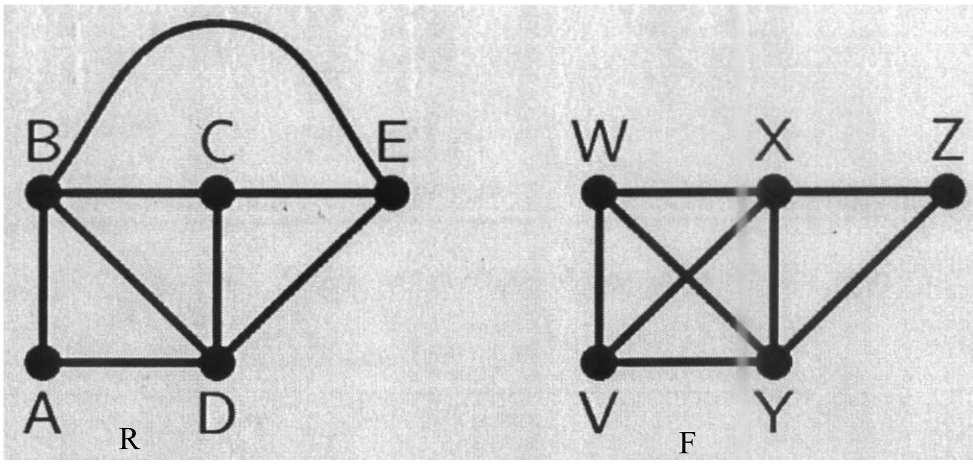
$(x+2) = (x+3)$ This is not possible

$\therefore$ Curve is not differentiable at any point.

So, this function is **One to One function**

PART2

A.



Assume the image R and F

A graph can exist in different shapes with the same number of vertices, edges, and also the same edge connectivity. These graphs are called isomorphic graphs. Note that we primarily name the images in this chapter to refer to them and identify them from one another.

Two graphs A and B are said to be isomorphic if –

- Their number of components (vertices and edges) are the same.
- Their edge connectivity is retained.

Note − In short, out of the two isomorphic graphs, one is a tweaked version of the other. An unlabeled graph also can be thought of as an isomorphic graph. (tutorialspoint, 2021)

1. If we look at the R and F graph above based on vertices and edges

Table 1: Graph R and F vertices and edge compression table

Graph R	Graph F
Number of vertices	
5	5
Number of edges	
8	8

So, first theory vertices and edges are same.

2. If we look at the R and F graph above based on edge connectivity

Table 2: Graph R edge connectivity letter compression table

Edge connectivity letter	Graph R
A	2
B	4
C	3
D	4
E	3

Table 3: Graph F edge connectivity letter compression table

Edge connectivity letter	Graph R
A	2
B	4
C	3
D	4
E	3

So, second theory edge connectivity are same.

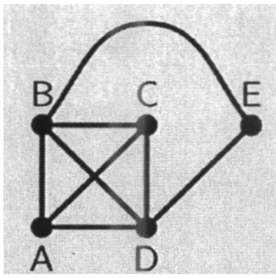
3. If we look at the R and F graph above based on mapping

$$f(A) = Z$$
$$f(B) = Y$$
$$f(C) = V$$
$$f(D) = X$$
$$f(E) = W$$

So, based on mapping also same.

In this regard Graph **R and F is isomorphic graphs.**

B.



This graph is not a Euler circuit. Because, The Euler circuit must satisfy two rules on which basis it is not the Euler circuit.

The two rules are

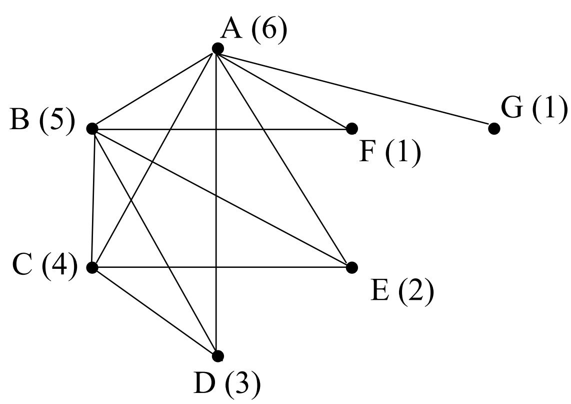
- Euler circuit are satisfaction on Euler path; The Eulerian path is a trace on a finite graph that **visits each edge exactly once**.
- Second rule is Euler path stating edge and ending edge are same.

