GU-RET 2016

Gauhati University Research Eligibility Test

Computer Science

Booklet Series : C

Invigilator's Name and Signature	Booklet No.	
	OMR Sheet No.	
	Roll No.	

Time : 2 hours 20 minutes **Total Marks : 80**

Number of Pages in this Booklet : **16**

Instructions for Candidates

1. Write your Roll No. and OMR Sheet No. in the boxes provided above.
2. This paper consists of two sections : **Section B** with 50 (fifty) multiple choice questions (MCQ) and **Section C** with 7 (seven) descriptive questions. Each MCQ has 4 (four) answers, out of which ONLY one is correct. You have to darken the circle (on the OMR Sheet) for the correct answer corresponding to the question given in this booklet.

   Example : (A) (B) (C) (D)

   where (C) is the correct answer. No marks will be given for markings made in this booklet. The descriptive questions in **Section C**, MUST be answered in the space provided in this booklet. **No extra pages will be provided in any case.**
3. Use a BLACK ball point pen in your OMR Sheet.
4. Read the instructions given inside this booklet before attempting to answer any questions.
5. DO NOT write your name, roll no, phone no, or anything, or put any marks anywhere in this booklet, otherwise your candidature will be disqualified.
6. If you are found to resort to any kind of unfair means such as carrying extra material other than pen, pencil, watch, eraser, and scale, or copying from somebody or from external material, your candidature will be disqualified.
7. Use of mobile phones, calculators, log tables or any other tables, wearable smart devices such as smart Android watches or objects of similar nature CAN NOT be used inside the examination hall.
8. At the end of the examination, you have to return this booklet and the OMR Sheet back to the invigilator.
9. There is no negative marks for incorrect answer.

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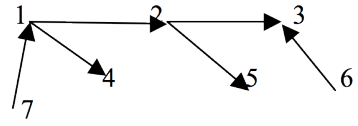
Section B (50 Marks)

1. Which of the following is the result of applying Topological sort on the following digraph?



(A) 4 1 7 2 6 3 5
(B) 7 1 4 5 6 3 2
(C) 7 1 4 2 6 3 5
(D) 5 7 1 4 2 6 3

2. Consider the languages

$$L1 = \{0^i 1^j \,/\, i \neq j\} \qquad L2 = \{0^i 1^j \,/\, i = j\}$$
$$L3 = \{0^i 1^j \,/\, i = 2j+1\} \qquad L4 = \{0^i 1^j \,/\, i \neq 2j\}$$

Which one of the following statements is true?

(A) Only $L1$ is context free
(B) Only $L2$ and $L3$ are context free
(C) Only $L2$ and $L1$ are context free
(D) All are context free

3. In the context of C++ programming, which one of the following statements is correct?

1. A constructor returns no value
2. A class can have any number of destructors
3. It is mandatory for a class to have a default constructor
4. Destructors can have parameters.

(A) 1
(B) 2
(C) 3
(D) 4

4. Consider the following code (assume no syntax error and the code is executed in Linux environment)

```
int *p; p=(int
*)malloc(10*sizeof(int));
```

It sets the pointer to a block of

(A) 10 bytes
(B) 20 bytes
(C) 30 bytes
(D) 40 bytes

5. Suppose an integer array A stores the following 4 possible lists of elements in the given order. Which one represents a min-heap?

(A) 5, 7, 10, 12, 15, 18, 19, 20, 20
(B) 20, 20, 19, 18, 15, 12, 10, 7, 5
(C) 5, 7, 10, 15, 18, 12, 20, 20, 19
(D) 5, 7, 15, 10, 12, 18, 20, 20, 19

6. Which one of the following is a MSOP expression of the Boolean expression

$$\overline{(\overline{A}+C)\cdot(B+\overline{D})}$$

(A) $\overline{A}\,\overline{C} + \overline{B}\,\overline{D}$
(B) $AC + BD$
(C) $A\,\overline{C} + \overline{B}\,D$
(D) $AD + BC$

7. In ER, model degree of a relationship is based on

(A) number of attributes of the relationship
(B) number of participating entities
(C) number of relationships in the ER model
(D) None of the above

8. Which of the following is not a necessary condition for application of the binary search algorithm?

(A) The list must be sorted
(B) There should be the ability to access any element in the list directly
(C) There must be mechanism to delete and/or insert elements in the list
(D) The length of the list has to be an even number

9. Which one of the following statements regarding a multiplexer is not true?

(A) It is also known as a data selector
(B) It can be used to realize logic functions
(C) It allows only one input to get through the output at a time
(D) It can be thought of as a distributor

