



COMPUTER SCIENCE AND APPLICATIONS

Name & Signature of the Invigilator

PAPER – II

OMR Answer Sheet No. :

DEC-21/19

Roll No. :

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Question Booklet Sl. No.

Time : 2 Hours]

No. of Printed Pages : 32

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- This paper consists of **one hundred (100)** multiple choice type of questions. **All** questions are compulsory.
- At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
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- Use only Blue/Black Ball point pen.
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- There shall be no negative marking.

પરીક્ષાર્થીઓ માટે સૂચનાઓ

- આ પાનાની ટોચ પર દર્શાવેલી જગ્યામાં તમારો રોલ નંબર લખો.
- આ પ્રશ્નપત્રમાં બહુવેકલ્પિક ઉત્તરો ધરાવતા સૌ (૧૦૦) પ્રશ્નો આપેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.
- પરીક્ષાની શરૂઆતમાં આપને પ્રશ્નપુસ્તિકા આપવામાં આવશે. પ્રથમ પાંચ (૫) મિનિટ દરમિયાન તમારે પ્રશ્નપુસ્તિકા ખોલી અને ફરજિયાતપણે નીચે મુજબ પરીક્ષણ કરવું :
 - પ્રશ્નપુસ્તિકાનો વપરાશ કરવા માટે આ કવર પૃષ્ઠની ધાર પર આપેલ સીલ સ્ટીકર કાઢી નાખો. કોઈપણ સંજોગોમાં સીલ સ્ટીકર વગરની કે ખુલ્લી પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં.
 - કવર પૃષ્ઠ પર છપાયેલ નિર્દેશાનુસાર પ્રશ્નપુસ્તિકાના પ્રશ્નો, પૃષ્ઠો અને સંખ્યાને બરાબર ચકાસી લો. ખામીયુક્ત પ્રશ્નપુસ્તિકા કે જેમાં પ્રશ્નો/ પૃષ્ઠો ઓછાં હોય, બે વાર છપાયા હોય, અનુક્રમમાં અથવા અન્ય કોઈ ફરક હોય અર્થાત કોઈપણ સંજોગોમાં ખામીયુક્ત પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં. અને જો ખામીયુક્ત પ્રશ્નપુસ્તિકા મળી હોય તો નિરીક્ષક પાસેથી તુરંત જ બીજી સારી પ્રશ્નપુસ્તિકા મેળવી લેવી. આ માટે ઉમેદવારને પાંચ (૫) મિનિટનો સમયગાળો આપવામાં આવશે. પછીથી, પ્રશ્નપુસ્તિકા બદલવામાં આવશે નહીં કે કોઈ વધારાનો સમયગાળો આપવામાં આવશે નહીં.
 - આ ચકાસણી સમાપ્ત થાય પછી, પ્રશ્નપુસ્તિકાનો નંબર OMR જવાબ પત્રક પર લખવો અને OMR જવાબ પત્રકનો નંબર પ્રશ્નપુસ્તિકા પર લખવો.
- પ્રત્યેક પ્રશ્ન માટે ચાર જવાબ વિકલ્પ (A), (B), (C) અને (D) આપવામાં આવેલ છે. તમારે સાચા જવાબના ઓવલ (oval) ને નીચે આપેલ ઉદાહરણ મુજબ પેનથી ભરીને સંપૂર્ણ કાળું કરવાનું રહેશે.
ઉદાહરણ : (A) (B) (C) (D) કે જ્યાં (B) સાચો જવાબ છે.
- આ પ્રશ્નપુસ્તિકાના પ્રશ્નોના જવાબ અલગથી આપવામાં આવેલ OMR જવાબ પત્રકમાં પેપર-II લખેલ વિભાગમાં જ અંકિત કરવા. જો આપ OMR જવાબ પત્રકમાં આપેલ ઓવલ (oval) સિવાય અન્ય સ્થાને જવાબ અંકિત કરશો તો તે જવાબનું મૂલ્યાંકન કરવામાં આવશે નહીં.
- કાચું કામ (Rough Work) પ્રશ્નપુસ્તિકાના અંતિમ પૃષ્ઠ પર કરવું.
- જો આપ OMR જવાબ પત્રક નિયત જગ્યા સિવાય અન્ય કોઈપણ સ્થાને, આપનું નામ, રોલ નંબર, ફોન નંબર અથવા એવું કોઈ ચિહ્ન જેનાથી તમારી ઓળખ થઈ શકે, અંકિત કરશો અથવા અલગ ભાષાનો પ્રયોગ કરો, અથવા અન્ય કોઈ અનુચિત સાધનોનો ઉપયોગ કરો, જેમકે અંકિત કરી દીધેલ જવાબ ભૂંસી નાખવો કે સફેદ શાહીનો ઉપયોગ કરી બદલશો તો આપને પરીક્ષા માટે અયોગ્ય જાહેર થઈ શકો છો.
- પરીક્ષા સમય પૂરો થઈ ગયા બાદ ઓરીજનલ OMR જવાબ પત્રક જે તે નિરીક્ષકને ફરજિયાત સોપી દેવું અને કોઈ પણ સંજોગોમાં તે પરીક્ષા ખંડની બહાર લઈ જવું નહીં. પરીક્ષા પૂર્ણ થયા બાદ ઉમેદવાર ઓરીજનલ પ્રશ્નપુસ્તિકા અને OMR જવાબ પત્રકની ડુપ્લિકેટ કોપી પોતાની સાથે લઈ જઈ શકે છે.
- માત્ર કાળી / ભૂરી બોલ પોઇન્ટ પેન વાપરવી.
- કેલ્ક્યુલેટર, લોગ ટેબલ અને અન્ય ઇલેક્ટ્રોનિક યંત્રોનો ઉપયોગ કરવાની મનાઈ છે.
- ખોટા જવાબ માટે નકારાત્મક ગુણાંકન પ્રથા નથી.



