TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Chaitra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEI, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm (CT 552)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What are linear and nonlinear data structures? Define abstract data type (ADT) with suitable example. [1+3]

2. Convert following infix expressions to Postfix and Evaluate the postfix expressions using A=8, B=5, C=4, D=6, E=2, F=1, G=12 and H=3. [5+3]
$$A + (B * C - (D/E + F) - G) * H$$

3. Explain how circular queue is efficient compared to linear queue. Write down an algorithm to perform insertion and deletion operation in a linear queue. [2+3]

4. Explain array representation of list. How it is different from dynamic list? [2+2]

5. Write an algorithm to insert a new node after any given node in doubly linked list. Explain how you add two polynomials with the help of linked list. [4+4]

6. Write an algorithm to find n^{th} Fibonacci number using tail recursion. Generate a recursion tree of TOH problem with 4 disks. [3+5]

7. What do you mean by complete binary tree? Explain with example. Create an AVL balanced tree for the following sequence of elements: 10, 9, 8, 4, 5, 7, 32, 16, 11, 1, 12 and 2. [2+6]

8. Create a Binary Search Tree by inserting the nodes: 12, 15, 25, 18, 20, 30, 28, 10 and 5. Then delete element 25 from it. [3+2]

9. Explain Heap as priority queue. Use heap sort to sort the following numbers: 27, 23, 16, 82, 47, 18, 38, 15, 2, 76, 22 and 12. [2+6]

10. What is collision? What are the techniques used for collision resolution in hashing? Insert the keys: 52, 27, 16, 14, 97, 21, 82, 41 and 31 using quadratic probing method. The hash function is h = (key) = key % 10 (Where 10 is the table size). [1+2+5]

11. Define Big-Oh and Theta notation with suitable example. [4]

12. What is minimum spanning tree? Explain Warshall's algorithm with example. Define Dijkstra's algorithm with explanation. [2+4+4]

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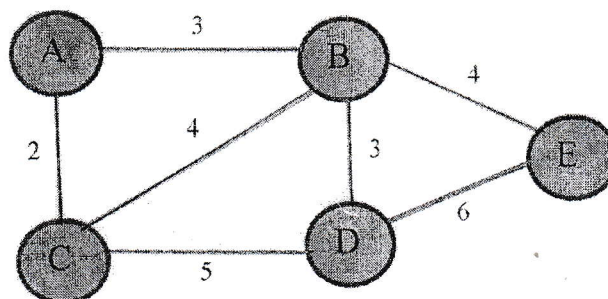**Examination Control Division**
2079 Chaitra

| Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEI, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data structure and Algorithm (*CT 552*)

1. Define data structure. Differentiate between primitive and non primitive structure. [2+2]

2. What is stack? Convert the infix expression a+b*c+(d*e+f)*g into infix expression. [2+6]

3. Define Queue with its logical representation. Write an algorithm to enqueue () and dequeue () element in Circular Queue. [2+4]

4. Write algorithm to insert data at the beginning in array implementation of lists. [4]

5. Write an algorithm to insert a new node after a given node and to delete the last node of singly linked list. [4+4]

6. What is recursion? Explain recursive module for Tower of Hanoi (TOH) problem. [2+4]

7. Construct an AVL tree for following sequence of elements: 42, 36, 56, 27, 63, 72, 30, 25, 20, 10. [6]

8. Construct a B-tree of order 5 from the following data: [6]

   4, 23, 12, 45, 3, 21, 41, 31, 26, 10, 12, 32

9. Explain about Big Omega (Ω) and Big Theta (θ) notions. [2+2]

10. Define Sorting and its types. Sort the given elements using Shell Sort: [3+5]

    Elements: 25, 31, 17, 21, 33, 9, 11, 7, 3

11. Explain how collision occurs? Use quadratic probing to insert following keys: 72, 27, 36, 24, 63, 81, and 101 into the hash table, considering hash table size 10. And also list out its advantages and disadvantages. [2+7+1]

12. Define minimum spanning tree. Create a minimum spanning tree for the following graph using Krushkal's algorithm. [2+8]

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Examination Control Division
2078 Chaitra

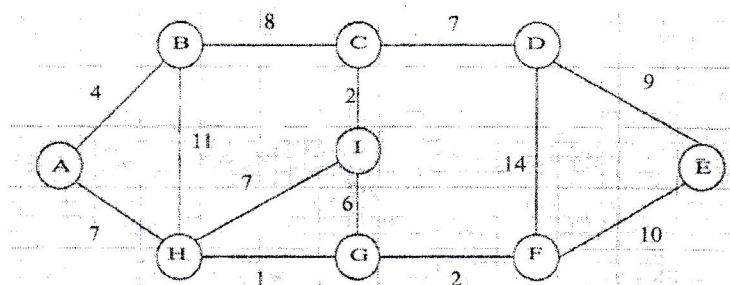| Exam.		**Regular**	
Level	BE	Full Marks	80
Programme	BEI, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure & Algorithm (*CT 552*)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
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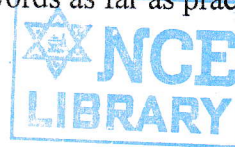
1. Explain the importance of data structures and point out the areas in which data structures are being applied extensively. Explain why List is called as Abstract Data type (ADT). [2+2]

