UGC-NET-COMPUTER SCIENCE & APPLICATIONS

Unit Test-1: *DATA STRUCTURE*

Time: 01:00 Hour **Date : 18-02-2014**
M.M. : 50

INSTRUCTIONS: Attempt all the 25 questions. Each question carry two marks.

1. If the expression $\left((2+3)*4+5(6+7)*8\right)+9$ is evaluated with * having precedence over '+' then the value obtained is the same as the value of which of the following prefix exp.
(a) + + * + 234 * * 5 + 6789 (b) + * + + 234 * * 5 + 6789
(c) * + + 234 * * 5 + + 6789 (d) * + + + 234 * * 5 + 6789

2. Consider the following code fragments

```
int i, j, x;
read (x);
i = 1, j = 1;
while (i < 10)
        {
                j = j*i;
                i = i+1;
                if(i = = x) exit;
        }
```

Which of the following is correct at the end of the execution of the program

(a) $\left(j=(x-1)!\right)\wedge(i\geq x)$

(b) $\left(j=9!\right)\wedge(i=10)$

(c) $\left(\left(j=10!\right)\right)\wedge(i=10)\vee\left(j=(x-1)!\right)\wedge(i=x)$

(d) $\left(\left(j=9!\right)\wedge(i\geq 10)\right)\vee\left(j=(x-1)!\right)\wedge(i=x)$

3. Lets consider the three matrices N_1 of w×x order and N_2 of x×y order and N_3 of y×z order. Under what condition will it take less time to compute the product as $(N_1 N_2)N_3$ than to compute it as $N_1(N_2N_3)$

(a) $\frac{1}{x}+\frac{1}{z}<\frac{1}{\omega}+\frac{1}{y}$ (b) $x > y$

(c) $\frac{1}{\omega}+\frac{1}{x}<\frac{1}{y}+\frac{1}{z}$ (d) $\omega + x < y + z$

4. A data structure is comprised of nodes each of which has exactly 2 pointers to other nodes, with no NULL pointers. The following C program is to be used to count the number of nodes accessible from a given node. It uses a mark field, assumed to be initially 0 for all nodes. There is a statement missing in this code

```
struct test {int info, mark; struct test *p, *q};
int nodecount (struct test *a)
  {
```

```
    if (a → mark)      return 0;
    return nodecount (a → p) + nodecount(a → q) + 1;
}
```

Which statement should be made to make the program run correctly

(a) Add "a → mark = 1" as the first statement

(b) Add "a → mark = 1" after the if statement

(c) Add "a → mark = 0" as the first statement

(d) Add "a → mark = 0" as the last statement

5. Which of the folllowing gives the best upper bound for the value of f(N) where

$f(2N+1) = f(2N) = f(N) + \log(N)$ for $N > 1$ with $f(1) = 0$

(a) O(log n) (b) O(Nlog N) ()c) O(N) (d) O(N^2 log N)

6. A block of 105 words of memory is used for dynamic storage of objects of size 3 and 10 words. The operation supported by the storage are

x = alloc(n) {Allocate any block of n-consecutive words and return its starting address NOTE that 3 and 10 are the only legal values of n}

free (y) {make the previously allocated block starting at address y available for re-use}

At a point where certain request for allocation of a block of words cannot be granted because of lack of a sufficeintly long blcok of consecutive words to fill that requeset. What is the minimum possible number of words that might actually be in use

(a) 10 (b) 24 (c) 53 (d) 96

7. Consider the following C-code

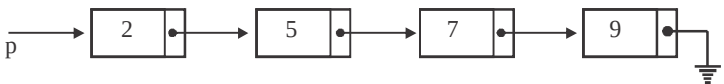
```
int f(int x)
 {  if (x < 1)  return 1;
    else return f(x–1) + g(x);
 }
int g(int x)
 { if (x < 2) return 2;
   else return f(x–1) + (x/2)
}
```

Which of the following best discribes the growth of f(n) as a function of x?

(a) Logarithmic (b) Quadratic (c) Exponential (d) Cubic

8. Consider the following code along with the given linked list

```
void pf(list *p)
        {       if (p = = NULL) return;
                else
                        {
                                pf (p → next);
                                printf("%d", p → info);
                        }
                }
```



What is the output of above code fragment?