10. Which is not an open source O/S?

(A) Linux
(B) GNU Hurd
(C) Mac OS
(D) FreeBSD

11. Which technique is used so that more than one process may enter critical section?

    (A) Spin-lock
    (B) Disabling interrupt
    (C) Mutex
    (D) Semaphore

12. Which technique is used for speeding up memory access?

    (A) Virtual memory
    (B) Paging
    (C) Segmentation
    (D) Cache memory

13. Which technique is used for allowing process larger than physical memory?

    (A) Virtual memory
    (B) Bankers algorithm
    (C) Shortest job first
    (D) Cache memory

14. Which I/O method frees the CPU during I/O activity?

    (A) Interrupt driven
    (B) Polled
    (C) DMA
    (D) All of these

15. A 32 bit CPU is one in which

    (A) data bus is 32 bit
    (B) address bus is 32 bit
    (C) ALU is 32 bit
    (D) registers are 32 bit

16. In C, the code

```
p = (4 < 3) || (4 > 3);
```

    will put a value in `p` which is

    (A) 0
    (B) 1
    (C) 2
    (D) The code is erroneous

17. The size of int variable in C is

    (A) 8 bit
    (B) 16 bit
    (C) 32 bit
    (D) compiler dependent

18. Which ISO OSI layer deals with routing?

    (A) Physical
    (B) Data Link
    (C) Network
    (D) Transport

19. Which ISO OSI layer deals with framing?

    (A) Physical
    (B) Data Link
    (C) Network
    (D) Transport

20. Which media or technology is suitable for long distance high speed network?

    (A) Unshielded twisted cable
    (B) Point to point wireless link
    (C) Fibre optic cable
    (D) Satellite

21. Which network media or technology is secured (that can not be tapped or listened)?

    (A) Unshielded twisted cable
    (B) Point to point wireless link
    (C) Fibre optic cable
    (D) Satellite

22. How many times the word 'print' shall be printed by the following program segment?

```
for(i=1; i<=2;i++)
  for(j=1;j<=2;j++)
    for(k=1;k<=2;k++)
      cout<<"print";
```

    (A) 8
    (B) 3
    (C) 6
    (D) 9

23. Which routing protocol is used in the Internet?

(A) Link state
(B) AODV
(C) Distance vector
(D) Flooding

24. To avoid race condition the number of processors that may be simultaneously inside the critical section is

(A) 3
(B) 2
(C) 1
(D) 0

25. In round robin scheduling, as the time quantum is increased, the average turn around time

(A) increases
(B) decreases
(C) remains constants
(D) varies irregularly

26. In a Red-Black tree the colour of root node is

(A) always red
(B) always black
(C) always red or black
(D) depending upon the data structure

27. Which of the following is not a software cost estimation technique?

(A) Expert Judgment
(B) Work Breakdown Structure
(C) Constructive Cost Model
(D) The Cost model

28. What does the following program print?

```
main()
{
  static char str[]="Limericks";
  char *s;
  s=&str[6]-6;
  while(*s)
    printf("%c", *s++);
}
```

(A) Limericks
(B) icks
(C) Limeri
(D) Infinite loop

29. Coupling between modules can be ranked on a scale strongest (least desirable) to weakest (most desirable) in the following order

(A) content coupling, common coupling, control coupling, stamp coupling
(B) content coupling, common coupling, stamp coupling, control coupling
(C) content coupling, stamp coupling, common coupling, control coupling
(D) stamp coupling, content coupling, common coupling, control coupling

30. Cohesion of elements occurs on the scale of weakest (least desirable) to strongest (most desirable) in the following order

(A) logical cohesion, temporal cohesion, communication cohesion, sequential cohesion
(B) logical cohesion, temporal cohesion, sequential cohesion, communication cohesion
(C) logical cohesion, sequential cohesion, temporal cohesion, communication cohesion
(D) sequential cohesion, logical cohesion, temporal cohesion, communication cohesion

31. Minimum number of comparisons needed to find the maximum of a set of n elements is

(A) $n/2$
(B) n
(C) $n-1$
(D) $n \log n$

32. Which of the following is the correct order if the functions are arranged in ascending order of their growth?

(A) $2^n, n, \log n, n \log n$
(B) $\log n, n, n \log n, 2^n$
(C) $n, \log n, n \log n, 2^n$
(D) $2^n, n \log n, n, \log n$