2. Define stack. Convert following infix expression to postfix expression showing stack status in each step: $A \times (B+C) - (B^\wedge D) \times A + E / F$. [2+6]

3. Explain the significance of dynamic list data structures over static list. Write algorithms to implement list structure using array for the operations:

   a) Insert at given position in the list

   b) Delete from given position in the list [2+4]

4. Consider two linked lists that represent two polynomials. Subtract them and return the difference as a linked list. Write an algorithm and program to implement above scenario. [10]

5. Explain how recursion uses stack data structures, use factorial of number calculation to illustrate the concept. [6]

6. Explain pre-order and in-order tree traversal with example. Construct an AVL balanced tree with given set of data: 15,20,24,10,13,7,30,36,25 [3+3+6]

7. Construct a Huffman code for the given symbols. [6]

Symbol	A	B	C	D	E	F
Frequency (in thousands)	35	18	10	20	9	8

8. Write an algorithm for quick sort. Sort the following numbers using quick sort: 30,25,79,19,48,28,21,44 and 120. [8]

9. What is collision? What are the techniques used for collision resolution in hashing? Insert the keys:62,37,36,44,67,91,82, and 31 using quadratic probing method. The hash function is: h(key) = key % 10 (where 10 is the table size). [1+2+5]

10. How do you find complexity of any algorithm? Explain with suitable example. [4]

11. Explain the concept of minimum spanning tree (MST) and find MST for the following graph using Kruskal's algorithm: [2+6]
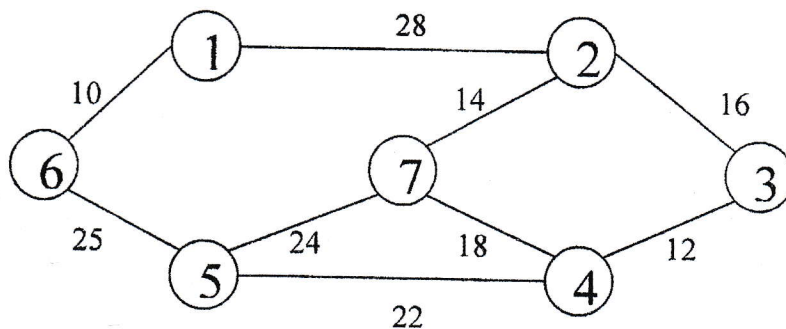
Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT, BEI	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm (CT 552)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
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1. Briefly explain the statement "ADT provides extraction" with suitable example. [4]

2. Define stack. Convert following infix expression showing stack status after every step. [2+6]
   $(A*B*(((C^X+D^Y)+E/Z)*F)))$

3. What is queue? What are different operations that can be performed over queue? [2+6]

4. Illustrate the use of stack in recursion taking any recursive program of your choice. [6]

5. Briefly explain the significance of asymptotic notations with suitable diagram. [4]

6. Describe an AVL tree. Construct AVL tree for following sequence of elements: 5, 10, 15, 30, 25, 20, 4, 2, 1 [2+6]

7. Define collision. Insert the keys 30, 15, 69, 28, 49, 58, 79 and 91 using quadratic probing method. The hash function is : h(key) = key%10 where 10 is the table size. [2+6]

8. Create a heap tree showing each insertion steps for the following data: 28, 24, 50, 36, 42, 58, 22, 56, 46. Use same heap tree to sort the data showing each intermediate step. [8]

9. Explain with example how n^{th} node in a singly linked list can be deleted? [6]

10. Explain balancing of B-tree with example. Construct an AVL tree from following sequence of data: 10, 20, 15, 25, 30, 16, 18, 19. [4+6]

11. Define depth first and breadth first traversal. Construct the minimum spanning tree (MST) for the given graph using Krushkal's algorithm. [4+6]

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2076 Baisakh

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structures and Algorithm *(CT 552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define data structure with its types. [4]

2. Define stack. Evaluate the postfix expression A*BC-DE*F/+G* with status of stack where A=2, B=3, C=10, D=5, E=2, F=4 and G=6. [1+4]

3. Differentiate linear queue and circular queue with suitable example. [5]

4. Explain array representation of list ? How is it different from dynamic list? [4+2]

5. Explain operations of stack using linked list. How do you add a node at the Kth position of the doubly linked list? [5+5]

6. What are tail and non- tail recursions? Write an algorithm for TOH with 'n' disks and generate a recursion tree of TOH problem with 3 disks. [2+2+4]

7. What do you mean by asymptotic notation? Define Big-O notation with its properties. [2+2]

8. Explain deletion of node with two children in BST with suitable example. Construct an AVL tree for following data: 36, 12, 42, 23, 65, 96, 37, 79, 19, 24, 33 and 44. [5+5]

9. Explain selection sort. Sort the numbers 92, 73, 22, 49, 46, 98, 21, 9, 70 and 63 using selection sort. [4+4]

10. Define binary search with example. What is the cause of collision in hashing and explain any one method for the collision resolution. [4+2+4]

