

SE (Comp) SEM: III
(old).

Nov. Dec 2013

Data Str. & Files

4/12/13

65 : 2nd - half 13 (a) - JP

Con. 5461-13.

(OLD COURSE)

(3 Hours)

LJ-10325

[Total Marks : 100

- N.B.** (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** out of remaining **six** questions.
(3) Assumptions made should be **clearly** stated.
(4) Assume **suitable** data wherever **necessary**.

1. (a) What is recursion ? State its advantages and disadvantages. 5
(b) Explain linear and non linear data structure with example. 5
(c) Write a program in Java to copy content of one file to another by using command line arguments. 10
2. (a) Write a program in Java to delete a node from binary tree. Show all possible cases clearly. 10
(b) What is priority queue ? Give applications of priority queue. 10
3. (a) Write a program to convert an infix expression to postfix expression using stack. 10
(b) Explain different representation of graph. State advantages and disadvantages of each representation. 10
4. (a) What are the advantages of linked list over array ? Write a program in Java to implement Stack using linked list. 10
(b) Explain Huffman encoding in detail with an example. 10
5. (a) Write a program in Java to sort 'n' given number using Merge sort. 10
(b) Construct a binary TREE for the inorder and postorder traversal sequence given below- 10
Inorder : "INFORMATION"
Postorder : "INOFMAINOTR"
6. (a) What is the use of hashing ? Show hash table entries for the given dataset using linear probing and quadratic probing : 10
12, 45, 67, 88, 27, 78, 20
(b) Write a Java program to create Binary Search Tree (BST). Show the BST for the following input : 10
10, 05, 14, 22, 17, 01, 08
7. Write short notes on (any two) :— 20
(a) AVL tree and Multiway search tree
(b) Graph Traversal Algorithms
(c) Expression Tree.

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Assume suitable **data** wherever **necessary**.
 (3) Solve any **four** out of the **remaining**.

1. (a) Using Quine Mccluskey method implement the following using gates 10
 $F(W, X, Y, Z) = \pi_m (1, 3, 4, 6, 9, 10, 11) * d(5, 8)$
- (b) State De' Morgans theorem and prove that NAND gate is an Universal gate. 10

2. (a) Simplify using boolean theorems and draw logic diagram for the same 10
 (i) $\bar{X} Y Z + X \bar{Y} Z + X Y \bar{Z} + X Y Z$
 (ii) $\bar{W} Y + \overline{\bar{W} X Z} + \bar{W} X \bar{Y} \bar{Z} + W \bar{X} Y$
- (b) Realise the following using 16 : 1 MUX and 4 : 16 decoder. 10
 $f(A, B, C, D) = \Sigma_m (1, 2, 4, 7, 11, 13)$

3. (a) Explain why Hamming code is called an error correcting code. Prove the same 10
 if a 7 - bit hamming code is received as 1 0 0 0 0 1 0.
- (b) Design a 4 bit adder (BCD adder) using IC7483 10

4. (a) Design a decade counter using JK flipflop. 10
 (b) Design a mod 13 down counter using JK flipflop. 10

5. (a) Minimize the following equation - 10
 $F(W, X, Y, Z) = \Sigma_m (0, 4, 5, 6, 12, 13) + d(7, 15)$
 (i) Design k - map for the same
 (ii) Minimize and realize the equation via gates.
- (b) Explain what is meant by shift register. Explain 4 bit bi directional shift register. 10

6. (a) Compare the different logic families with respect to following parameters - Fan 10
 in, fan out, noise margin, speed, power dissipation.
- (b) Explain 2 input TTL NAND gate in detail. 10

7. Write short notes on any **two** of the following :— 20
 (a) Self complementry code
 (b) PAL, PLA
 (c) ALU
 (d) 74180 - parity generator and checker.

Con. 5574-13.

LJ-10394

(OLD COURSE)

(3 Hours)

[Total Marks : 100

N.B. :(1) Question No. 1 is compulsory.

(2) Answer any **four** questions out of remaining **six** questions.(3) Assume suitable **data** wherever **required**.(4) **Figures** to the **right** indicate **full** marks.

1. (a) Find how many integers between 1 and 60 are not divisible by 2, nor by 3 and nor by 5. 4

(b) Prove by Mathematical Induction :- 6

$$1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = (4n^3 - n)/3$$

(c) Explain the following term with suitable example :- 4

(i) Disjoint set.

(ii) Symmetric difference.

(iii) Partition set.

(iv) Power set.