(a) 2, 5, 7, 9 (b) 9 (c) 9, 5, 7, 2 (d) Out of memory

9. Consider the following functions

```
int  fc (char *s)
        { int n = stren (s);
        int i;
        for (i = 0; i < n/2; i++)
                {
                        if (S[i]! = S[n–n/2 + i) return 0;
                }
        return 1;
        }
```

Now suppose the function is called for the following parameters

x_1 = fc ("abab")
x_2 = fc("abba")
x_3 = fc ("abcba")
x_4 = fc("abcab")

(a) $x_1 = 1, x_2 = 0, x_3 = 0, x_4 = 1$ (b) $x_1 = 1, x_2 = 1, x_3 = 1, x_4 = 1$
(c) $x_1 = 0, x_2 = 1, x_3 = 1, x_4 = 0$ (d) None of these

10. Find all the value of variable 'a' such that the following algorithm goes into an infinite loop

```
int k = 7, c = 0;
int a = ? ?
while (k%2)
        {       c = 3*a + k;
                k = 3*c;
        }
```

(a) $a \geq 1$ (b) $a > 1$
(c) for all even values of a (d) for all odd values of a

11. Consider the following sequence of instructions intended for the execution of a stack. Each arithmetic operation pop the second operand and then pop the first operand, operates on them and then pushes the result back into the stack:
push b, push x, add, pop c, pusch c, push y, add, push c, sub, pop z
Which of the following statement is TRUE
(I) At the end of execution, z contains the same value as y.
(II) At the end of execution stack is empty
(a) I (b) II (c) both I and II (d) None of the above.

12. Consider the following function

```
int Dinesh (int n)
        { if (n ≤ 2) return 1;
                return Dinesh (n/2) * log n;
        }
```

What does Dinesh (n) returns if n is power of 2.
(a) log n (b) nlogn (c) (log n)! (d) n! log n

13. Suppose that on a certain system, every function call puts 10 bytes onto a stack plus another 4 bytes onto the stack for every integer formal parameter. Consider the following function definition.

```
void UGC (int n)
        {
```

```
        if (n ≤ 1) then return;
                CSIR (n, n/2);
        }
void CSIR (int x, int y)
    {   if (x ≥ y) UGC(y);
    }
```

If n is a power of 2 then how much stack space must be available so that UGC(n) can be called?
(a) 14 log n (b) 18 log n (c) 32 log n –18 (d) 32 log n + 18

14. Suppose that 2 repositories exists for sorting and searching through a certain type of record. The first repository uses linked list, on an average it requires 10 ms to search 1024 records or 10240 ms to search 1048576 records. The second repository uses a sorted array and binary search on an average it requires 400 ms to search 1024 records or 800 ms to search 1048576 records.
For what number of records do the two versions require approximately equal time on average?
(a) 2048 records (b) 4096 records
(c) 16384 records (d) 65536 records

15. Which of the following expressions evaluate to the largest number?
(a) + * – 2357 (b) 2 + 3 * 5 –7 (c) 23 + 57 – * (d) 23 + 5 * 7–

16. Suppose c is an integer greater than 1 and some function f is defined such that f(0) = f(1) = 1 then which of the following statement must not be TRUE

(a) $f(n) = f(n-2) + c$ is $O(n)$ (b) $f(n) = f(n-2) + n^c$ is $O(n^c)$

(c) $f(n) = cf(n-2)$ is $O(c^n)$ (d) $f(n) = c\, f\left(\frac{n}{2}\right)$ is $O\left(n^{\log^c}\right)$

17. Let k be an integer greater than 1. Which of the following represents the growth rate of the expression $\sum_{i=1}^{n} k^i$ as a function of n?