11. What are different representation methods of graph? Explain Kruskal's algorithm to find Minimum Spanning Tree with example. [4+6]
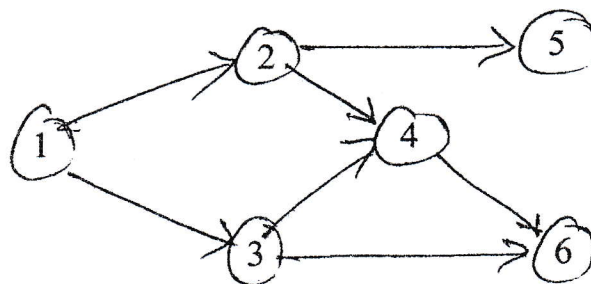
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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm *(CT 552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
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1. Define algorithm and write down its properties. [4]

2. Write an algorithm for converting infix expression to postfix expression. convert the given infix expression to postfix expression using above algorithm:-
$a^{\wedge}b*c-d-e-f/e/(g-h)$ [5+5]

3. What is difference between static and dynamic implementation of list? How do you insert element in static list? [3+3]

4. Explain how the addition of polynomial equations is done using linked list. Write an algorithm to insert element in queue using linked list. [5+5]

5. Explain how recursive program uses stack with illustrative stack diagram. Write an algorithm for solving Tower Hanoi problem with 'n' discs. [4+4]

6. What is an AVL tree? Construct AVL tree using following sequence of data:
16, 27, 9, 11, 36, 54, 81, 63, 72 [2+6]

7. Describe the insertion operation in B-tree with suitable example. [6]

8. Define O mega and Theta notation with suitable example. [4]

9. Define Collision. Insert following keys: 30, 25, 79, 19, 48, 28, 21 and 44 in hash table using linear probing method where h(key) = key % 10. [2+6]

10. Prove that time complexity of bubble sort is $O(n^2)$. Sort the numbers 40, 90, 20, 10, 30, 5, 60, 100, 80 using heap sort method. [2+6]

11. Explain Warshall's algorithm with example. Determine the breadth first topological ordering for the following graph. [4+4]

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Exam.		Regular	
Level	BE	Full Marks	80
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Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
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1. What do you mean by Abstract Data Type? What is difference between primitive and non primitive data structure?   [2+2]

2. Define stack. Convert given infix expression to postfix showing stack status in each step: [2+6]

   $(A+B*(C+D/E)^F*G)$

3. Define linear queue and circular queue. Explain queue operation in circular queue.   [3+5]

4. Discuss advantages and disadvantages of recursion. Generate a recursion tree for TOH problem consisting 3-discs.   [3+5]

5. Differentiate between array implementation and Dynamic implementation of list with suitable example.   [4]

6. Write an algorithm and element after K^{th} node in doubly linked list. Explain the advantages and disadvantages of using doubly linked list.   [4+4]

7. Define almost complete binary tree. Construct a tree from its given preorder and inorder traversals.   [2+6]

   Inorder: EACKFHDBG

   Preorder: FAEKCDHGB

8. Write an algorithm for insertion sort. Sort the following number using radix sort: 141, 456, 342, 789, 90,2,870,192,938 and 243   [4+6]

9. Draw hash table obtained from double hashing with hash functions: $h1(K) = K \bmod 11$ and $h2(K) = K \bmod 9$ for the given keys: 76,36,47,49,21,65 with table size 11. Use $hp(k,i) = (h1(k) + i * h2(k)) \bmod m$.   [8]

10. Explain Big-oh notation with its significance and limitation.   [4]

11. What is minimum spanning tree? Explain Warshall's algorithm with example.   [2+8]

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define ADT and construct ADT of Linked List using value definition and operator definition. [2+4]

2. Define stack. How to convert infix to postfix notation? Explain with example. Evaluate the postfix expression AB+C*DEFG-*+with status of stack where $A = 2$, $B = 3$, $C = 10$, $D = 5$, $E = 2$, $F = 4$ and $G = 6$. [2+4+4]

3. Explain array representation of list? How does it differ from dynamic list? [4+2]

4. Write algorithms of implementation of stock and queue using singly linked list. [10]

5. How recursive algorithm uses STACK to store intermediate results, illustrate with an example? Distinguish between normal function and recursive function. [5+3]

6. Explain deletion of node with one child in BST with suitable example. Construct a B-tree of order 5 for following data: 82, 12, 22, 23, 56, 96, 37, 99, 59, 74, 28, 65, 60 and 44. [5+5]

7. Explain shell sort. Sort the numbers 92, 83, 22, 49, 36, 98, 12, 9, 70 and 51 using shell sort. [4+4]

8. Compare sequential search with binary search. Discuss about linear probing and quadratic probing. [5+5]

9. Describe the importance of growth function in algorithm. Discuss about theta function, Big-Oh function and Omega function. [2+4]

10. Write an algorithm for Warshall's algorithm and illustrate with an example. [6]

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Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
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1. Define data structure with its importance. [4]

2. Convert A + B - C * (D - E + F/G) / H expression into postfix expression using stack. [10]

3. Define queue. Explain enqueue and dequeue operation with example. [1+4]

4. Write algorithms of insertion and deletion of data in array implementation of lists. [6]

5. How do you delete a node at the end of the doubly linked list? Explain how the addition of polynomial equations is done using linked list. [5+5]

6. What is tree recursion? Write an algorithm for TOH with 'n' disks and generate a recursion tree of TOH problem with 3 disks. [1+3+4]

7. Discuss about AVL rotations with suitable examples. Create a AVL balanced tree for data sequence 10 20 30 50 45 40 8 5 3. [6+6]