(d) Explain with an example different types of quantifiers :- 6

(i) $\exists x p(x)$ (ii) $\forall x (\sim p(x))$

2. (a) Determine the Hasse diagram of the relation on $A = \{1, 2, 3, 4, 5\}$:- 6

$$M_2 = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

(b) Define with example the injective, surjective and bijective function. 4

(c) Explain Warshall's Algorithm. 10

Let $A = \{1, 2, 3, 4, 5\}$ and R be a relation on A such that $R = \{(1, 1), (1, 4), (2, 2), (3, 4), (3, 5), (4, 1), (5, 2), (5, 5)\}$.Find transitive closure of R by Warshall's Algorithm.

3. (a) Let $f : \mathbb{R} \rightarrow \mathbb{R} \quad f(x) = x^3$ 6
 $g : \mathbb{R} \rightarrow \mathbb{R} \quad g(x) = 4x^2 + 1$
 $h : \mathbb{R} \rightarrow \mathbb{R} \quad h(x) = 7x - 2$

Find :- (i) $go(hog)$
(ii) $go(hof)$

- (b) Find solution of Recurrence Relation. 4

$$a_n = 5a_{n-1} - 6a_{n-2} + 7_n$$

- (c) Prove that if $(F, +, \cdot)$ is a field then it is an integral domain. 10

4. (a) Determine whether the following graph has a Hamiltonian circuit or Eulerian circuit and Hamiltonian path or Eulerian path. 8

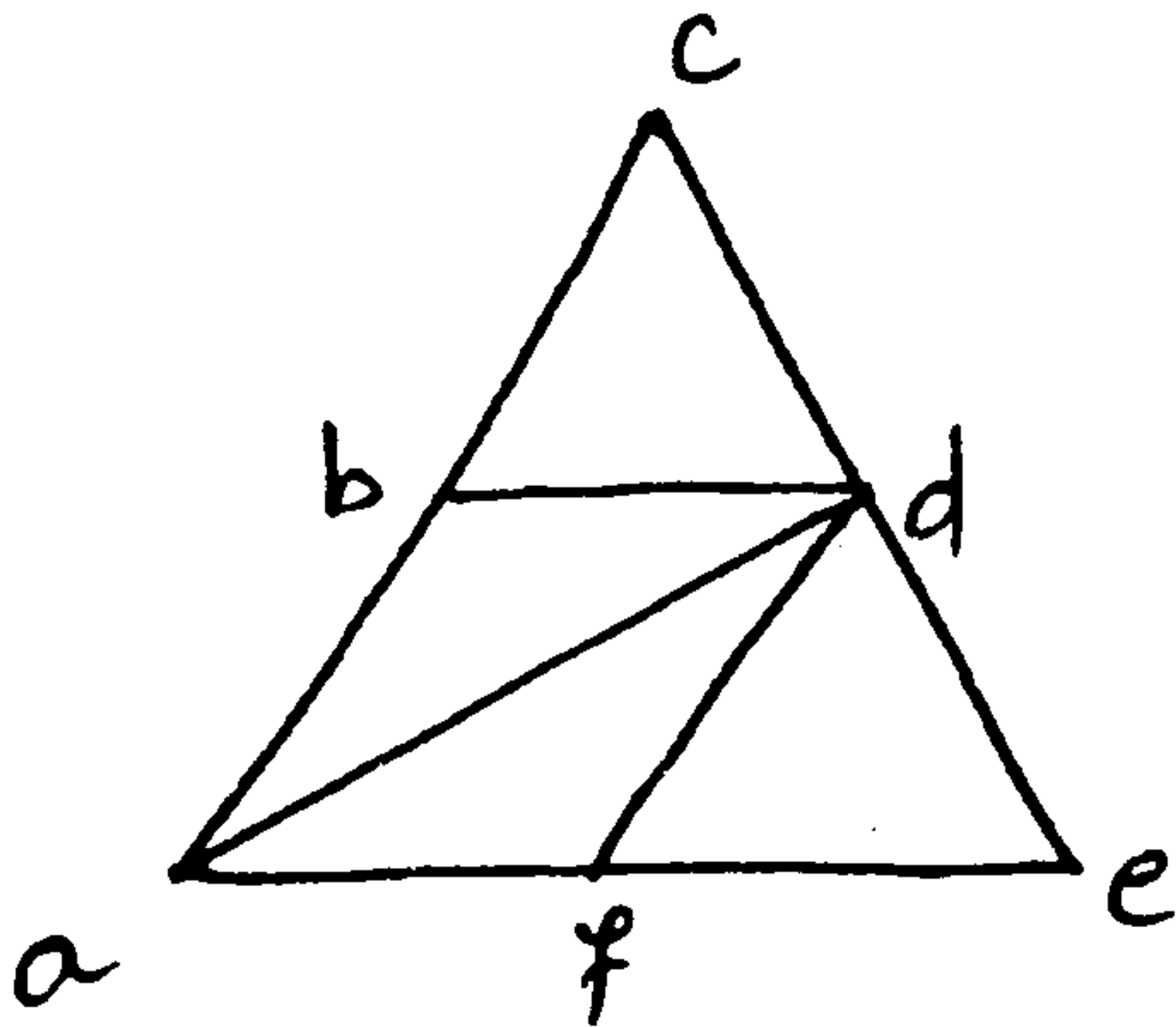


Fig. (a)

