

Department of Computer Science

Sample Paper for Admission to PhD Program

Part I

Time : 30 min

Max Marks: 15

Each Q carries 1 marks. $\frac{1}{4}$ 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 i th 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

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