8. Explain selection sort. Sort data sequence 40 90 20 -10 30 5 60 100 80 using selection sort method. [10]

9. Define big-O notation and Big-Ω notation with their respective curves. [5]

10. Explain Depth first traversal in graph. Create minimum spanning tree for the following graph using Kruskal's algorithm. [4+6]
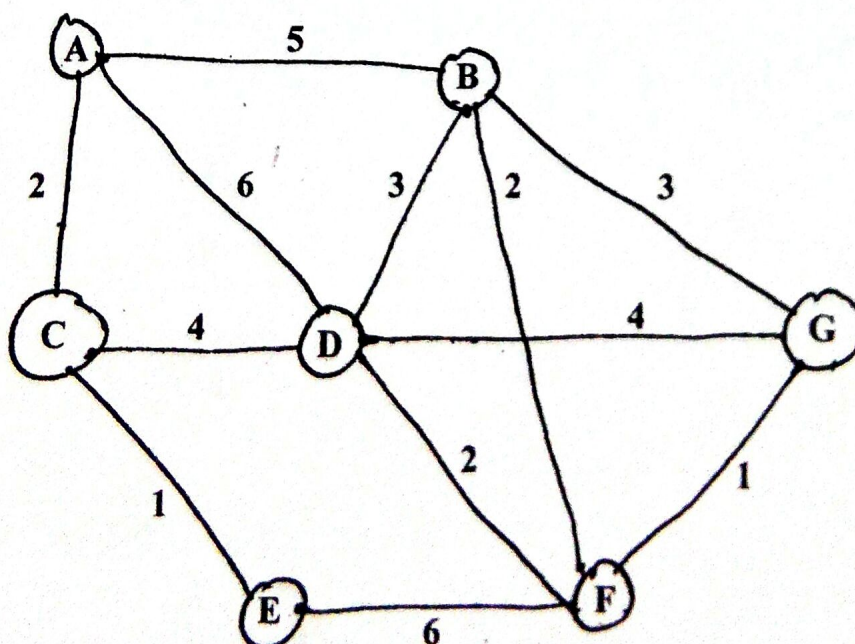
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Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
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1. Differentiate between primitive and non-primitive data structure. [4]

2. Explain how a circular queue differ from linear queue with suitable example. Show status of stack while converting following infix expression to postfix expression: $A+B-(C*D/E+F)-G*H$. [5+5]

3. Differentiate between a static and dynamic list structure and write an algorithm forgetnode () and freenode () of static list structure. [2+2+2]

4. How do you perform a push and pop operation in stack as a linked list? How do you insert and delete a node at the kth position of the doubly linked list. [5+5]

5. Explain how a recursive algorithm uses stack with suitable illustrative stack diagram. [8]

6. Draw a binary Tree: [6]

   Preorder F A E K C D H G B
   In order E A C K F H D B G

7. Prove that strictly binary tree with a n leaves contain 2n-1 nodes. [6]

8. Provide best case, average case and worst case for following algorithms in Big-Oh: bubble sort, insertion sort, merge sort and selection sort. Construction heap sort for following given list with an algorithm: 37, 33, 26, 92, 57, 18, 48, 25, 12, 86, 42, 22. [2+6]

9. Explain a binary search with example. Consider a hash table of size 10. Using linear probing, insert the keys 62, 37, 36, 44, 67, 91, 82 and 107. [3+5]

10. Define Omega and theata notation with suitable example. [4]

11. Write an algorithm for warshall's algorithm with suitable example. Define Breadth first traversal and depth first traversal with an example. Define Kruskal's Algorithm with suitable example. [3+3+4]
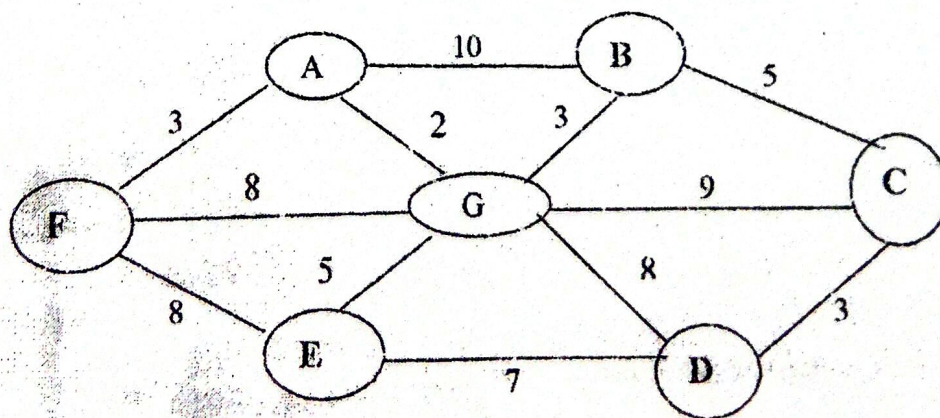
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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Describe value definition and operator definition of ADT and apply it to describe STACK. [4]

2. What is a stack data structure? Is stack a linear or non linear data structure. [3+2]

3. When do you get error message "Queue overflow and Queue underflow"? Explain with example. [2+3]

4. How do you implement array to represent queue as list? [6]

5. In a linked list data cannot be accessed randomly, Justify with suitable example. Write complete algorithm to implement circular queue linked list. [2+8]