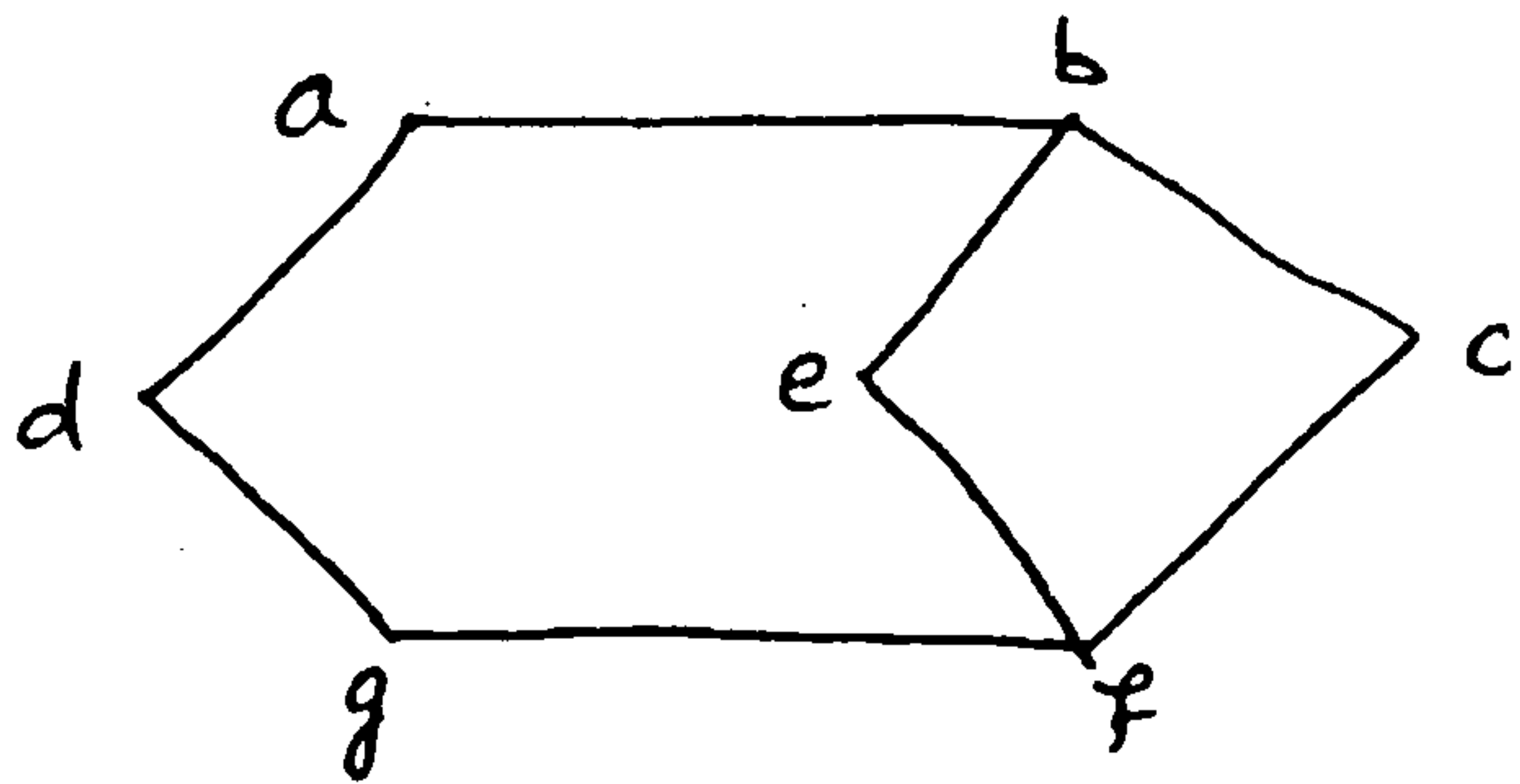


Fig. (b)

- (b) Define the term with example. 2
(i) Planner Graph.
(ii) Spanning Tree.