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**COMPUTER SCIENCE AND APPLICATIONS****Paper – II**

1. In propositional logic, which of the following assertions is not a tautology ?
- (A) $P \Rightarrow (P \vee Q)$
 - (B) $(P \wedge Q) \Rightarrow (P \vee Q)$
 - (C) $(P \vee Q) \Rightarrow (P \wedge Q)$
 - (D) $(P \wedge Q) \Rightarrow Q$
2. Which of the following assertions is not valid in the Calculus of Predicates for any universe and any interpretation of the predicates involved ?
- (A) $\forall x[P(x) \wedge Q(x)] \Rightarrow [\forall xP(x) \vee \forall xQ(x)]$
 - (B) $[\exists xP(x) \wedge \exists xQ(x)] \Rightarrow \exists x[P(x) \wedge Q(x)]$
 - (C) $\forall xP(x) \Rightarrow \exists xP(x)$
 - (D) $[\forall xP(x) \vee \forall xQ(x)] \Rightarrow \forall x[P(x) \vee Q(x)]$
3. Which pair of rules of inference are used in the following argument ?
“All human beings are mortal.
Socrates is a human being.
Therefore, Socrates is mortal.”
- (A) Universal Generalization and Modus Ponens
 - (B) Existential Specification and Modus Ponens
 - (C) Universal Specification and Modus Tollens
 - (D) Universal Specification and Modus Ponens
4. How many bit strings of length eight either start with the two bits 10 or end with the two bits 01 ?
- (A) 128
 - (B) 122
 - (C) 112
 - (D) 256



5. How many numbers must be selected from the set $\{1, 2, 3, 4, 5, 6, 7\}$ to guarantee that atleast one pair of these selected numbers add up to 8 ?
- (A) 3 (B) 4
(C) 5 (D) 6
6. Let G be a complete graph of n vertices. What is the minimum value for n for which G is non-planar ?
- (A) 3
(B) 4
(C) 5
(D) 6
7. If you are given a NAND-to-NAND two-level gate network to implement a Boolean function, then to which of the following gate network form can it be directly transformed by just replacing every gate in the network by a different type of gate ?
- (A) NOR-to-NOR
(B) NOR-to-NAND
(C) OR-to-AND
(D) AND-to-OR
8. Consider the Linear Programming Problem having the following constraints :
- a. $2x_1 - x_2 + 3x_3 + x_4 = 7$
b. $3x_1 + x_2 + 3x_3 + 2x_4 = 11$
c. $x_1, x_2, x_3, x_4 \geq 0$;

Then how many basic feasible solutions does this LPP have ?