6. Explain a Tower of Hanoi for '3' disks and also generate recursion tree. Explain the basic principle of recursion with example. [6+2]

7. Write an algorithm to implement a Binary Search Tree using doubly linked list. [6]

8. Describe an AVL tree. Construction AVL tree for following sequence of elements 3, 2, 1, 4, 5, 6, 7, 16, 15, 14, 13, 12 [2+4]

9. Explain Radix sort and sort the numbers 345, 654, 924, 123, 56, 72, 555, 808, 911 and 57. [8]

10. Write down the algorithm for binary search with suitable example. [8]

11. Explain about Big-oh notation with its significance and limitation. [4]

12. Explain Kruskal algorithm for finding minimum spanning tree in a graph. [10]

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Exam.		Regular	
Level	BE	Full Marks	80
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Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
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1. Define a data structure? Explain the basic data structure operations. [4]

2. What is a stack? Write an algorithm to convert infix expression into postfix expression using stack. [1+4]

3. Define a queue. Explain enqueue and dequeue operation in circuit queue. [1+4]

4. Differentiate static and dynamic implementation of list with suitable example. [6]

5. Define different types of linked list with suitable example. [5]

6. Write an algorithm creates a single linked list. [5]

7. Do you think recursive function is slow? Compare recursive and non-recursive functions. Draw recursion tree for Tower of Hanoi assuming 4 disks. [1+2+5]

8. Create an AVL balanced tree for the set of data 10, 20, 30, 35, 50, 70, 40, 80, 60, 65 by explaining each rotation rules used. [6]

9. Construct B-tree of order 5 for the set of data C N G A H E K Q M F W L T Z D P R X Y S showing each steps. [6]

10. Define a radix sort with its algorithm. Trace the steps to sort the following set of data using merge sort: 85, 76, 46, 92, 30, 41 and 12. [5+3]

11. How a linear probing, quadratic probing and double hashing techniques are used to resolve collision? Explain with suitable example. [8]

12. Define an Omega and Theta notation with suitable example. [4]

13. Explain a breadth first traversal in graph with suitable example. Explain Kruskal's algorithm to find minimum spanning tree with suitable example. [5+5]

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Exam.		New Back (2066 & Later Batch)	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm (CT552)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Define a data-structure and also write down the difference between primitive data structure and non-primitive data structure. [2+2]

2. Convert $a*b^c-d+(e/f*g)/(k-1)$ into prefix and postfix expression. Write an algorithm for top of stack fix stack operation. [4+3]

3. Write an algorithm to design a data structure that provides enqueue, dequeue and display operations. The first two are the normal circular queue operations and the last one returns all elements in the circular queue without removing them from queue. [5]

4. Why do you choose either static implementation or dynamic implementation for list? State the reasons. [4]

5. Define a doubly linked list with its advantages and disadvantages. Write an algorithm to insert an element before K^{th} node in doubly linked list. [3+3]

6. Explain how do you add two polynomials using linked list. [4]

7. Define a recursion. Which algorithm would you refer between iterative and recursion. [1+2]

8. Explain TOH problem with its solution for 'n' disks. [5]

9. Define Huffman tree with its properties and example. Construct a B-tree of order 3 for given set of data: 52, 46, 27, 81, 90, 108, 72, 110, 35, 115, 121 and 86. [6+6]

10. Create a heap tree showing each insertion steps for the following data. Use the same heap tree to sort the data showing each intermediate steps 14, 12, 25, 18, 21, 29, 11, 28, 23. [8]

11. Explain a binary search with example. Explain the chaining strategy for collision resolution. [4+4]

12. Define Big O, Big Omega and Big Theta notation. [4]

13. What are the differences between DFs and BFs? [5]

14. Find the minimum spanning tree of the following graph using KrusKals algorithm. [5]
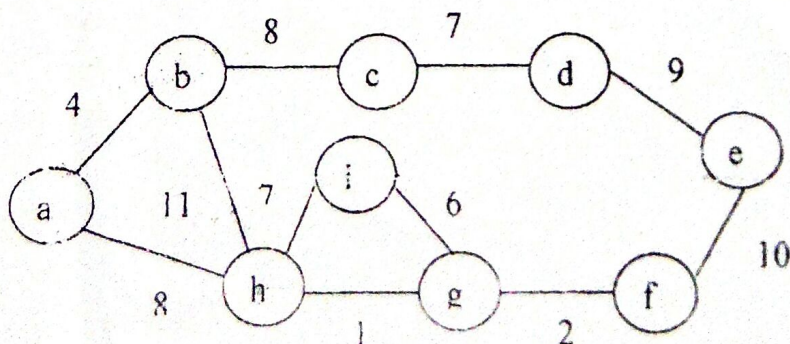
Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
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1. Differentiate between ADT and Data Structure. What are the significant traits of good algorithm? [2+2]

2. a) What is the importance of postfix expression? Convert the given infix expression (a+b*c+(d/e*f)-g) into equivalent postfix expression showing the status of stack in each steps. [2+3]

   b) How elements are inserted and deleted in circular queue? Explain with example. [5]

3. Compare static and dynamic implementation of list with suitable example. [6]

4. Suppose you have a doubly linked list that stores bank customers information. Explain how a customer with account number 00056PR can be deleted and how a new customer can be inserted. What is the difference in this implementation relative to singly linked list? [6+4]