- (c) What is Minimum Spanning tree? Explain any one technique to find Minimum cost spanning tree and solve the following example with the same technique :- 10

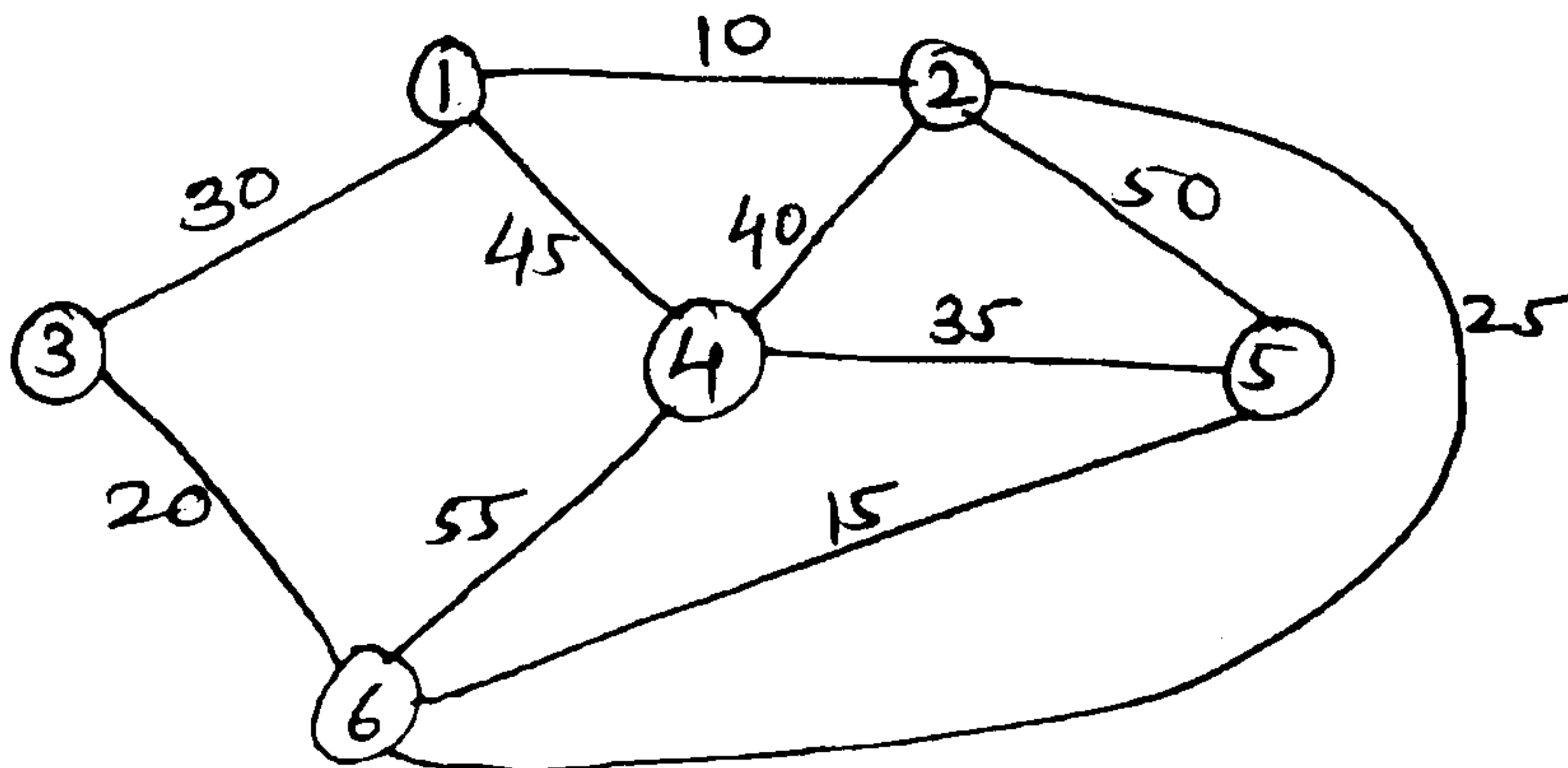


Fig. (a)

5. (a) Show that following two graphs are isomorphic or not.

