Programming and Data Structures Test 1

Number of Questions: 35 **Section Marks: 30**

Directions for questions 1 to 35: Select the correct alternative from the given choices.

1. Which one of the following is true about a strict binary tree with 16 leaf nodes?
(A) has exactly 2^5 nodes
(B) has atmost $2^5 - 1$ nodes
(C) has atmost 30 nodes
(D) has exactly 31 nodes

2. Consider 2 sorted lists of size 50 and 60 respectively. Find the number of comparisons needed in the worst case by merge sort algorithm?
(A) 109 (B) 50
(C) 60 (D) 3000

3. The print statement printf("%*d*", ++10); prints
(A) 11 (B) 10
(C) An error message (D) Garbage value

4. Consider the following C code segment

```
if(ptr!= NULL)
      *ptr = NULL; else  *ptr = NULL;
Which of the following has the same
effect as the above code?
  (I) if(ptr)
      *ptr = NULL; else *ptr = NULL
 (II) *ptr = NULL;
(III) if(!ptr)
      *ptr = NULL; else *ptr = NULL;
 (IV) if(ptr= NULL)
      *ptr = NULL; else *ptr = NULL;
```

(A) I and III (B) I and IV
(C) I, III and IV (D) I, II, III and IV

5. Which of the following statements are true?
(I) Casting refers to implicit type conversion
(II) Coercion refers to implicit type conversion
(III) Casting refers to explicit type conversion
(IV) Coercion refers to explicit type conversion
(A) I and II (B) II and III
(C) I and IV (D) III and IV

6. For implementing queue using linked list, the enqueue and dequeue operations are performed as
(A) Enqueue after the last element, dequeue the first element
(B) Enqueue in front of the first element, dequeue the first element
(C) Enqueue after the last element, dequeue the last element
(D) Enqueue in front of the first element, dequeue the last element

7. The tree transversal in which the node is processed before the recursive call to the child nodes complete?
(A) Postorder (B) Preorder
(C) Inorder (D) Level order

8. What is the number of '*n*' node binary trees with items 1, 2, …, *n* that have identical postorder and inorder transversals?
(A) $\frac{n+1}{2}$ (B) n
(C) 1 (D) $n!$

9. Which of following uses the unweighted single source shortest path problem?
(A) Breadth First Search (B) Dijkstra's algorithm
(C) Kruskal's algorithm (D) Depth First Search

10. Which one of the following data structure is best suited to check whether an arithmetic expression has balanced parentheses?
(A) List (B) Queue
(C) Stack (D) Tree

11. What is the output returned by following code?

```
# include <stdio.h>
int main( )
{
for(;NULL;)
printf ("TIME");
return 0;
}
```

(A) T (B) TIME
(C) Infinite loop (D) Compilation Error

12. Which of the following statements are TRUE?
(I) Recursive programs are efficient
(II) Binary search using a linear linked list is efficient
(III) The worst case Time complexity of Quick sort is $O(n^2)$
(IV) As the number of entries in the hash table increases, the number of collisions also increase.
(A) II and III (B) I and III
(C) III and IV (D) II and IV

13. If the processor supports only the immediate and direct addressing modes, then which one of the following programming language feature cannot be implemented on that processor?
(A) Arrays
(B) Pointers
(C) Records
(D) Recursive procedures with local variables

14. Which one of the following is true about the result returned by function under value-result and reference parameter passing conventions?
(A) May differ in the presence of exceptions
(B) Do not differ
(C) Differ in the presence of loops
(D) Differ in all cases

15. If L_1 is deterministic context free and L_2 is regular then which of the following is also deterministic context free?