5. a) What are the main characteristics of recursion? Write three methods for solving recurrences. [2+2]

   b) How do you solve TOH using recursion? Show the steps to solve TOH problem for 3 disks. [4]

6. a) Construct expression tree for (a+(b*c)-d+(e*f/g)) and traverse it according to pre-order and in-order traversal algorithm. [6]

   b) Write an algorithm for the insertion of B-Tree. Create an AVL tree for the following data: jan, feb, mar, apr, may, jun, jul, aug, sep, oct, nov, dec [6]

7. Discuss the algorithm merge sort. Show the steps to sort the data 5, 2, 4, 6, 1, 3, 2, 6 using merge sort. [3+5]

8. What is collision? What are the techniques used for collision resolution in hashing technique? Explain two different methods with suitable example. [8]

9. Why do we use asymptotic notations during algorithm analysis? Show that whether the following assertion is true or false, justify. [1+3]

   $1/2 \, n(n-1) \in \Theta \, (n^2)$

10. a) Define graph with its different representation techniques. [1+3]

    b) Discuss Dijkstra's shortest path algorithm. Find the shortest paths for given graph with source node 'F' using Dijkstra's algorithm. [2+4]
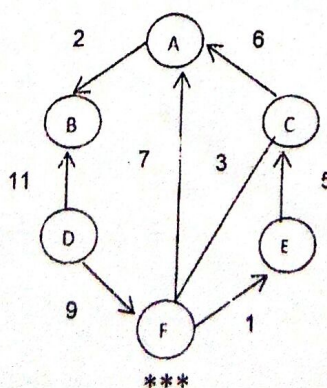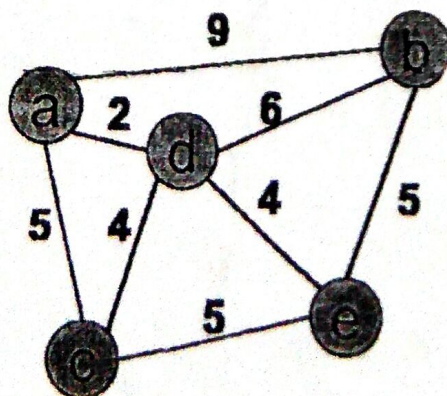

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Exam.		New Back (2066 & Later Batch)	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithms *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What do you mean by data structure? What are the different types of data structures and operations that can be carried out on them?   3   [1+3]

2. a) Define Stack. Write an algorithm to convert given infix expression to postfix expression.   4   [1+4]

   b) What is polish notation and reverse polish notation? Convert the following expression to postfix expression using Stacks: P: (a + b * c + (d * e + f) * g)   3   [2+3]

3. Implement a linear queue as a list by using static implementation. Write pseudo code for this implementation.   [6]

4. a) Mention the significance of circular linked list with suitable example. 2   [5]

   b) Explain how you add two polynomials with the help of linked list. 2   [5]

5. a) Explain direct and indirect recursion with suitable example. 2   [4]

   b) What is box trace? Construct a recursion tree for tower of Hanoi problem consisting of 3 disks. 3   [1+3]

6. a) Discuss the advantage of AVL Tree. Construct an AVL Tree for given integers: 52, 65, 72, 15, 11, 32, and 20. 6   [2+5]

   b) Define an almost complete binary tree. Show that the depth of complete binary tree is $\log_2(T + 1) - 1$ where T is the total number of nodes in a tree.   [2+3]

7. Trace the sorting steps in merge sort and radix sort for sorting the data 142, 523, 228, 375, 462, 198, 249, 144, 123 in ascending order.   [8]

8. How does quadratic probing help to reduce bad clustering problem associated with linear probing. Insert the following data elements into hash table using hash function $h(k) = k \bmod m$, take m = 13, assume collisions are handled by chaining.   [2+6]

   Keys for hashing are: 5, 28, 19, 25, 20, 43, 22, 27, and 30.

9. What is the usage of asymptotic notation? Explain big-O notation with its properties.   [1+3]

10. Write two properties of spanning tree. Find MST of graph-1 using Round Robin Algorithm.   [2+8]
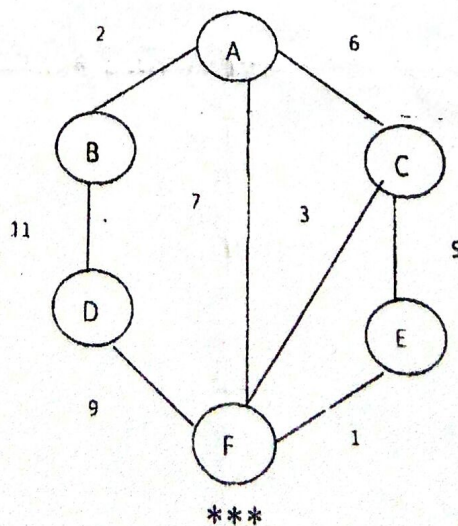

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure & Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define ADT with suitable example. [4]

2. a. Define Stack. How does static implementation and dynamic implementation of stack differ? Explain. [1+4]
   b. What is queue? Explain enqueue and dequeue operation. [1+4]

3. Explain array implementation of list. State the reason why would you choose either static implementation or dynamic implementation for list. [3+3]