6

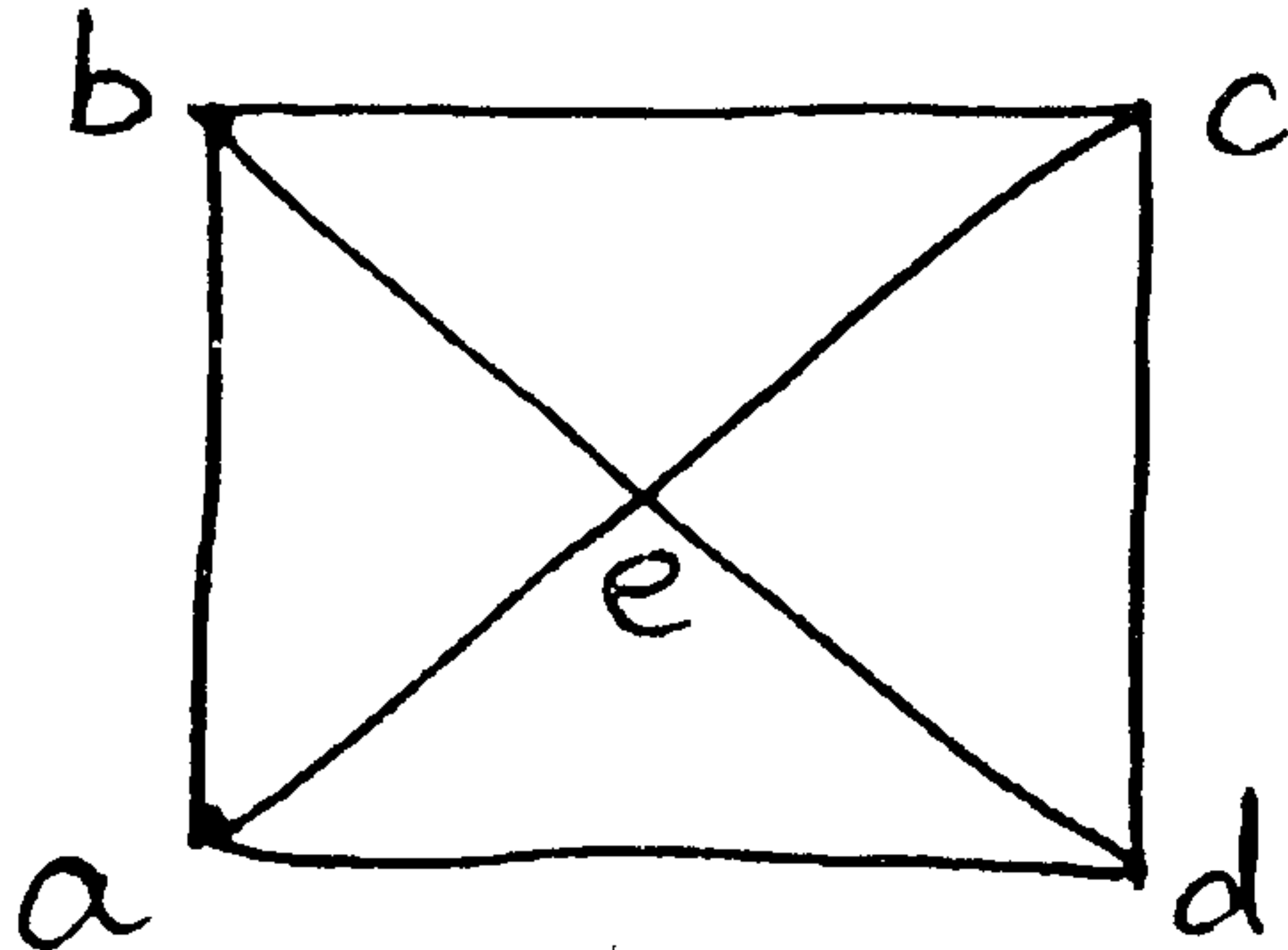


Fig. (a)