On that basis This graph is not a Euler circuit but this graph is Euler path graph.

Euler path of this graph: $AD \rightarrow DC \rightarrow CB \rightarrow BD \rightarrow DE \rightarrow EB \rightarrow BA \rightarrow AC$

C.

This graph cannot be draw.



Reason:

Figure 1: Degree sequence diagram

- This diagram has 7 vertices; Vertices order {6,5,4,3,2,1,1}.
- On that basis **A** vertices contact in **6 edges.** (B:5, C:4, D:3, E:2, F:1, G:1)
- But **E vertices contact in 3 edges** and **F vertices contact in 2 edges**. So, Assume This graph in **not a Degree Sequence diagram.**

PART3

I.

	Junior	Senior
Male	100	80
Female	120	100

$$\begin{pmatrix} 100 & 120 \\ 80 & 100 \end{pmatrix}_{2\times 2}$$

II.

	Healthy	Sick	Carrier
Junior	33	77	110
Senior	55	54	71

$$\begin{pmatrix} 33 & 77 & 110 \\ 55 & 54 & 81 \end{pmatrix}_{2\times 3}$$

III. $$\begin{pmatrix} 100 & 120 \\ 80 & 100 \end{pmatrix}_{2\times 2} \times \begin{pmatrix} 33 & 77 & 110 \\ 55 & 54 & 71 \end{pmatrix}_{2\times 3}$$

$$\begin{pmatrix} 100 \times 33 + 120 \times 55 & 100 \times 77 + 120 \times 54 & 100 \times 110 + 120 \times 71 \\ 80 \times 33 + 100 \times 55 & 80 \times 77 + 100 \times 54 & 80 \times 110 + 100 \times 71 \end{pmatrix}_{2\times 3}$$

$$\begin{pmatrix} 9900 & 14180 & 19520 \\ 8140 & 11560 & 15900 \end{pmatrix}_{2\times 3}$$

PART4

Children: x

Adult: y

I.

$$\frac{3}{2}x + 4y = 5050$$

$$x + y = 2200$$

II.

$$\begin{pmatrix} \frac{3}{2} & 4 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5050 \\ 2200 \end{pmatrix}$$

III.

$$A^{-1} = \frac{1}{\frac{3}{2} - 4} \begin{pmatrix} 1 & -4 \\ -1 & \frac{3}{2} \end{pmatrix}$$

$$A^{-1} = \frac{1}{-\frac{5}{2}} \begin{pmatrix} 1 & -4 \\ -1 & \frac{3}{2} \end{pmatrix}$$

$$A^{-1} = -\frac{2}{5} \begin{pmatrix} 1 & -4 \\ -1 & \frac{3}{2} \end{pmatrix}$$

$$A^{-1} = \begin{pmatrix} -\frac{2}{5} & \frac{8}{5} \\ \frac{2}{5} & -\frac{3}{5} \end{pmatrix}$$

$AX = B$

$A^{-1}AX = A^{-1}B$

$IX = A^{-1}B$

$X = A^{-1}B$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -\frac{2}{5} & \frac{8}{5} \\ \frac{2}{5} & -\frac{3}{5} \end{pmatrix} \begin{pmatrix} 5050 \\ 2200 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -2020 & +3520 \\ 2020 & -132 \end{pmatrix}$$

$\boldsymbol{X = 1500}$

$X + Y = 2200$

Y = 700

References

tutorialspoint, 2021. *Graph Theory - Isomorphism.* [Online]
Available at: https://www.tutorialspoint.com/graph_theory/graph_theory_isomorphism.htm
[Accessed 1 December 2021].