4. a. Define different types of linked list with suitable example. [5]
   b. Explain how you insert and delete k^{th} element in doubly linked list. [5]

5. a. What are the conditions for solving the problems recursively? [3]
   b. Explain TOH problem with its solution for 'n' disks. [5]

6. a. Explain different traversal methods for a binary tree. What will be the result of pre-order traversal for given binary search tree with nodes: 20, 10, 18, 4, 8, 5, 13, 16, 47, 1, and 27 [3+4]
   b. Write down the properties of B-tree. Construct a B-tree of order 5 for following data: 3, 14, 7, 1, 8, 5, 11, 17, and 13? [2+3]

7. Explain radix sort. Sort the given data 32, 45, 60, 83, 75, 43, 70, and 69 using radix sort. [3+5]

8. Write down the algorithm for binary search with suitable example. What is the complexity of binary search? [6+2]

9. Define Omega and Theta notation with suitable example. [4]

10. a. Discuss depth first traversal for graph with example. [5]
    b. What do you mean by minimum spanning tree? Find out the minimum spanning tree for given graph using Kruskal's algorithm. [5]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. What are different types of data structures? Give an example of abstract data type. [1+3]

2. Convert the following infix expression into postfix and also evaluate it: [4+1]

    A+(B*C-(D/E^F)*G)*H

3. Write an algorithm to implement circular queue with the condition for insertion, deletion, queue full and queue empty. [5]

4. Write algorithms to insert and delete a node before a node in a singly linked list. How can you implement stack and queue using linked list? [5+5]

5. What is list? Explain the operations that can be performed in lists. [2+4]

6. What is tail and non-tail recursion with example? Write an algorithm for solving a Tower of Hanoi (TOH) problem using recursion. [3+5]

7. What is an almost complete binary tree? Create an AVL tree using the following data sets: jan, feb, mar, apr, may, jun, july, aug, sept, oct, nov, dec. [2+4]

8. Define Red Black tree. Write an algorithm for constructing a Huffman Code. [2+4]

9. Differentiate between stable and unstable sorting with example. Construct a heap for the following data: 8, 10, 5, 12, 14, 18, 19. What is the time complexity for sorting the unsorted elements using heap-sort? [2+4+2]

10. What is the importance of using Sentinel during sequential searching? Explain three different methods of collision resolution with reference to hashing. [2+6]

11. Justify $\frac{1}{2}(n(n-1)) \ \varepsilon \ n^2$. Differentiate between small o and small ω notations. [2+2]

12. What is transitive closure? How is the breadth first algorithm implemented? Explain Prim's algorithm for finding minimum spanning tree along with an example. [2+3+5]

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Exam.		Regular (2066 & Later Batch)	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data structure and Algorithm *(CT552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define data type and define abstract type (ADT) with suitable example. [4]

2. a) Evaluate the following postfix expression showing stack after every step in tabular form: 574-*8/4+ [5]

   b) Define linear and circular queue. Write down algorithms for basic operations that can be performed over linear and circular queues. [5]

3. What do you mean by static and dynamic data structures? Explain array implementation of list with its limitations. [2+4]

4. a) What are linked list? What are the basic operations of a linked list? [3]

   b) Suppose you have a doubly linked list that stores employee information. Explain how an employee with employee ID 165-64 can be deleted from the list with necessary illustrations and pseudo codes. [7]

5. a) Discuss TOH problem with its solution for 3 discs. [4]

   b) Define recursion. What do you mean by direct and indirect recursion? Explain with example. [2+2]

6. Show the sequence of nodes in preorder and postorder traversal in the BST formed by 52, 38, 40, 27, 20, 66, 55, 46, 60, 26, 5, 68, 23, 54. Construct B-tree from the data set given by 78, 21, 14, 11, 97, 85, 74, 63 showing each insertion steps. [6+6]

7. Differentiate internal and external sorting. Explain heap sort with an appropriate example. [2+6]

8. Draw the hash table obtained from double hashing with hash functions: $h_1(k)=k \bmod 11$ and $h_2(k) = k \bmod 9$ to the keys given by: 76, 26, 37, 59, 21, 65 with table size m = 11. Use $hp(k, i) = (h_1(k) + i*h_2(k))\bmod m$. [8]

9. If you have two different algorithms for the solution to same problem with $O(n)$ and $O(\log(n))$, which one would you prefer and why? [4]

10. a) Explain depth first traversal and breadth first traversal in graph with suitable example. [5]

    b) Discuss Dijkstra's shortest path algorithm with suitable example. [5]

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Exam.	**New Back (2066 & Later Batch)**			
Level	BE	Full Marks	80	
Programme	BCT	Pass Marks	32	
Year / Part	II / II	Time	3 hrs.	

