

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
May/June, 2019

Mark scored:

Level : B.E./B.Sc.  
Year : II

Course : COMP 202  
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 06 JUN 2019

SECTION "A"

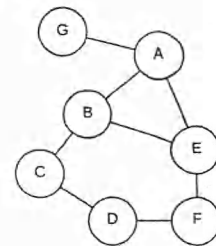
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate answer from the alternatives given. All symbols have their usual meanings.

- If the algorithm algo1 has an efficiency factor of  $5n$ , what is the run-time efficiency of the following program segment?  
for ( $i = 1; i \leq n; i++$ )  
    algo1( $i$ );  
a.  $O(n)$                       b.  $O(n^2)$                       c.  $O(1)$                       d.  $O(\log n)$
- Which of the following is true?  
a.  $N \log N + N^2 = O(N \log N)$                       b.  $N^2 \log N + N^2 = O(N^2)$   
b.  $N^{1/2} + \log N = O(\log N)$                       d. None of the mentioned.
- Which of the following sort algorithm is guaranteed to be  $O(n \log n)$  even in the worst case?  
a. Quick Sort                      b. Merge Sort                      c. Insertion Sort                      d. Selection sort
- The equivalent postfix expression for the infix expression  $U * W - X / Y + Z$  is  
a.  $UW*XY/-Z+$                       b.  $UW*XY/Z+-$                       c.  $UWXYZ+/-*$                       d.  $UW*-XY/Z+$
- One difference between a queue and a stack is:  
a. Queues require linked lists, but stacks do not.  
b. Stacks require linked lists, but queues do not.  
c. Queues use two ends of the structure; stacks use only one.  
d. Stacks use two ends of the structure, queues use only one.
- If data is a circular array of  $N$  elements, and  $rear$  is an index into that array, what is the formula for the index after  $rear$ ?  
a.  $(rear \% 1) + N$                       b.  $rear \% (1 + N)$                       c.  $(rear + 1) \% N$                       d.  $rear + (1 \% N)$
- If  $getFront()$  is called on a priority queue that has exactly two entries with equal priority, which entry will be returned?  
a. One is chosen at random.  
b. The one which was inserted most recently.  
c. The one which was inserted first.  
d. This can never happen.
- How many nodes will have exactly two children in a binary tree with 8 leaf nodes?  
a. 10                      b. 9                      c. 7                      d. Cannot be determined

9. Select the FALSE statement about binary trees:
- Every binary tree has at least one node.
  - Every node has at most two children.
  - Every non-leaf node has at least one child.
  - Every node has at most one parent.
10. Which of the following collision resolution technique is the best when the amount of data is not known?
- Linear probing
  - Quadratic probing
  - Double hashing
  - Separate chaining
11. Insert the following sequence of keys in a hash table using the hash function  $h(\text{key}) = \text{key} \% 13$  with linear probing: 25, 98, 17, 21, 20, 72, 87. At what index, 20 will be stored?
- 7
  - 1
  - 8
  - 9
12. If the following operations are performed in an empty stack, what will be the content of the stack after the last operation? push(1), push(2), pop() push(3), push(2), pop(), pop(), push(4), pop(), push(3), push(1), push(4)
- 1 2 3 2 4 3 1 4
  - 1 2 3 2
  - 1 3 1 4
  - 4 3 1 4
13. A max heap is created and stored in an array from the following sequence of keys: 78, 98, 34, 49, 16, 41, 5. What will be the content of the array?
- 98, 78, 49, 16, 41, 34, 5
  - 78, 34, 98, 16, 49, 5, 41
  - 5, 16, 34, 41, 49, 78, 98
  - 98, 78, 41, 49, 16, 34, 5
14. Consider a binary search tree containing the following keys: 43, 3, 12, 6, 9, 10, 25, 8, 50. Which sequence of keys will be produced by in order traversal in this tree?
- 43, 3, 12, 6, 9, 8, 10, 25, 50
  - 3, 6, 8, 9, 10, 12, 25, 43, 50
  - 8, 10, 9, 6, 25, 12, 3, 50, 43
  - 43, 3, 50, 12, 6, 25, 9, 8, 10
15. What is the worst-case time for sequential search finding a single item in an array?
- Constant time
  - Logarithmic time
  - Quadratic time
  - Linear time
16. If G is a directed graph with 20 vertices, how many boolean values will be needed to represent G using an adjacency matrix?
- 20
  - 40
  - 200
  - 400

