Marks Obtained:

KATHMANDU UNIVERSITY
End-Semester Examination [C]
July, 2017

Level : B. E. /B. Sc.		Course	: COMP 202
Year : II		Semester	: I
Exam Roll No. :	Time: 30 mins.	F. M.	: 10
Registration No.:		Date	: JUL 0 5 2017

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Circle the most appropriate answer.

1. Suppose you are doing a sequential search of the list [15, 18, 2, 19, 18, 0, 8, 14, 19]. How many comparisons would you need to do in order to find the key 18?
   a. 5 b. 10 c. 4 d. 2

2. Suppose you have the following sorted list [3, 5, 6, 8, 11, 12, 14, 15, 17, 18] and are using the recursive binary search algorithm. Which group of numbers correctly shows the sequence of comparisons used to search for the key 16?
   a. 11, 14, 17 b. 18, 17, 15 c. 14, 17, 15 d. 12, 17, 15

3. Which of the following time complexities describes the removal of an element from an array in the worst case?
   a. O(1) b. O(n) c. O(n logn) d. O(logn)

4. What is the worst case time complexity of searching in a sorted list using linear search?
   a. O(n) b. O(logn) c. O(1) d. O(n logn)

5. The following postfix expression with single digit operands is evaluated using a stack:
   8 2 3 ^ / 2 3 * + 5 1 * -
   Note that ^ is the exponentiation operator. The top two elements of the stack after the first * is evaluated are:
   a. 6, 1 b. 5, 7 c. 3, 2 d. 1, 5

6. The result evaluating the postfix expression 10 5 + 60 6 / * 8 – is
   a. 284 b. 213 c. 142 c. 71

7. Given a hash table T with 25 slots that stores 2000 elements, the load factor α for T is _____
   a. 80 b. 0.0125 c. 8000 d. 1.25

8. Consider the following array of elements. [89, 19, 50, 17, 12, 15, 2, 5, 7, 11, 6, 9, 100] . The minimum number of interchanges needed to convert it into a max-heap is:
   a. 4 b. 5 c. 2 d. 3

9. Consider a binary tree T that has 200 leaf nodes. Then, the number of nodes in T that have exactly two children are _____.
   a. 199 b. 200
   c. Any number between 0 and 199 d. Any number between 100 and 200

10. Assume that a mergesort algorithm in the worst case takes 30 seconds for an input of size 64. Which of the following most closely approximates the maximum input size of a problem that can be solved in 6 minutes?
    a. 256 b. 512 c. 1024 d. 2048

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11. Consider the following recursive C function. If get(6) function is being called in main() then how many times will the get() function be invoked before returning to the main()?

```
void get (int n)
{
  if (n < 1) return;
  get(n-1);
  get(n-3);
printf("%d", n);
}
```

a. 15 b. 25 c. 35 d. 45

12. Following is C like pseudo code of a function that takes a Queue as an argument, and uses a stack S to do processing.

```
void fun(Queue *Q)
{
   Stack S;  // Say it creates an empty stack S

   // Run while Q is not empty
   while (!isEmpty(Q))
   {
      // deQueue an item from Q and push the dequeued item to S
      push(&S, deQueue(Q));
   }

   // Run while Stack S is not empty
   while (!isEmpty(&S))
   {
     // Pop an item from S and enqueue the popped item to Q
enQueue(Q, pop(&S));
   }
}
```

What does the above function do in general?

a. Removes the last from Q
b. Keeps the Q same as it was before the call
c. Makes Q empty
d. Reverses the Q

13. Which of the following is a true about Binary Trees?

a. Every binary tree is either complete or full.
b. Every complete binary tree is also a full binary tree.
c. Every full binary tree is also a complete binary tree.
d. No binary tree is both complete and full.
e. None of the above

14. What is common in three different types of traversals (Inorder, Preorder and Postorder)?

a. Root is visited before right subtree
b. Left subtree is always visited before right subtree
c. Root is visited after left subtree
d. All of the above
e. None of the above