Subject: - Data Structure and Algorithm *(EX551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What do you mean by Abstract Data Type (ADT)? Give an example to illustrate implementation of an ADT. [4]

2. a) Define Stack with suitable example. Write down the algorithm for the basic operation that can be performed over the stack. [1+3]

   b) Convert the given infix expression (A + (B*C–(D/E–F)*G)*H) into equivalent prefix and postfix expressions showing each steps in tabular form. [6]

3. Discuss merits and demerits of contiguous list. Explain static implementation of list. [2+4]

4. a) How doubly linked list differ from singly linked list. Write an algorithm for deleting K^{th} node from the doubly linked list. [2+3]

   b) How do you represent polynomial equation using linked list? Write an algorithm to add two polynomial equations. [2+3]

5. Write an algorithm for TOH problem. Hence find all solution for three disks from your algorithm, showing recursion tree for the same. [3+5]

6. a) What are the properties of a Binary Search Tree (BST)? Explain recursive algorithm to search a BST. [3+5]

   b) If you delete a Node from an AVL tree and insert it back again, will you always get the original tree back? Illustrate with example. [4]

7. Trace the sorting steps in radix sort for: 25, 57, 48, 37, 12, 92, 86, 33 showing status of all queues in each iterations. Show that efficiency of quick sort is O(n log (n)). [5+3]

8. Write down the algorithm for binary search. Show steps to search 54 from the given data 8, 15, 36, 40, 41, 54, 62 using binary search. [4+4]

9. Define Θ, O and Ω notation with their respective curves. [4]

10. Explain Dikstra's shorest path algorithm with suitable example. Use Round Robin's algorithm to find minimum weight spanning tree from following graph. [6+4]
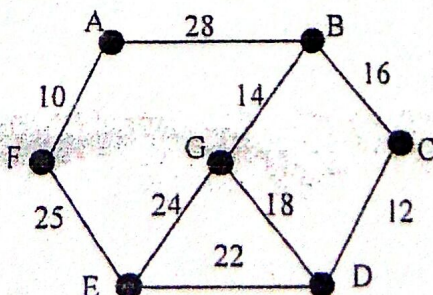
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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structure and Algorithm

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Define data structures. Explain ADT with suitable example. [4]

2. Suppose you are asked to simulate people waiting in a petrol pump, which data structure would you use? Discuss suitable algorithm required for your simulation. [4]

3. Convert the given infix expression A/B-(C+D)*E into equivalent postfix expression showing each steps in tabular form and evaluate the obtained postfix expression showing STACK status each time when A=8, B=2, C=3, D=1 and E=1. [6]

4. What are the considerations to be taken while developing an algorithm using linked list? Explain array implementation of list in C with suitable example. [6]

5. Differentiate singly linked list from doubly linked list. Write an algorithm for the dynamic implementation of queue. Also verify your algorithm with necessary illustrations. [2+6+2]

6. Define recursion. Which algorithm would you prefer between iterative and recursive for the Fibonacci sequence and why? Discuss TOH problem and its solution. [8]

7. Write an algorithm for inserting nodes in BST. Encode the symbols A, B, C, D, E and F with frequencies 0.10, 0.08, 0.15, 0.12, 0.30 and 0.25 respectively by using Huffman algorithm. Also calculate average number of bits used to encode a symbol. [4+6+2]

8. Write an algorithm for any one of the exchange sort. Trace the sorting steps in merge sort for the data: 47,27,56,23,3,9,94,11. Calculate efficiency of straight selection sort. [3+3+2]

9. Use binary search to find 89 from the data: 8,12,20,24,30,45,50,68,72,85,89,98. Define hashing and demonstrate different hash functions. [3+5]

10. Illustrate measures of efficiency of algorithm with standard curve and problem size. [4]

11. Explain Prim's algorithm for minimum spanning tree with suitable example. Let G=(V,E) with V={a,b,c,d} and E={(a,d),(b,a),(b,c),(c,a),(c,d),(d,c)} be a directed graph. Find the transitive closure of G using Warshall's algorithm, showing each iterations. [4+6]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Data Structures and Algorithms

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Define data types. Classify algorithms and explain any one that you have studied. [4]
2. In some unfair customer service centre, a person who comes at last gets services at first and the persons who come at first are still waiting for the services up to last. Devise a suitable algorithm required for the simulation of this system. [4]
3. Convert the given infix expression (A+B)*(C-D) into equivalent postfix expression showing each steps in tabular form and evaluate the obtained postfix expression showing STACK status each time when A=5, B=7, C=9 and D=4. [6]
4. Explain array implementation of list in C with suitable example. What are limitations of this implementation? [6]
5. Define doubly linked list and mention its merits. Devise an algorithm that overcomes the demerits of array implementation of stack. Also verify your algorithm with necessary illustrations. [2+6+2]
6. State properties of recursion. Why recursive method for Fibonacci sequence is not preferred? Write an algorithm for TOH problem and use it to find the solution for three disks. [8]
7. Create an AVL tree from the data: 24,12,8,15,35,30,57,40,45,78. How can you resolve underflow problem in B-tree? Discuss with reference to balance and combine. Define Red-Black tree and mention its purpose. [5+5+2]
8. Write any sorting algorithm of your choice. Trace the sorting steps in straight selection sort for the data: 33,90,45,8,52,76,5,22. Calculate efficiency of quick sort. [3+3+2].
9. What is sequential search and how sentinel is useful in this algorithm? Define hashing and discuss different collision resolution techniques in hashing. [3+5]
10. Define O, Θ and Ω notations with corresponding curves. [4]
11. Write Kruskal's algorithm for minimum spanning tree. Let G=(V,E) with V={a,b,c,d,e} and E={(a,c),(b,c),(b,d),(c,d),(d,e)} be a directed graph. Find the transitive closure of G using Warshall's algorithm, showing each iterations. Also draw initial and final graphs. [2+8]

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