- (A) 6 (B) 4
(C) 5 (D) 8



9. Consider the LPP :

Maximize $2x_1 + 3x_2$

Subject to constraints :

$$x_1 + x_2 \geq 4;$$

$$x_1 + 2x_2 \geq 6;$$

$$x_1 - x_2 \geq 0;$$

If the dual of this LPP has 3 variables y_1, y_2, y_3 , which of the following assertions is valid regarding this dual problem and its solutions ?

(A) $y_1, y_2, y_3 \geq 0$ and the problem has a finite optimum solution.

(B) $y_1, y_2, y_3 \geq 0$ and has an unbounded solution.

(C) $y_1, y_2 \geq 0, y_3$ unrestricted and has an unbounded solution.

(D) $y_1, y_2 \geq 0, y_3$ unrestricted and has no feasible solution.

10. The following table gives the activities in a construction project and other relevant data :

Activity i – j	Preceding activities	Normal time (days)	Crash time (days)	Normal cost (Rs.)	Crash cost (Rs.)
1 – 2	–	20	17	600	720
1 – 3	–	25	25	200	200
2 – 3	1 – 2	10	8	300	440
2 – 4	1 – 2	12	6	400	700
3 – 4	1 – 3, 2 – 3	5	2	300	420
4 – 5	2 – 3, 3 – 4	10	5	300	600

Then normal project completion time, Minimum project completion time and Additional cost required to achieve this minimum time are respectively given by

(A) 45, 32, 980

(B) 45, 40, 0

(C) 45, 32, 960

(D) 40, 28, 980



11. If a system represents signed integers in 8-bit 2's complement form, what is the value represented by the hexadecimal representation FB ?
- (A) -4 (B) -5 (C) 5 (D) -6
12. If the 32-bit representation of a floating point number according to the IEEE 754 standard is given by the hexadecimal digit sequence 9BD2C58A, what is the hexadecimal representation of the 8-bits that constitute the exponent part in the number ?
- (A) 37 (B) 3A
(C) 9B (D) BD
13. In microprogrammed control, what type of instructions are stored in a Control ROM ?
- (A) Machine Language Instructions
(B) Assembly Language Instructions
(C) Microprogram Instructions
(D) C Program Statements
14. At any time of execution of a program, which of the following is stored in the Program Counter ?
- (A) A control word
(B) A machine language instruction
(C) An address from address ROM
(D) A memory address
15. If a ring counter has 8 Flip-Flops in it, how many different 8-bit values can be represented by it ?
- (A) 256 (B) 128
(C) 8 (D) 64



16. Consider the following statements about computer system architecture :

- I. Array processor uses multiple synchronized ALUs (i.e. Processing units) to achieve spatial parallelism with a lock-step operation.
- II. Processors operate asynchronously in array processing.
- III. Pipeline processing improves Throughput.

Which of the following is true ?

- (A) Statements (I) and (III) are true
- (B) Statements (I) and (II) are true
- (C) Only Statement (III) is true
- (D) Statements (II) and (III) are true

17. Which one of the following is true for Array and Vector processors ?

- (A) Array and Vector processors fall under the categories of SISD and SIMD respectively.
- (B) Array and Vector processors fall under the categories of SIMD and SISD respectively.
- (C) Array and Vector processors both fall under the categories of MIMD.
- (D) Array and Vector processors both fall under the categories of SIMD.