33. Number of comparisons performed by any comparison based sorting algorithm is

(A) $\Omega(n)$

(B) $\Omega(n \log n)$

(C) $\Omega(\log n)$

(D) $\Omega(n^2)$

34. The worst case running time of Quick sort is

(A) $O(n \log n)$

(B) $O(n^2)$

(C) $O(n)$

(D) $O(\log n)$

35. Assuming that there is no compile time error, what will be the output produced by the following C++ code?

```
void main()
{
   int a[4] = {10,11,12,13}, b;
   b = *(a+3);
   cout << b++;
}
```

(A) 13

(B) 14

(C) 15

(D) 12

36. To determine if an edge (u, v) is present in a graph, the amount of work done in the adjacency matrix representation can be expressed as

(A) $\theta(1)$

(B) $\theta(|V|)$

(C) $\theta(|V| + |E|)$

(D) $\theta(|V|^2)$

37. Let P be a relation defined as $P = \{(x, y) : x, y \in N$ (set of natural numbers) and $x^2 + y^2$ is a perfect square$\}$, then P is

(A) Reflexive

(B) Symmetric

(C) Anti Symmetric

(D) Transitive

38. In a singly link list which one of the following is correct to insert a node after a particular node (where, node is the pointer to point to the newly created node and ptr is the pointer to the node after which insertion is to be done)

(A) ptr → next = node; node → next = ptr → next;

(B) node → next = ptr → next; ptr → next = node;

(C) ptr → next = node → next; ptr → next = node;

(D) node → next = ptr; ptr → next = node;

39. What is the maximum number of distinct Boolean functions that can be constructed in n Boolean variables?

(A) n^2

(B) 2^{2^n}

(C) 2^{n+1}

(D) $n + 1$

40. The 2's complement representation of an integer using 8 bits is 10010101, the decimal integer is

(A) -107

(B) 108

(C) 107

(D) -108

41. The following C function takes a singly-linked list as input argument. It modifies the list by moving the last element to the front of the list and returns the modified list. Some part of the code is left blank.

```
typedef struct node
{
  int value;
  struct node *next;
} Node;
Node *move_to_front (Node *head)
{
  Node *p, *q;
  if ((head == Null) ||
    (head->next == NULL))
  return head;
  q = NULL; p = head;
  while (p->next !=NULL)
    { q = p; p = p->next; }
  ..... //blank code
  return head;
}
```

The blank code is

(A)
```
q = NULL; p->next = head;
head = p;
```

(B)
```
q->next = NULL; head = p;
p->next = head;
```

(C)
```
head = p; p->next = q;
q->next = NULL;
```

(D)
```
q->next = NULL; p->next = head;
head = p;
```

42. What does the following program print?

```
#include <stdio.h>
void f(int *p, int *q)
{
  p = q; *p = 2;
}
int i = 0,j=1;
int main()
{
  f(&i, &j);
  printf("%d %d \n",i,j);
  return 0;
}
```

(A) 2 2

(B) 1 0

(C) 0 1

(D) 0 2

43. Let $L = \{w\varepsilon(0+1)^* / w$ has an even number of 1's$\}$, i.e. L is the set of all strings with even number of 1s. Which one represents L?

(A) $(0^*10^*1)^*$

(B) $0^*(10^*10^*)^*$

(C) $0^*(10^*1)^*0^*$

(D) $0^*1(10^*1)^*10^*$

44. A hash table of length 10 uses open addressing with hash function $h(k) = k \mod 10$, and linear probing. After inserting 6 values into the empty hash tree the table is as shown below

0	28
1	
2	42
3	23
4	52
5	
6	
7	
8	18
9	29

Which one gives a possible order in which the key values could be inserted in the table?

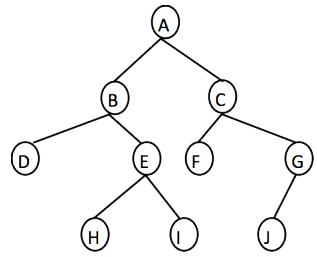
(A) $18, 42, 23, 52, 28$

(B) $23, 52, 42, 29, 18, 28$

(C) $42, 23, 52, 18, 29, 28$

(D) $18, 52, 42, 29, 28, 23$

45. A binary tree is given below.



Which one of the following is the inorder, preorder and postorder traversal respectively?