(i) $L_1 \cup L_2$ (ii) $L_1 \cap L_2$
(iii) L_2
(A) (i), (ii) Only (B) (ii), (iii) Only
(C) (ii) Only (D) (i), (ii) and (iii)

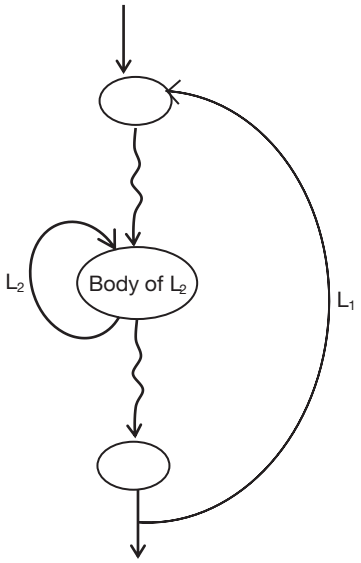
16. Consider the following C code segment

```
main ()
{
static int i;
for(putchar('G'); putchar('A');
putchar('E'))
    {
putchar ('T');
if(i == 2)
    break;
else
    i++;
    }
}
```

The output will be

(A) Syntax error (B) GAETETET
(C) GATEATEATE (D) GATEATEAT

17. Consider the below flow graph, which has two loops: L_1 and L_2



Let variables x, y are assigned registers in L_1 but not in L_2, then which of the following actions are TRUE?

(i) Store x, y on entry to L_2
(ii) Load x, y on entry to L_2
(iii) Load x, y on exit from L_2
(iv) Store x, y on exit from L_2
(A) (i), (ii)
(B) (i), (iii)
(C) (ii), (iv)
(D) (iii), (iv)

18. Consider the following recursive function

$$\text{fun}(n) = \begin{cases} 2 & \text{if } n = 0 \\ x & \text{if } n = 1 \\ 2\,\text{fun}\,(n-1) + 4\,\text{fun}\,(n-2) & \text{if } n \geq 2 \end{cases}$$

If the value of fun(4) is 88, then the value of 'x' is

(A) –1 (B) 0
(C) 2 (D) 1

19. What will be the output of following code?

```
# include<stdio.h>
int main ( ) {
int b, a = 6;
b = - a - - ;
printf ("%d %d", b, a);
}
```

(A) 6 5 (B) –5 5
(C) – 6 5 (D) compilation error

20. Which of the following is the prefix expression for the given infix expression?

$A - B * C + (D/E)/F * G$

(A) $+ - A * BC * / DE / FG$
(B) $+ - A * BC / DE / * FG$
(C) $+ - A * BC * \| DEFG$
(D) $- A * BC + * \| DEFG$

21. The following postfix expression with single digit operands is evaluated using a stack 4 2 2 ∗ / 2 3 ^ + 5 –
The top two elements of the stack after the evaluation of ^ are (^ is the exponentiation operator)

(A) (8, 1) (B) (9, 1)
(C) (5, 9) (D) (5, 1)

22. A circular queue of capacity (m –1) elements is implemented with an array of m elements. Insertion and deletion operation are done at rear and front respectively. Initially rear and front are initialized to zero. The condition to check whether the queue is full and empty are

(A) full :(rear + 1) mod m == front
empty :(front + 1)mod m == rear
(B) full:(front +1) mod m == rear
empty: rear == front
(C) full : (rear +1) mod m == front
empty : rear == front
(D) full : rear == front
empty : (rear +1) mod m == front

23. The number of comparisons needed to search a single linked list of length 'n' for a given element in worst case scenario is?

(A) $\frac{n}{2}$ (B) $\log_2 n - 1$
(C) $\log_2 n$ (D) n

24. Consider the following C code segment and predict the correct output ?

```
# define cube(x) (x*x*x)
main ()
```

```
{
int i, j = 4;
i = cube (j ++);
printf ("%d %d", i, j);
}
```

(A) 64 7 (B) 64 4
(C) 125 7 (D) 343 7

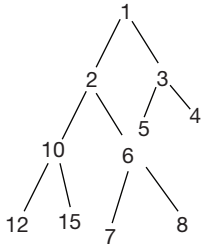
25. What will be the output of the following C code segment?