18. Which one of the following is the disadvantage of Pipelining ?

- (A) Instruction Latency is higher
- (B) Cycle time is less
- (C) Multiple instructions are overlapped
- (D) System throughput increases



19. What is the addressing mode of a Machine Language Instruction in which the data for the instruction is given as an operand in the instruction itself ?
- (A) Immediate addressing
 - (B) Register addressing
 - (C) Direct addressing
 - (D) Indirect addressing
20. Assume that the binary equivalent of integer value 375 is stored in a 16-bit Shift-Left register. What will be the value (in hexadecimal) in the register after the Shift-Left operation is carried out on it twice ?
- (A) 02EE
 - (B) 05DC
 - (C) 0177
 - (D) 04BA
21. What will be the output of following code segment ?
- ```
int main ()
{
 int i, k = 0;
 float c [100];
 for (i = 0; i < 10; i += 3)
 if (&c [i + 20] - &c [i + 16])
 k += &c [i + 3] - &c [i];
 else k++;
 printf ("k = %d", k);
}
```
- (A) 12
  - (B) 30
  - (C) 48
  - (D) Compiler Error





22. Consider the following code segment :

```
int mult (int x, int n)
{
 int val = 1;
 if (n > 0)
 {
 if (n%2 == 1) val = val * x;
 val = val * mult (x*x, n/2);
 }
 return val;
}
```

What value is returned for mult (3, 6) ?

- (A) 729 (B) 216  
(C) 243 (D) 108

23. Consider the following program :

```
#include <stdio.h>
main ()
{
 int a = 3, b = 5, c, d ;
 c = a++, ++a;
 d = (b++, ++b);
 printf("a = %d b = %d c = %d d = %d", a, b, c, d);
}
```

The output of this program is

- (A) a = 4 b = 6 c = 4 d = 6  
(B) a = 5 b = 7 c = 3 d = 7  
(C) a = 5 b = 7 c = 4 d = 6  
(D) Syntax Error



**24.** In C++, the address of the object

- (A) cannot be accessed from inside the member function.
- (B) cannot be accessed in the program.
- (C) is available inside the member function using the *this* pointer.
- (D) can be accessed using the object name inside the member function.

**25. Which of the following are true about constructors in C++ ?**

- I. They cannot be virtual.
- II. They cannot be private.
- III. They are automatically called by the *new* operator.
- IV. They have no return type.
- V. The maximum number of constructors that a class can have is 64.

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

**26. Which of the following is false ?**

- (A) A point  $(x, y)$  in 2D can have an infinite number of homogenous coordinates.
- (B) Homogeneous coordinates can be used to represent point at infinity.
- (C) With homogeneous coordinates, we can represent 2D affine transformations as 3D linear transformations.
- (D) Homogeneous coordinates consume less memory than Cartesian coordinates.

27. Which of the following point will not be part of line plotted between the points (20, 10) and (30, 18) using Bresenham Line Drawing Algorithm ?

- (A) (23, 12) (B) (25, 15)  
(C) (27, 16) (D) (28, 16)



28. Reflection of a point about x-axis, followed by a counter-clockwise rotation of 90 degrees, is equivalent to reflection about the line
- (A)  $x = -y$   
(B)  $x = 0$   
(C)  $x = y$   
(D)  $x + y = 1$
29. In the Cohen Sutherland line clipping algorithm, if the codes of the four points P, Q, R and S are 1001, 0101, 0010 and 1010 respectively, then which of the following line segments is lying partially inside the clipping window ?
- (A) PQ                      (B) PR                      (C) PS                      (D) RS
30. Perspective projection is classified on the basis of
- (A) Vanishing points  
(B) View plane  
(C) Direction of projection  
(D) Centre of projection
31. Consider the following statements about Data Models in DBMS :
- i. Data is represented in form of entities, relations, objects or similar other ways by Data models.  
ii. Data Model is used to store, manipulate and retrieve the data.  
iii. Data Model doesn't represent data semantics.  
iv. Data Model describes consistency constraints.
- Which pair of statements from the above are true ?
- (A) i and iii                      (B) i and iv  
(C) ii and iii                      (D) ii and iv