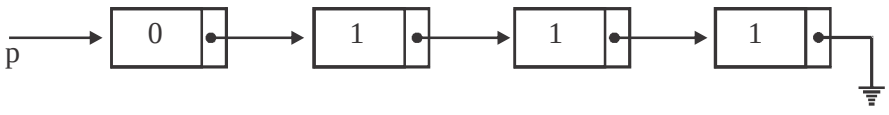
(a) $\theta(k^n)$ (b) $\theta(k^{n \log n})$ (c) $\theta(k^n \log n)$ (d) $\theta(n^{k+1})$

18. Consider the following function

```
int AAP (int k)
    {
        x = 2;
        for (int i = 1; i ≤ k; i + +)
            x = x * x;
        return x;
    }
```

If n and k are positive integers, then the least value of k such that AAP(k) > n is approximately
(a) $\log_2 \log_2 n$ (b) $\log_2 n$ (c) n (d) $n \log_2 n$

19. Assume that n bit positive integer x is stored as a linked list so that the first element of the list is the least significant bit for example $x = 14 = (1110)_2$ is stored as a linked list of size n = 4



For this data structure the operation that replaces x by $\left\lfloor \frac{x}{8} \right\rfloor$ can be done in

(a) $\theta(\log n)$ (b) $\theta(n)$ (c) $\theta(n^2)$ (d) $\theta(1)$

20. Consider the recursive algorithm for sorting an array of $n \geq 2$ integers that works as follow
(A) If there are only 2 elements to be sorted, compare them and swap them if they are out of order.
(B) Otherwise do the following steps in order
(i) Recursively sort first (n–1) elements of the array.
(ii) In the resulting array, recursively sort last (n–1) elements of the array.
(iii) In the resulting array recursively sort the first 2 elements of the array.
What is the asymptotic running time of above algorithm

(a) $\theta(n \log n)$ (b) $\theta(n^2)$ (c) $\theta(2^n)$ (d) $\theta(n^3)$

21. Suppose that L_1 is a singly linked list with *l* nodes and L2 is a doubly linked list with m nodes. If data part requires d bytes of memory and the pointer needs p bytes of memory then total memory in bytes required for L_1 and L_2 is

(a) $\ell m + dp$ (b) $(d+p)(\ell+m)$ (c) $(d+p)(\ell+m)+mp$ (d) $dp\ell m$

22. If a stack has 100 elements and Queue is empty then consider the following operations
1. while (stack is not empty)
insert_queue(pop( ));
2. while (queue is not empty)
push (delete-from_queue())
The above block of code is executed 100 times then which is correct?
(a) stack is empty (b) queue is not empty
(c) The content of stack is reversed (d) None of the above.

23. If an array has n elements then what is the minimum number of comparision needed to find second maximum

(a) $2(n-1)$ (b) $2n-3$ (c) $n+\log n-2$ (d) $\log n$

24. If $T(n) = 2T(n^{1/3}) + \log n$ then $T(n) = ?$

(a) $\theta(\log n)$ (b) $\theta(\log \log n)$ (c) $\theta(\log n \log \log n)$ (d) $\theta(n \log \log n)$

25. Suppose stack and queue offering only operations to add elemernts, to remove elements and to test for emptyness suppose that a programmer Satya Nadella wants to count the number of elements in a given stack or queue which is currently at some state t, using only one auxilliary stack or queue D. The structure C and D can be used in any way possible based on the methods they offer but C must be restored to its state 't' after counting its elements.
Counting elements as described above is possible for which of the following data types
(I) C is a stack and D is a queue
(II) C is a stack and D is a stack
(III) C is a queue and D is a stack
(IV) C is a queue and D is a queue
(a) I, II (b) I, IV (c) II, IV (d) I, III

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UGC-NET-COMPUTER SCIENCE & APPLICATIONS

Unit Test-1: ***THEORY OF COMPUTATION***

Date : 18-02-2014

1. (a)	**2. (d)**	**3. (a)**	**4. (b)**	**5. (a)**	**6. (b)**	**7. (c)**
8. (c)	**9. (c)**	**10. (c)**	**11. (c)**	**12. (c)**	**13. (d)**	**14. (d)**
15. (d)	**16. (b)**	**17. (a)**	**18. (a)**	**19. (d)**	**20. (c)**	**21. (c)**
22. (d)	**23. (c)**	**24. (a)**	**25. (c)**			