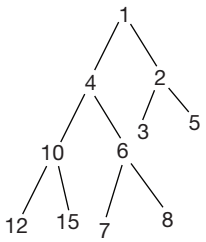
```
# define m(a, b) (((a)>(b))?(a):(b))
main ()
{
int x = 10, y = 5, z = 0;
z = m(++x, y++);
printf("%d %d %d", x, y, z)
}
```

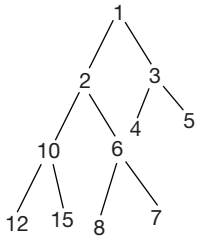
(A) 11 6 11 (B) 12 7 12
(C) 13 6 13 (D) 12 6 12

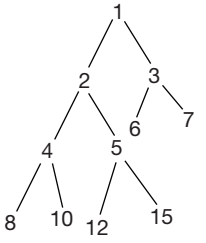
26. Which of the following sequence of array elements form a valid binary max heap?
(A) 35, 21, 10, 14, 15, 9, 6
(B) 50, 18, 14, 15, 17, 16, 12
(C) 40, 20, 14, 15, 21, 4, 11
(D) 9, 6, 4, 2, 1, 5, 3

27. Construct a binary min-heap with following elements inserted in order 5, 10, 2, 6, 8, 4, 3, 12, 15, 1, 7
What will be the resultant binary min-heap after the above operation?

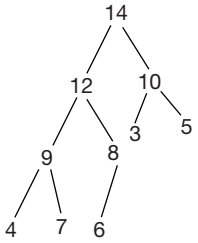
(A)


(C)


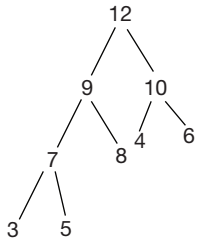
(B)


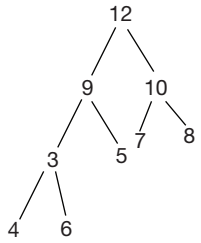
(D)


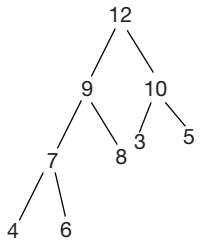
28. Consider the following max–heap

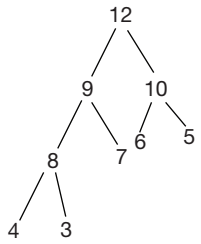


On deleting the element '14' from the max–heap, the resultant heap will be

(A)


(C)


(B)


(D)


29. Consider a complete binary tree of 15 nodes. How far are the most distant two nodes? (Assume each path count as 1)
(A) about 2 $\log_2$ 15 (B) about $\log_2$ 15
(C) about 3 $\log_2$ 15 (D) about 4 $\log_2$ 15

30. Let the last vertex visited of a complete binary tree in preorder, inorder and postorder are denoted by LPRE, LIN, LPOST respectively. Then which of the following is always true?
(A) LPRE = LPOST (B) LIN = LPRE
(C) LIN = LPOST (D) None of the above

31. Consider the following pairs of traversals on a labeled binary tree. Which of these pairs identify a tree uniquely?
(I) Inorder and Postorder
(II) Preorder and Postorder
(III) Preorder and Inorder
(IV) Level order and Postorder
(A) II only (B) I and III
(C) III only (D) IV only

Common Data for Questions 32 and 33:

```
Consider the following C code segment
int x, y, z = 0;
void fun(void);
main()
{
static int x = 4; ---------------S1
fun();
x++;
fun();
printf("\n %d %d" , x, y);
}
void fun(void)
} static int x = 6; ------------S2
int y =2;
x + = ++y;
```

```
printf("\n %d %d", x, y);
}
```

32. What output is generated by the given code segment?

(A) 9 3
9 3
5 0

(B) 9 3
12 3
5 0

(C) 9 3
9 3
9 3

(D) 9 3
12 4
5 garbage value

33. What output is generated by the given code segment if S_1 is replaced by auto int $x = 4$; S_2 is replaced by register int $x = 6$;

(A) 9 3
12 3
5 0

(B) 9 3
12 3
4 0

(C) 9 3
9 3
5 0

(D) 9 3
9 3
5 Garbage value

Linked Data Questions 34 and 35

Construct a binary search tree with elements 55, 40, 65, 60, 35, 20, 25, 70, 50, 10, 15. Inserted in order.