32. Consider the relation *STUD* (*sid*, *sname*, *city*). Assume that one of the values of *sid* is "S1". Which one from the following queries will find students who belong to the same city as that of student with *sid* "S1" ?
- (A) SELECT *sname* from *STUD* where *city* = "S1";
  - (B) SELECT *sname* from *STUD* where *city* LIKE "S1";
  - (C) SELECT *sname* from *STUD* where *city* = (SELECT *city* from *STUD* where *sid* = "S1");
  - (D) SELECT *sname* from *STUD* where *city* = (SELECT *city* from *STUD* where *sid* LIKE "S1");
33. If all non-key attributes of a relation are fully functionally dependent on primary attributes only, then the relation satisfies which of the following Normal Form ?
- (A) 5<sup>th</sup>
  - (B) 3<sup>rd</sup>
  - (C) 4<sup>th</sup>
  - (D) 2<sup>nd</sup>
34. Which types of databases allow time-based reasoning ?
- (A) Deductive database
  - (B) Temporal database
  - (C) Semistructured database
  - (D) Both (A) and (B)
35. An employee is allowed to work in several departments and a department is allowed to have several employees is an example of
- (A) one-to-one relationship
  - (B) one-to-many relationship
  - (C) many-to-many relationship
  - (D) many-to-one relationship



36. Which operator preserves unmatched rows of the relations being joined ?
- (A) Union (B) Inner Join  
(C) Outer Join (D) Union Join
37. Which one of the following constraints does not enforce uniqueness but enforce data integrity ?
- (A) UNIQUE  
(B) Primary Key  
(C) Super Key  
(D) Foreign Key
38. Which of the following relational algebra operations is not commutative ?
- (A) Projection (B) Selection  
(C) Union (D) Intersection
39. Consider the join of a relation R with relation S. If R has m tuples and S has n tuples, then the maximum size of join is
- (A)  $m + n$  (B)  $2(m + n)$   
(C)  $mn$  (D)  $2m + n$
40. Suppose you would like to use supervised learning to predict the price of a car based on an existing dataset for several cars. This is an example of
- (A) Classification  
(B) Regression  
(C) Clustering  
(D) Structural Equation Modelling



**41. Which of the following statements is (are) true ?**

- I. Interpreters usually take less amount of time to analyse the source code.
- II. Interpreters usually take less amount of time to execute the code.
- III. Compilers generate Object Code which further requires linking, hence require more memory.

(A) I only

(B) I and II

(C) I and III

(D) II and III

42. What is wrong with the following program that implements Peterson's solution with two processes  $P_0$  and  $P_1$ ?

```
1. bool flag[2] = {false, false};
```

```
2. int turn;
```

```
// P0's code
```

3.  $P_0$  : flag[0] = true;

4.  $P_{0-g} : \text{turn} = 1;$

```
5. while (flag[1] == true
```

6. `&&turn == 1)`

7. `{//busy wait}`

8. //begin CS

9. ...

```
10. // end CS
```

```
11. flag[0] = false;
```

```
// P1's code
```

P<sub>1</sub> : flag[1] = true;

P<sub>1</sub>\_g : turn = 0;

```
while(flag[0] == true
```

```
&&turn == 0)
```

```
{//busy wait}
```

```
//begin CS
```

...

```
// end CS
```

```
flag[1] = false;
```

- (A) Line 3 :  $P_0$  should set  $\text{flag}[1] = \text{true}$  and  $P_1$  should set  $\text{flag}[0] = \text{true}$
- (B) Line 4 :  $P_0$  should set  $\text{turn} = 0$  and  $P_1$  should set  $\text{turn} = 1$
- (C) Line 6 :  $P_0$  should check  $\text{turn} == 0$  and  $P_1$  should check  $\text{turn} == 1$
- (D) There is nothing wrong with the above code





43. A deadlock may occur when which of the following set of conditions hold true ?

- (A) Mutual Exclusion, Hold and Wait, No preemption, Circular Wait
- (B) Mutual Exclusion, Hold and Wait, No preemption, Bounded Waiting
- (C) Critical Section, Hold and Wait, Preemption, Bounded Waiting
- (D) Mutual Exclusion, Starvation, No preemption, Circular wait

44. Consider the arrival times and burst times of P1 – P4 :

| Process | Arrival Time | Burst Time |
|---------|--------------|------------|
| P1      | 0            | 8          |
| P2      | 1            | 4          |
| P3      | 2            | 9          |
| P4      | 3            | 5          |

What will be the order of completion based on preemptive shortest-remaining-time-first policy ?

