Department of Computer Science
Admission Test for PhD Program

Part I

Time : 30 min Max Marks: 15

Each Q carries 1 marks. ¼ mark will be deducted for every wrong answer. Part II of only those candidates will be evaluated who will score at least 6 marks in Part I.

1. Consider a linked list whose node has two fields: "info" field containing information and "next" field containing address of the next node in the list. The code to insert a node pointed to by q, at the end of the list is
   1) for (ptr = list; ptr-> next != Null; ptr = ptr->next)
      ptr -> next = q;
   2) for (ptr = list; ptr != Null; ptr = ptr->next)
      ptr -> next = q;
   3) for (ptr = list; ptr-> next != Null; ptr = ptr->next);
      ptr ->next = q;
   4) for (ptr = list; ptr != Null; ptr = ptr->next)
      ptr = q;

2. What will be the output of the following code segment, if the function is called as fn(10, 20) ?

```
int fn(int x, int y) {
        int temp = x;
        if (temp < y) {
                temp = y;
                return y;
        }
        else
                return x;
        cout << "Larger of " << x << " and " << y << " is " << max;
}
```

(1) Program will not compile as the function has two return statements.
(2) Larger of 10 and 20 is 10.
(3) Larger of 10 and 20 is 20.
(4) No output.

3. The internal data structure used by the system (compiler/assembler) to implement procedure calls is
   1) Arrays
   2) Linked list
   3) Queues
   4) Stacks

4. To insert an element into a sorted list, which of the following is true?
    1) The element can be inserted in a sorted array in constant time.
    2) The element can be inserted in a sorted linked list in constant time.
    3) The element can be inserted in a binary search tree in O(log n) time, where n is the number of elements in the list.
    4) None of the above.

5. You have an array of student records in descending order of their roll-numbers. Which algorithm will put the array in increasing order of the roll-numbers in minimum time?
    1) Insertion sort
    2) Quick sort
    3) Merge sort
    4) Selection sort

6. Consider Insertion Sort performed on an array of n elements. The number of comparisons performed by the algorithm to insert the ith element into the sorted sublist consisting of the first i – 1 elements in the worst case is

    1) n
    2) 1
    3) i - 1
    4) n -1

7. Consider the following algorithm to compute x^n for any x. Assume n = 2^m, where m is a non negative integer.

```
prod = x;
for i = 1 to m do
      prod = prod * prod;
Output prod;
```

   The recurrence relation for the time complexity of the above algorithm is
    1) T(n) = T(n/2) + 1
    2) T(n) = T(n-1) + n
    3) T(n) = 2*T(n/2) + 1
    4) None of the above

8. In the cable TV with multiple channels running several programs with commercial breaks, which of the following is/are used?
    1) Frequency Division Multiplexing only
    2) Time Division Multiplexing only

3) Both Frequency Division Multiplexing and Time Division Multiplexing
4) Code Division Multiplexing

9. What is the role of MAC sub-layer in computer networks?
    1) Map the IP addresses to MAC addresses.
    2) Control the access to the channel so that the chances of collision are reduced.
    3) Route the data frames from one LAN to another.
    4) Enhance the quality of the signal.

10. Http is a/an
    1) application layer protocol
    2) transport layer protocol
    3) network layer protocol
    4) Internet layer protocol

11. Which of the following is true?
    1) There is no internal fragmentation in paging scheme.
    2) There is no external fragmentation in segmentation scheme.
    3) There is no internal fragmentation in segmentation scheme.
    4) There is no fragmentation in paging scheme.

12. Which of the following sets of scheduling schemes suffer from the problem of starvation?
    1) Shortest Job First and Round Robin.
    2) Priority Scheduling and First Come First Serve.
    3) Round Robin and First Come First Serve.
    4) Shortest Job First and Priority Scheduling.

13. The binary representation of -16 in signed 2's complement requires at least _____bits.
    1) 4
    2) 5
    3) 3
    4) 6

14. A 32-bit processor has
    1) 32 registers
    2) 32 I/O devices
    3) 32 Mb of RAM
    4) a 32-bit bus and 32-bit registers

15. Cache memory enhances

1) memory capacity
2) memory access time
3) secondary storage capacity
4) secondary storage access time

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Part II

Time : 1 hour Max Marks: 30

1. Write a recursive function in C to compute the maximum of n elements in an array.
3
2. What is the difference between “int” and “long int” in a typical programming language?
1
3. What is the height of a binary search tree with n nodes in the worst case?
1
4. What is the difference between “data type” and “data structure”?
2
5. What are the main advantages and disadvantages of arrays over linked list?
2
6. Write a “for-loop” in C/C++/Java to insert an element x in an array A containing n elements at position k (k<n).
2
7. Which sorting algorithm is best suited to sort the roll numbers of the students in a university. The roll numbers are 7 digit numbers. What is the time complexity of the algorithm?
2
8. A large integer is an integer number that cannot be stored in a constant number of memory words and the number of words it requires grows as the value of the integer number grows. Give an algorithm to add two large integers.
3
9. What is the difference between local IP address and public IP address?
2
10. Give two advantages of framing, in a computer network.
2
11. Write -48 in 2’s complement representation.
2
12. What do you understand by a core-2-duo processor?
1
13. Differentiate between logical address and physical address. Explain very briefly with the help of an example.
3
14. What do you understand by virtual memory space? Explain very briefly with the help of an example.
2
15. What is the role of an operating system in a computer? Write in no more than 15 words. 2