34. What will be the output of post order transversal of the BST?

(A) 15, 10, 25, 20, 35, 40, 50, 60, 70, 65, 55
(B) 15, 10, 25, 20, 35, 50, 40, 60, 70, 65, 55
(C) 15, 10, 25, 20, 35, 40, 60, 50, 70, 65, 55
(D) 15, 10, 25, 20, 35, 40, 70, 65, 60, 50, 55

35. In the above binary search tree, to locate the number 15, which of the following probe sequence is possible?

(A) 55, 40, 35, 25, 10, 15 (B) 55, 40, 50, 20, 10, 15
(C) 55, 40, 35, 20, 10, 15 (D) 55, 60, 35, 25, 10, 15

Answer Keys

1. D	**2.** A	**3.** C	**4.** D	**5.** B	**6.** A	**7.** B	**8.** C	**9.** A	**10.** C
11. B	**12.** C	**13.** B	**14.** A	**15.** D	**16.** D	**17.** B	**18.** D	**19.** C	**20.** C
21. A	**22.** C	**23.** D	**24.** A	**25.** D	**26.** A	**27.** C	**28.** C	**29.** A	**30.** D
31. B	**32.** B	**33.** C	**34.** B	**35.** C					

Hints and Explanations

1. Number of nodes of strict binary tree
$= (2n - 1)$; $n \rightarrow$ number of leaf nodes Choice (D)

2. $m + n - 1$
That is $50 + 60 - 1 = 109$ Choice (A)

8. Unique tree can be created using postorder and inorder transversals
$\therefore$ Only 1 tree is possible with same item that have identical post order and in order Choice (C)

11. Here NULL is micro constant, value of this symbolic constant is '0' as defined in stdio.h.
So for loop should not execute any time because initial condition is false. But it is bug of turbo *C* compiler. Loop will execute one time and it will print: TIME
Choice (B)

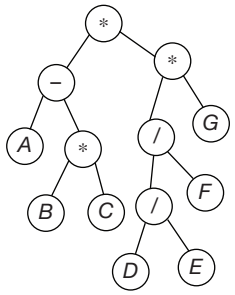
15. L_1 is DCFL
L_2 is regular.
Every regular language is DCFL. $L_1 \cup L_2$ and $L_1 \cap L_2$ are also DCFL's. Choice (D)

17. As the variables belongs to L_1 we need to store x, y on entry to L_2 and load x, y on exit from L_2. Choice (B)

18. $T(4) = 2T(3) + 4T(2)$
$T(3) = 2T(2) + 4T(1)$
$T(2) = 2T(1) + 4T(0) \rightarrow 8 + 2x$
Back substitute the value of $T(2)$
$\therefore \quad x = 1$ Choice (D)

19. $b = -a - -$
$b = -6 - -$
$b = -6$
Now value of variable 'a' will be 5.
Choice (C)

20.



Prefix :$* - A * BC * || DEFG$

Choice (C)

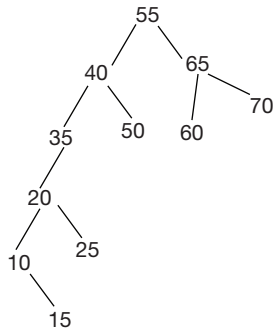
24. $i = 4 * 4 * 4 = 64$
$j = 4 + 3 = 7$

Choice (A)

25. The line $z = m(++x, y++)$ is replaced by
$z = (++x) > (y++)\ ?\ (++x) : (y++)$

Choice (D)

34.



15, 10, 25, 20, 35, 50, 40, 60, 70, 65, 55 Choice (B)