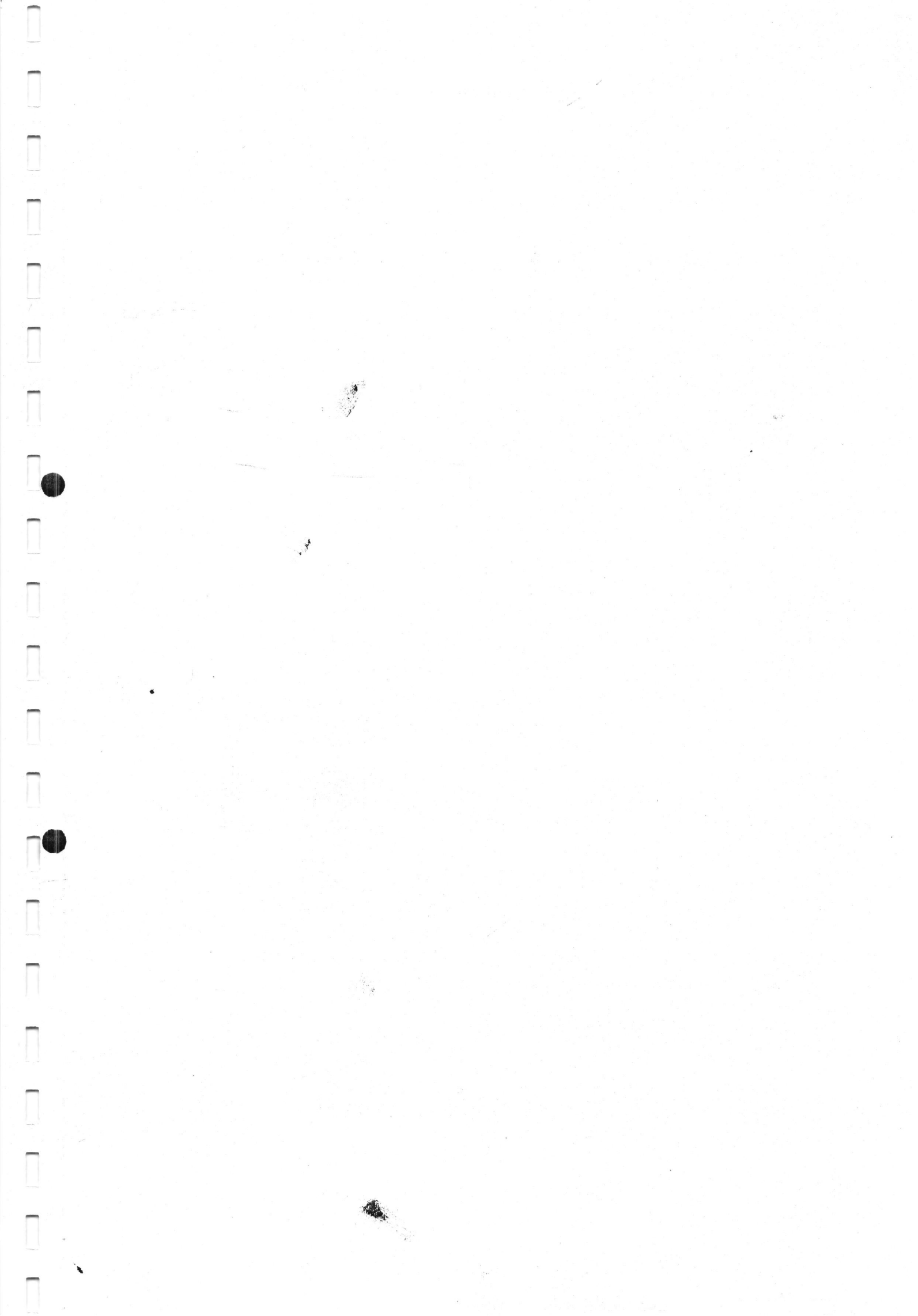
17. In the following graph, what would be the sequence of vertices if depth-first traversal is performed starting from the vertex A?
- AGBECDF
  - AEBGFCD
  - ABEFDCG
  - AEFDCGB



18. Which of the following is not a spanning tree of the above graph of Question 17?
- $\langle \{A, B, C, D, E, F, G\}, \{\{A, B\}, \{A, E\}, \{A, G\}, \{B, C\}, \{C, D\}, \{D, F\}\} \rangle$
  - $\langle \{A, B, C, D, E, F, G\}, \{\{A, E\}, \{A, G\}, \{B, E\}, \{B, C\}, \{C, D\}, \{D, F\}\} \rangle$
  - $\langle \{A, B, C, D, E, F, G\}, \{\{A, B\}, \{A, E\}, \{A, G\}, \{B, E\}, \{C, D\}, \{D, F\}\} \rangle$
  - $\langle \{A, B, C, D, E, F, G\}, \{\{A, B\}, \{A, G\}, \{B, E\}, \{E, F\}, \{C, D\}, \{D, F\}\} \rangle$