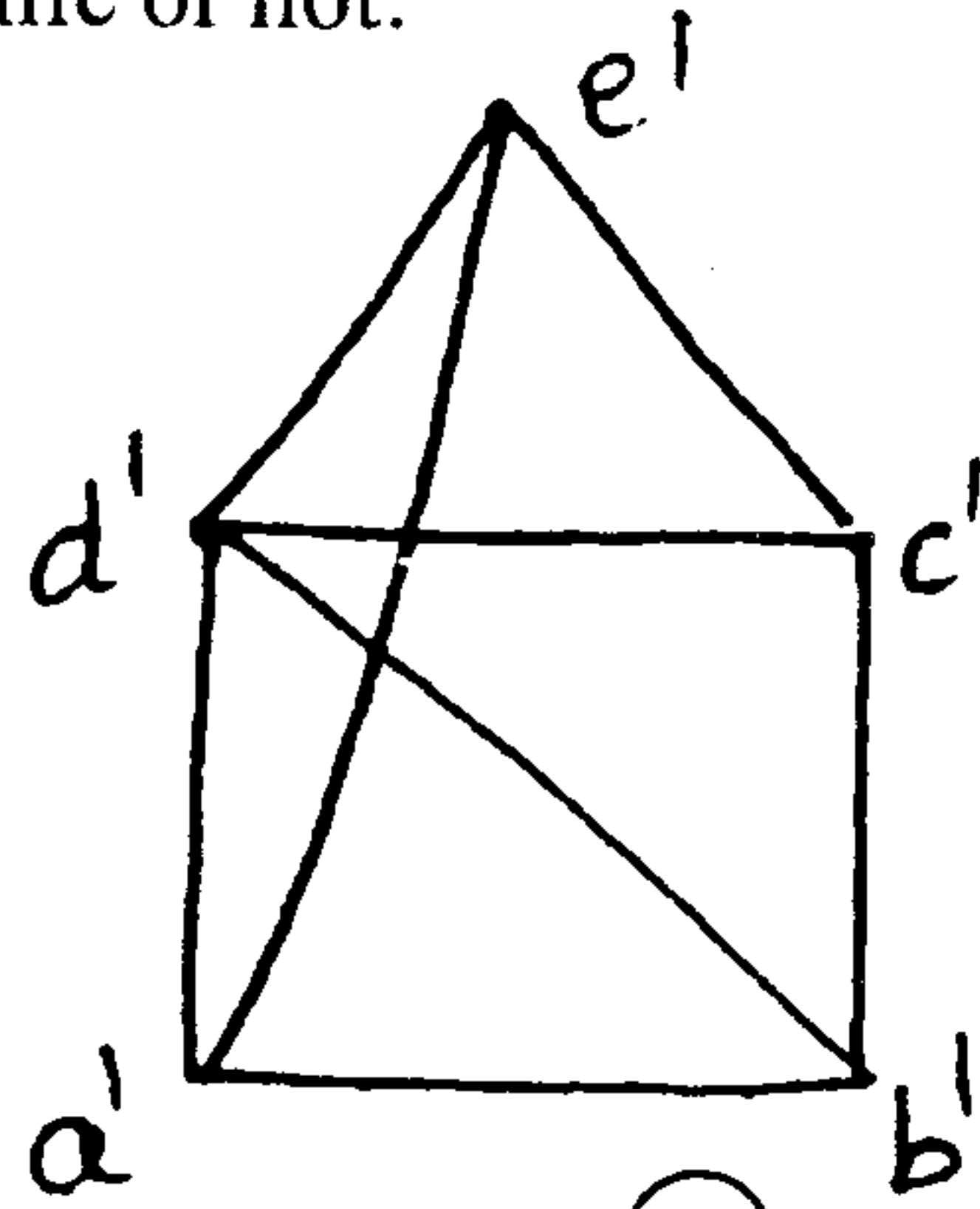


Fig. (b)

5. (b) Show that a group $(G, *)$ is abelian. If and only if $(a * b)^2 = a^2 * b^2$

4

(c) Find the number of vertices of the graph having 16 edges if degree of each vertex is 2.

4

(d) $R = \{0, 2, 4, 6, 8\}$ show that R is commutative ring under addition and multiplication modulo 10.

6

6. (a) Let $H = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ be a parity check matrix.