(A) DBHEIAFCJG, ABDEHICFJG, DHIEBFJGAC

(B) DBHEIAFCJG, ABDEHICFJG, DHIEBFJAGC

(C) DBHEIAFCJG, ABDEHICFGJ, DHIEBFJGCA

(D) DBHEIAFCJG, ABDEHICFJG, DHIEBFJGCA

46. Match the following

A. Product complexity	1. Software Requirements definition
B. Structured system analysis	2. Software Design
C. Coupling and Cohesion	3. Validation technique
D. Symbolic execution	4. Software cost estimation

(A) A-2, B-3, C-4, D-1

(B) A-3, B-1, C-4, D-2

(C) A-4, B-1, C-2, D-3

(D) A-3, B-4, C-1, D-2

Question 47. to 50. are based on the following table

EMP NO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-14	800		20
7499	ALLEN	SALESMAN	7698	20-FEB-13	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-14	1250	500	30
7566	JONES	MANAGER	7839	02-APR-14	2975		20
7654	MARTIN	SALESMAN	7698	28-SEP-14	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-14	2850		30
7782	CLARK	MANAGER	7839	09-JUN-14	2450		10
7788	SCOTT	ANALYST	7566	09-DEC-13	3000		20
7839	KING	PRESIDENT		17-NOV-14	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-14	1500	0	30
7876	ADAMS	CLERK	7788	12-JAN-13	1100		20
7900	JAMES	CLERK	7698	03-DEC-13	950		30
7902	FORD	ANALYST	7566	03-DEC-13	3000		20
7934	MILLER	CLERK	7782	23-JAN-12	1300		10

47. How many rows will be displayed by the following query?

```
SELECT DEPTNO   ''DEPARTMENT NUMBER''
                ROUND(AVG(SAL),2) ''AVERAGE SALARY''
FROM            EMP
GROUP BY        DEPTNO
HAVING          COUNT(*)>3;
```

(A) 1

(B) 2

(C) 3

(D) 4

continued to the next page ...

48. How many rows will be displayed by the following query

```
SELECT ENAME
FROM          EMP
WHERE SAL     (SELECT AVG(SAL) FROM EMP);
```

(A) 2
(B) 4
(C) 6
(D) 8

49. How many rows will be displayed by the following query

```
SELECT ENAME,  SAL, JOB
FROM           EMP
WHERE SAL      IN(SELECT MAX(SAL) FROM EMP GROUP BY JOB);
```

(A) 2
(B) 5
(C) 6
(D) 7

50. How many rows will be displayed by the following query

```
SELECT ENAME,          SAL, DEPTNO
FROM                   EMP
WHERE (SAL,DEPTNO)     IN(SELECT MIN(SAL), DEPTNO FROM EMP
GROUP BY DEPTNO)       ORDER BY SAL;
```

(A) 1
(B) 2
(C) 3
(D) 4

Section C (30 Marks)

Answer any 5 (five) from the following

1. Three networks are to be interconnected using a router. Network A shall connect 50 hosts, network B shall connect 60 hosts and network C shall connect 125 hosts. Show network address, subnet mask and broadcast address for each network. Give IP addresses for the router. Give the highest allowed IP address in each network. For host in each network, state default gateways. All addresses are to be allocated from the subnet 10.10.0.0/24. (Marks : 6)

2. Compare polled I/O, Interrupt driven I/O and DMA. What is cycle stealing DMA? (Marks : 6)

3. Distinguish between RISC and CISC. How instruction pipelining helps increase CPU throughput? What happens when a branch instruction is encountered in a pipeline? (Marks : 6)

4. Develop a class complex. Overload operator '/' for division. It should throw "DivideByZero" exception in appropriate situation. (Marks : 6)

5. Assuming a binary file `JOKES.DAT` is containing objects belonging to a class `JOKES` (as defined below). Write a user defined function in C++ to add more objects belonging to the class `JOKES` at the bottom of it. Also write the main program to execute it.

```
class JOKES
{
  int jokeid;          //Joke identification number
  char type[5];        //Joke type
  char jokedesc[250]; //Joke description
  public:
  void newjokeentry()
  { cin>>jokeid;gets(type);gets(jokedesc); }
  void showjoke()
};
```

(Marks : 6)

6. Two binary files are given (i.e. `Number1.dat` and `Number2.dat`) with few numbers. Write a program to create a 3rd file (Say `Number3.dat`) that contains all the numbers present in the above two file. The numbers in the above two files are need not to be in sorted order but the numbers in the third file should be in sorted order. (Marks : 6)

7. Trace the Binary search algorithm on the following array while searching for the element 8 (Marks : 6)

2 5 8 13 24 45 56 78 90 100 120

8. Design FA (deterministic or non-deterministic) to accept the following languages over $\Sigma = \{a, b\}$ (Marks : 6)

   (A) All strings in which the total number of b's is a multiple of 3.

   (B) All strings having aab as a sub string.

9. Write a C/C++ function to check if a square integer matrix is upper diagonal i.e. all elements below the diagonal are zero. (Marks : 6)

Space for Answers (Section C) : for Questions 1 to 9 (5 pages)

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