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15. What is the time complexity of Build Heap operation. Build Heap is used to build a max(or min) binary heap from a given array. Build Heap is used in Heap Sort as a first step for sorting.
a. O(n logn) b. $O(n^2)$ c. O(logn) d. O(n)

16. What does the following function do for a given binary tree?

```
int fun(struct node *root)
{
  if (root == NULL)
    return 0;
  if (root->left == NULL && root->right == NULL)
    return 0;
  return 1 + fun(root->left) + fun(root->right);
}
```

a. Counts leaf nodes
b. Counts internal nodes
c. Returns height where height is defined as number of edges on the path from root to deepest node
d. Return diameter where diameter is number of edges on the longest path between any two nodes.

17. What is the worst case time complexity for search, insert and delete operations in a general Binary Search Tree?
a. O(n) for all
b. O(logn) for all
c. O(logn) for search and insert, and O(n) for delete
d. O(logn) for search, and O(n) for insert and delete

18. Which of the following is true about linked list implementation of stack?
a. In push operation, if new nodes are inserted at the beginning of linked list, then in pop operation, nodes must be removed from end.
b. In push operation, if new nodes are inserted at the end, then in pop operation, nodes must be removed from the beginning.
c. Both of the above
d. None of the above

19. Which of the following is true about linked list implementation of queue?
a. In push operation, if new nodes are inserted at the beginning of linked list, then in pop operation, nodes must be removed from end.
b. In push operation, if new nodes are inserted at the end, then in pop operation, nodes must be removed from the beginning.
c. Both of the above
d. None of the above

20. Which of the following traversal outputs the data in sorted order in a BST?
a. Preorder b. Inorder c. Postorder d. Level order

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Year : II
Time : 2 hrs. 30 mins.

Course : COMP 202
Semester: I
F. M. : 40

SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Give the Big-O performance of the following code fragments. Provide justification to your answer. [2 + 2]

a.
```
for i in range(n):
    for j in range(n):
        for k in range(n):
            k = 2 + 2
```

b.
```
for i in range(n):
    k = 2 + 2
for j in range(n):
    k = 2 + 2
for k in range(n):
    k = 2 + 2
```

2. Convert the following infix expressions into prefix and postfix expressions: [1 × 4]
   a. A + B * C + D
   b. (A + B) * (C + D)
   c. A * B + C * D
   d. A + B + C + D

3. Differentiate between linear and non-linear data types. Provide suitable examples. [2 + 2]

4. Define algorithms. Distinguish between best, worst and average complexities of an algorithm. [2 + 2]

5. Explain the concept of data type. Explain the various operations performed on data structures. [2 + 2]

6. Discuss the advantages and disadvantages of the link list and array-based implementations of a queue. [4]

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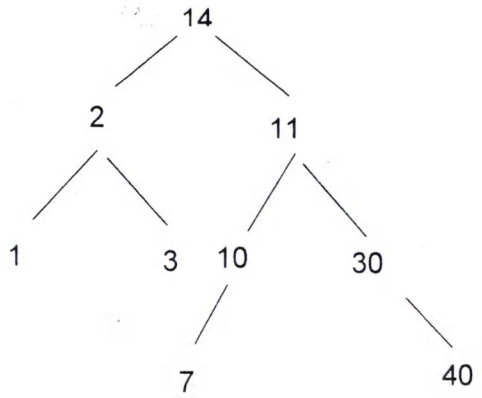
7. Define a binary tree as a data structure. [1+3]



Write the order of the nodes visited in:
a. An in-order traversal:
b. A pre-order traversal:
c. A post-order traversal:

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Define hashtables. What is the collision problem in hashtables? What are the approaches used for collision resolution? Briefly describe them with suitable illustrations. [2+2+4]

9. Explain the Search problem. Distinguish between linear, binary and interpolation search. Provide suitable examples. [2+4+2]

10. Explain the working mechanism of insertion sort algorithm with a pseudocode. Discuss the best and worst case scenarios. [4+4]