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19. In a selection sort of  $n$  elements, how many times is the swap function called in the complete execution of the algorithm?
- a. 1                      b.  $n - 1$                       c.  $n \log n$                       d.  $n^2$
20. While sorting an array of eight integers using heapsort, after performing reheapifications  $n$  times, the array now looks like as below:  
6 4 5 1 2 7 8  
Then, how many reheapifications downward have been performed so far?
- a. 1                      b. 2                      c. 3 or 4                      d. 5 or 6



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0-6 JUN 2019

Level : B. E./B. Sc.  
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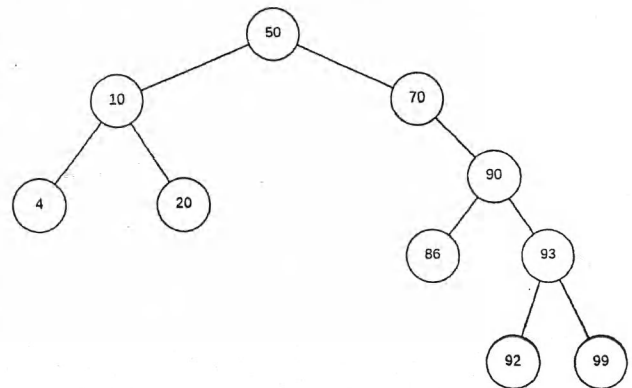
Course : COMP 202  
Semester : I  
F. M. : 40

SECTION "B"

[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Write an algorithm to construct a binary search tree from user given list of keys. What is the time complexity of your algorithm? [2 + 2]
2. Using a stack, determine the value of the following postfix expression. Also, show the content of the stack in each step of the evaluation process.  
X Y Z -A \* /  
where A = 2, X = 3, Y = 4, Z = 5.
3. Which data structure would you use in the following systems or programs? Explain your choice. [1 + 1 + 1 + 1]
  - a. A program to determine if the input string is a palindrome. A palindrome is a word, number, or other sequence of characters which reads the same backward as forward.
  - b. A program to find the order of files for compilation or to find which files can be compiled in parallel
  - c. A program to keep track of files inside a directory
  - d. A system to minimize waiting customers and idle tellers in a bank
4. Discuss linked list implementation of a queue. Illustrate it with appropriate figures wherever necessary. [4]
5. Compare and contrast selection sort algorithm and insertion sort algorithm. Apply selection sort algorithm to for the given sequence of keys: [2 + 2]  
45, 2, 89, 12, 37, 16, 3, 2, 70, 55, 88, 90
6. What is a priority queue? Explain how a priority queue can be implemented using a heap data structure. [1 + 3]
7. Consider the following binary search tree and answer the following questions:
  - a. What is the balance factor of this tree? [1]
  - b. Perform infix traversal on this tree. [1]
  - c. Insert the following keys into the tree and draw the resulting tree: [1]  
63, 7, 34, 82, 22, 89, 88
  - d. Remove 70 from the tree and draw the resulting tree. [1]



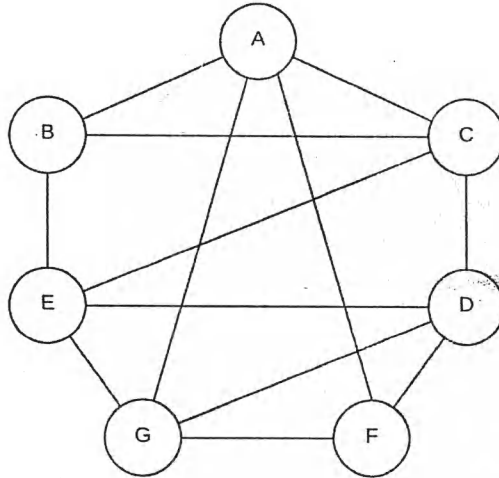
SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Explain the principle behind merge sort. Discuss the worst-time complexity of merge sort. Apply merge sort algorithm to sort the following list of elements: [2 + 2 + 4]  
98, 23, 25, 1, 96, 34, 21, 34, 55, 1, 3, 2, 5

9. Consider the following graph and answer the following questions:



- a. List the degree of all vertices in this graph. [1]  
b. Draw both the adjacency matrix and adjacency list representations of this graph. [2]  
c. What is a spanning tree? [1]  
d. Construct a spanning tree of this graph by performing depth-first search (DFS) starting from vertex A. [2]  
e. Construct a spanning tree of this graph by performing breadth-first search (BFS) starting from vertex A. [2]
10. What is a hash table? Give some examples of hashing methods. Why does a collision occur during hashing? Give an example of a hash function that can result in a collision. Explain briefly how such collisions can be resolved. [1 + 2 + 1 + 1 + 3]