- (A) P1, P2, P4, P3
- (B) P2, P4, P1, P3
- (C) P3, P1, P2, P4
- (D) P2, P1, P3, P4

45. Consider a serial program in two parts A and B for which the time taken by A,  $T_A = 4s$  and the time taken by B,  $T_B = 1s$ . Now suppose B can be executed in parallel on 5 processing cores, then the speedup based on Amdahl's law will be

- (A) 1.25
- (B) 1.66
- (C) 1.19
- (D) 2.77



**46.** Which of the following statements is (are) true regarding RAID ?

- I. Disk striping is done to ensure continuous availability.
- II. Disk mirroring cannot be used for increasing throughput.
- III. Parity data is used by RAID to achieve redundancy.

- (A) II only
- (B) I and II
- (C) I and III
- (D) II and III

**47.** Which of the following statements is (are) true about free space management ?

- I. Bit map requires extra space.
- II. In linked list method, free disk blocks can be found quickly.
- III. In Bit map, it is easy to get contiguous files.

- (A) II only
- (B) I and II
- (C) I and III
- (D) II and III

**48.** Which of the following statements is (are) true ?

- I. After loading a kernel module, the system needs to be rebooted.
- II. A kernel module can extend the kernel functionality at runtime.
- III. The disadvantage of loadable kernel modules is that it incurs a fragmentation penalty.

- |               |                |
|---------------|----------------|
| (A) I only    | (B) I and II   |
| (C) I and III | (D) II and III |





- 49.** Interprocess communication in Linux does not happen via
- (A) Signals
  - (B) Mailslots
  - (C) Semaphores
  - (D) Pipes
- 50.** Which of the following is/are true regarding a Unix File System (UFS) ?
- I. A super block contains the metadata for files such as ownership, type, and access.
  - II. The boot block is located in the first few sectors of a file system.
  - III. Each data block contains a magic number.
- (A) III only                      (B) II only                      (C) I and II                      (D) I and III
- 51.** Consider the statements of the user requirement : The system shall not accept passwords longer than 15 characters. If the user enters more than 15 characters while choosing the password, an error message shall ask the user to correct it. The requirement is
- (A) Incomplete
  - (B) Inconsistent
  - (C) Repetitive
  - (D) Unambiguous
- 52.** An exception handler that closes all open files, creates an error log, notifies user etc. If such functionalities are implemented using object-oriented approach the developer will take care of utilizing which cohesion ?
- (A) Functional
  - (B) Temporal
  - (C) Communicational
  - (D) Layer



53. A team of students designed an e-commerce website and wanted to test the Add to Cart functionality of the site. In order to achieve this, around 100 students were asked to login to the site at the same point of time. The dashboard of the students failed to display even after 20 seconds. Which software quality attribute did the software did not pass ?
- (A) Functionality
  - (B) Reliability
  - (C) Usability
  - (D) Performance and Load
54. Consider a Hospital Management System that maintains patient's records. The system does not have a payment module, which indicates
- (A) the scope of the system
  - (B) the constraint of the system
  - (C) the limitation of the system
  - (D) the system is not efficient
55. Given the following specification, "A tourist of age greater than 21 years and having a clean driving record is supplied a rental car. A premium amount is also charged if the tourist is on business, otherwise it is not charged. If the tourist is less than 21 year old, or does not have a clean driving record, the system will display the following message : "Car cannot be supplied". Which functional testing technique(s) would NOT suit the scenario to test whether all the conditions have been tested ?
- (A) Cause-Effect Graphing
  - (B) Branch coverage
  - (C) Equivalence Partitioning
  - (D) Decision Table



