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, after a node pointed to by p, is
   1) for (ptr = list; ptr-> next != p; ptr = ptr->next)
      { ptr -> next = q; q->next = ptr->next;}
   2) for (ptr = list; ptr != p; ptr = ptr->next)
      {ptr -> next = q; q->next = ptr->next;}
   3) for (ptr = list; ptr-> next != p; ptr = ptr->next);
      { ptr ->next = q; q->next = ptr->next;}
   4) for (ptr = list; ptr != p; ptr = ptr->next)
      { ptr = q; q->next = ptr->next;}

2. What will be effect of the following code?

```
Int x= -1 ;
while ( !x)
{ x++ ;
   printf(« %d », x) ;
}
```

   (1) The loop will execute infinitely many times.
   (2) The loop will not execute at all.
   (3) The loop will execute only twice.
   (4) The loop will execute once.

3. Which of the following is true about the data types "char", "short", "long" and "int" in a typical programming language like C/C++?
   1) All of them store an integer value.
   2) "char", "short" and "int" store an integer value whereas "long" stores a real value.
   3) "char" stores only English alphabet, "long" stores real values and 'int" stores integers.
   4) None of the above.
4. Which of the following is true? To compute fn, the nth Fibonacci number, the most efficient technique is
   1) Recursive

2) Iterative
3) Dynamic
4) Greedy

5. Data of a warehouse of motorparts needs to be stored. Everyday many new motor parts arrive at the warehouse and many are delivered to the client. Which data structure is most suited to store the data so that all these operations (addition of parts and deletion of parts) including search can be performed in O(log n) time?

    1) A sorted array with binary search.
    2) A sorted linked list with binary search.
    3) A balanced binary search tree.
    4) All of the above.

6. An array of characters needs to be sorted in increasing order. One of the worst case input for insertion sort is f,e,d,c,b,a. Another worst case input for it is
    1) a,b,c,d,e,f
    2) c,b,a,f,e,d
    3) a,b,d,c,e,f
    4) e,f,d,c,b,a

7. Consider Quick Sort performed on an array of n elements. The number of comparisons performed by the algorithm in the worst case is

    1) O(n log n)
    2) O(n^2)
    3) O(n)
    4) Omega(n log n)

8. Consider the error control function in the Data Link Layer of the OSI stack. Which of the following is true?
    1) It checks the error caused during transmission and not the ones caused in the sender's memory.
    2) It checks the errors caused in the sender's memory but not the ones caused during transmission.
    3) It checks both the errors caused in the sender's memory as well as the ones caused during transmission.
    4) Error control is not a function of DLL.

9. Consider a data coding scheme QAM -32 in which one bit is an error control bit. How many bits of data is transfered?
    1) 32
    2) 31
    3) 4

4) 5

10. What is the role of DNS (Domain Name Server)?
    1) Map a local IP address to the global IP address.
    2) Map the symbolic URL to an IP address.
    3) Map the symbolic URL to its domain.
    4) Assign a domain to a new website.

11. A semaphore in operating system solves,
    1) thrashing problem of concurrent interacting processes
    2) thrashing problem of sequential processes
    3) mutual exclusion of concurrent interacting processes
    4) mutual exclusion of sequential processes

12. Thrashing is
    1) Frequent swapping of jobs in the processor?
    2) Frequent page default?
    3) Frequent file swapping from the disk?
    4) Frequent overflow message?
    5)

13. The binary representation of -16 in signed 2's complement in 7 bits is
    1) 1110000
    2) 1010000
    3) 1101111
    4) None of the above

14. The number of address lines and input-output data lines required for a memory unit consisting of 4 giga words where each word consists of 64 bits are

    1) 32 , 6
    2) 32 , 64
    3) 22, 6
    4) 22, 64

15. Which of the following is true?

    1) Access time of cache > access time of RAM > access time of secondary memory.
    2) Access time of cache > access time of RAM > access time of secondary memory.
    3) Access time of RAM < access time of cache < access time of secondary memory.
    4) Access time of RAM < access time of secondary memory < access time of cache.

16. A semaphore in operating system solves,
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Part II

Time : 1 hour Max Marks: 30

18. Write a recursive function in C to search for an element in a binary search tree.
3

19. Consider the following code in C;

```
int a,b; float c;
a = 3;
b = 2;
c = -a/b;
```

The value assigned to c is zero. Identify the error. Correct it and explain why your solution will work.

2

20. Which sorting algorithm is best suited to sort integers in the range [1.. 10^c] where c is a constant. Derive the time complexity of your algorithm?
2

21. What is the difference between “data type” and “data structure”?
2

22. What are the main advantages and disadvantages of iterative functions over recursive ones?
2

23. Write a “for-loop” in C/C++/Java to insert an element x in a sorted array A containing n elements.
2

24. Tertiary search in a sorted array finds two elements p and q (p< q) that divide the list into three equal parts. If the key is less than p, the algorithm recursively searches the first part else it compares the key with q. If the key is greater than p and less than q, it searches the middle part else (key is greater than q) it searches the last part. Write the exact recurrence relation for the number of comparisons performed by the algorithm and solve it exactly. Is it faster or slower than binary search? Please do not use asymptotic notation.
4

1.

i. What do you understand by the dotted decimal notation of an IP address? Explain with the help of an example.
2

ii. How does your computer recognize the remote (google) server when you type http://google.com in the address bar of your browser.

2

9. When 2's complement representation is used to store negative numbers, what is the minimum number of bits required to store 16. Justify your answer by explaining why lesser number of bits would not suffice.

2

10. Discuss the advantages and disadvantages of shortest job first policy for job scheduling.

3

11. Can an application of size 1Gb run on a RAM of size 256Mb. If yes, explain how? If no, explain why?

2

12. Give the sequence of events that take place when you click on the icon to execute an application.

2