6

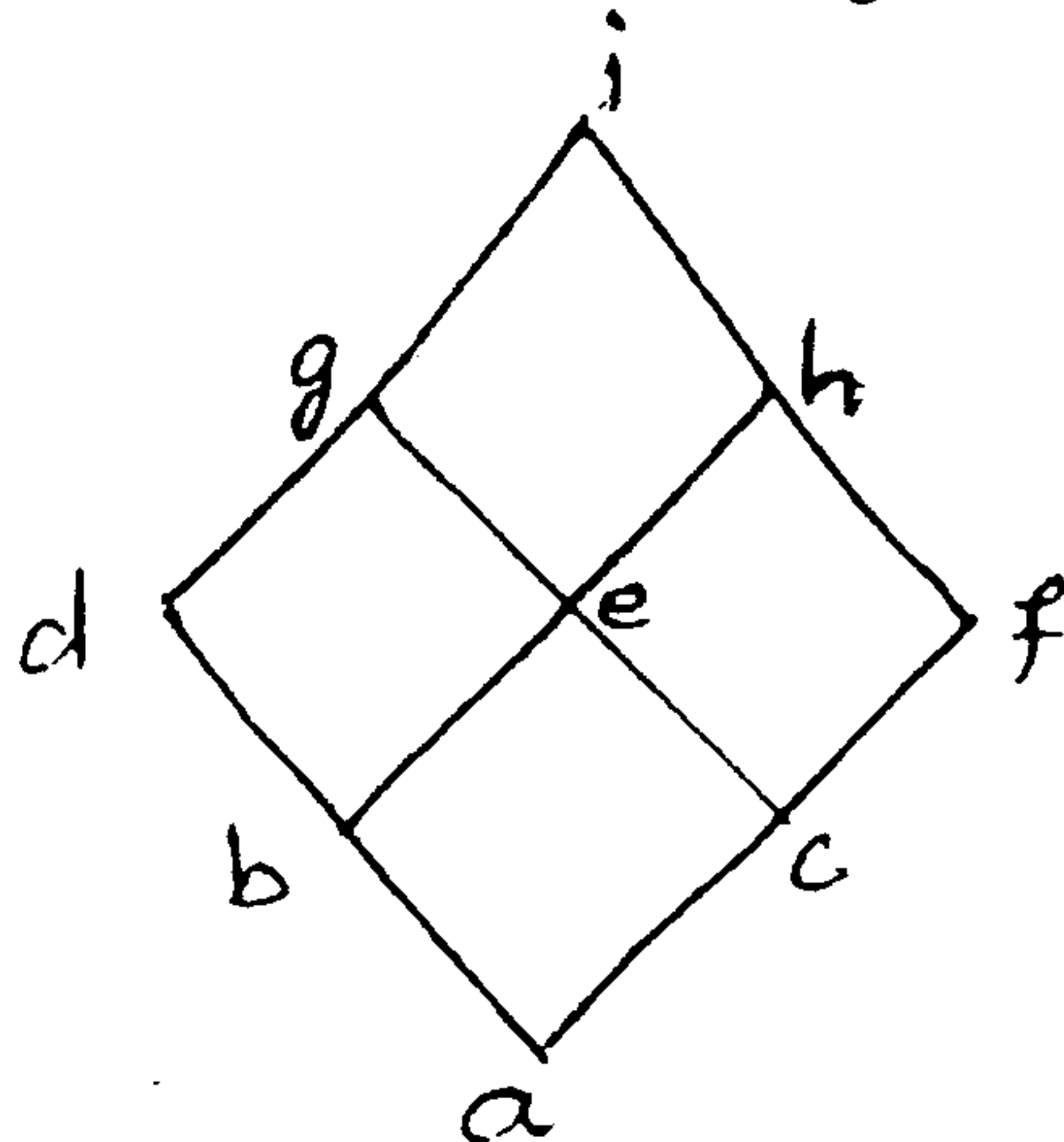
Decode the following words relative to maximum likelihood decoding function :-

(i) 011001

(ii) 101001.

(b) Determine whether the below Hasse diagram represents a Lattice.

4



Con. 5573-LJ-10393-13.

4

- (c) Define equivalence Relation and equivalence class with example. **4**
- (d) Let $A = \{1, 2, 3, 4, 6\}$ and Let R be the relation on A defined by “x divides y” **6**
(x/y) (Note x/y if there exist an integer z such that $xz = y$).
(i) Write R as a set of ordered pairs.
(ii) Draw the directed graphs.
(iii) Find the inverse relation of R.
7. (a) Show that if seven numbers from 1 to 12 are choosen, then two of them will add upto 13. **4**
- (b) Define subgroup and normal subgroup with example. **4**
- (c) Determine whether Lattice D_{30} is distributive, complemented or both. Justify your answer. **6**
- (d) Explain the following term with example :- **6**
(i) Symmetric Relation and Antisymmetric Relation.
(ii) Partially Ordered set.
(iii) Complete graph and bipartite graph.

(Old Course)

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question No. 1 is **compulsory**.
(2) Solve any **four** questions from Question No. 2 to 7.
(3) Draw neat **diagram** wherever **necessary**.
(4) Answers to each **new** question to be **started** on a **fresh** page.

1. (a) Explain different addressing modes with examples. 10
(b) Explain PCI bus architecture in details. 10
2. (a) Explain high-order and low-order memory interleaving techniques. 10
(b) A two level memory (M1, M2) has the access time $t_{A1} = 10^{-9}$ sec and $t_{A2} = 10^{-4}$ sec. What must be the hit ratio H in order for the access efficiency to be atleast 65% of it's maximum possible value ? 10
3. (a) Explain Cache-Memory mapping techniques with examples. 10
(b) Explain with neat diagram DMA data transfer techniques. 10
4. (a) Explain General organisation of CPU ? State function of following CPU registers. 10
(i) MAR
(ii) MBR
(iii) IR
(iv) PC
(v) SP
(b) Define IO-Modules ? State difference between programmable and non- 10
programmable devices with suitable examples.
5. (a) Explain difference between Microprogrammed and Hardwired control unit 10
organisation with suitable examples.
(b) Explain Four - stages CPU instruction pipeline with neat diagram. 10
6. (a) Explain Booth Multiplication Algorithm and implement for following numbers :- 10
 $11 * 5$
(b) Explain the Flynn's classification for parallel processing system. 10
7. Write a short notes (any two) :- 20
(a) TLB
(b) RISC and CISC
(c) SPARC Processor.

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question 1 is compulsory.
 (2) Attempt any **four** out of remaining **six** questions.
 (3) **Figures** to the **right** indicate **full** marks.

1. (a) Find Z transform and region of convergence of :- 5

$$f(k) = \begin{cases} 5^k & k < 0 \\ 3^k & k \geq 0 \end{cases}$$

- (b) If $\int_0^{\infty} e^{-\alpha t} \sin(t + \alpha) \cdot \cos(t - \alpha) dt = \frac{1}{4}$ Find α 5

- (c) If A and B are 2 non-singular square matrices of same order, show that $\text{adj}(A \cdot B) = (\text{adj } B) \cdot (\text{adj } A)$ 5

- (d) Obtain Fourier series of $x \cos x$ in $[-\pi, \pi]$. 5

2. (a) Find Laplace transform of $\frac{e^{-2t} \sin 2t \cosh t}{t}$ 6

- (b) Is following matrix orthogonal? If not can it be converted to an orthogonal matrix? If yes, how? 6

$$A = \begin{bmatrix} -8 & 1 & 4 \\ 4 & 4 & 7 \\ 1 & -8 & 4 \end{bmatrix}$$

- (c) Obtain half range sine series of $f(x)$ 8

where $f(x) = \begin{cases} x & 0 < x < \pi/2 \\ \pi - x & \pi/2 < x < \pi \end{cases}$ hence find sum of $\sum_{(2n-1)}^{\infty} \frac{1}{n^4}$

Real infcn as
 " $0 < x < \pi/2$ "

3. (a) Find $z\{k^2 a^{k-1} U(k-1)\}$ 6

- (b) Find rank of matrix A reducing to normal form where 6

$$A = \begin{bmatrix} 1 & 2 & -2 & 3 \\ 2 & 5 & -4 & 6 \\ -1 & -3 & 2 & -2 \\ 2 & 4 & -1 & 6 \end{bmatrix}$$

TURN OVER

- (c) (i) Find $L \{te^{-4t} \sin 3t\}$ 4
- (ii) Find $L \left\{ e^{-t} \int_0^t \frac{\sin u}{u} du \right\}$ 4
4. (a) Prove that every Hermitian Matrix A can be written as $P + iQ$ where P is real symmetric and Q is real skew symmetric. 6
- (b) Find $L^{-1} \tan^{-1} \left(\frac{2}{s^2} \right)$ 6
- (c) Show that set of functions $\sin \left(\frac{3\pi x}{2L} \right), \sin \left(\frac{3\pi x}{2L} \right), \sin \left(\frac{5\pi x}{2L} \right)$ is orthogonal over (0, L). Hence construct an orthonormal set. 8
5. (a) Find Fourier transform of – 6
- $$f(x) = \begin{cases} (1-x^2) & |x| \leq 1 \\ 0 & |x| > 1 \end{cases}$$
- (b) Investigate for what values of λ and μ the equations. 6
- $$x + y + z = 6, \quad x + 2y + 3z = 10$$
- $$x + 2y + \lambda z = \mu$$
- (i) No solution (ii) A unique solution
- (iii) Infinite many solutions
- (c) Solve using Laplace transform $\frac{d^2 y}{dt^2} + 9y = 18t$ given that $y(0) = 0$ and $y\left(\frac{\pi}{2}\right) = 0$ 8
6. (a) Using Laplace transform evaluate $\int_0^{\infty} e^{-t} (1 + 2t - t^2 + t^3) H(t-1) dt$ 6
- (b) Show that the vectors X_1, X_2, X_3 are linearly independent and vector X_4 depends upon them where 6
- $$X_1 = (1, 2, 4), \quad X_2 = (2, -1, 3)$$
- $$X_3 = (0, 1, 2), \quad X_4 = (-3, 7, 2)$$
- (c) Find Fourier cosine integral for $f(x) = e^{-x} \cos x$. 8

TURN OVER

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7. (a) Find inverse Z - transform for $f(z) = \frac{3z^2 - 18z + 26}{(z-2)(z-3)(z-4)}$ $3 < z < 4$ **6**

(b) Find Laplace transform of $f(t) = a \sin pt$ $0 < t < \frac{\pi}{p}$ **6**

$$f(t) = 0 \quad \frac{\pi}{p} < t < \frac{2\pi}{p}$$

$$f(t) = f\left(t + \frac{2\pi}{p}\right)$$

(c) Obtain the complex form of Fourier series for $f(x) = \cos hax$ in $[-l, l]$ **8**