56. Which of the following is not a size measure for a software product ?
- (A) Function Point
  - (B) Cyclomatic Complexity
  - (C) LOC (i.e. Lines of Code)
  - (D) Key Classes
57. Which of the following testing phase usually uses Impact analysis ?
- (A) Component Testing
  - (B) Acceptance Testing
  - (C) Maintenance Testing
  - (D) Integration Testing
58. "Does the software deliver all features including all functionalities error-free as and when required without failure" is a part of which software quality dimension ?
- (A) Performance
  - (B) Conformance
  - (C) Aesthetics
  - (D) Reliability
59. Consider the following statements regarding Information Hiding during software design
- i. Information Hiding implies that effective modularity can be achieved by defining a set of independent modules.
  - ii. Information Hiding does not help when modification is required during testing and maintenance.
  - iii. Information Hiding enforces access constraints to both procedural details within a module and the local data structure used by the module.
- Which of the above statements are true ?
- (A) i and ii
  - (B) i and iii
  - (C) ii and iii
  - (D) ii only



60. Cohesion is an extension of
- (A) Information Hiding (B) Modularity  
(C) Abstraction (D) Refinement
61. In order to search for an element in a set containing  $n$  elements, which among the following technique is the most time-efficient in the worst-case ? [Note : Don't include the time taken to construct the data structure into account.]
- (A) The elements are stored in a hash table using chaining and hashing operation is applied.  
(B) The elements are stored in a sorted array and binary search operation is applied.  
(C) The elements are stored in a doubly linked list and binary search operation is applied.  
(D) The elements are stored in a binary search tree and search operation is applied.
62. The following insertions are made to an initially empty B-tree of order 5 :  
1, 12, 8, 2, 25, 5, 14, 28, 17. The root node now contains the element (s)
- (A) 8 (B) 12 (C) 8, 17 (D) 5, 14
63. Suppose we are implementing quadratic probing with a hash function  $\text{Hash}(X) = X \bmod 7$ . If the keys 14, 8, 21, 2 and 7 are to be inserted in that sequence in a table of size 7, then at which index position will key 7 be stored ?
- (A) 3  
(B) 4  
(C) 5  
(D) Quadratic probing will not be able to find an empty slot
64. Let  $G$  be a directed graph whose vertex set is the set of numbers from 1 to 200. There is an edge from a vertex  $i$  to a vertex  $j$  iff either  $j = i + 1$  or  $j = 11 * i$ . What will be the minimum number of edges in a path in  $G$  from vertex 1 to vertex 200 ?
- (A) 10 (B) 11 (C) 20 (D) 199



65. Which sorting algorithm will you use to sort an array in which 98% of elements are already in sorted positions and only 2% of the elements need to be placed at proper position in the array ?
- (A) Quick Sort
  - (B) Insertion Sort
  - (C) Heap Sort
  - (D) Merge Sort
66. When is the Breadth First Search of a graph unique ?
- (A) When the graph is a complete binary tree.
  - (B) When the graph is a singly linked list.
  - (C) When the graph is a forest.
  - (D) When the graph is a ternary tree.
67. Given a knapsack with capacity of 11 and 5 objects with weights  $w[1...5] = 1, 2, 5, 6, 7$ . For which of the following profit values, the fractional and 0/1 knapsack have same profit ?
- (A) Profits  $p[1...5] = \{1, 6, 18, 22, 28\}$
  - (B) Profits  $p[1...5] = \{8, 16, 18, 32, 28\}$
  - (C) Profits  $p[1...5] = \{4, 6, 30, 36, 32\}$
  - (D) Profits  $p[1...5] = \{3, 8, 10, 18, 14\}$
68. How many comparisons are needed using KMP algorithm, to search for the pattern  $P = \text{"abacab"}$  in the string  $S = \text{"abacaabaccabacabaabb"}$  ?
- (A) 18
  - (B) 19
  - (C) 20
  - (D) 21





69. From the following choose the one which uses an algorithm design technique different from the other three.
- (A) Merge sort
  - (B) Dijkstra's shortest path algorithm
  - (C) Binary search
  - (D) Quick sort
70. The following are the statements regarding the NP problems. Choose the correct option from the following options.
- I. All NP-complete problems are not NP-hard.
  - II. Some NP-hard problems are not known to be NP-complete.
- (A) Both I and II are true
  - (B) Both I and II are false
  - (C) Only I is true
  - (D) Only II is true
71. Which of the following CFG cannot be simulated by an FSM ?
- (A)  $S \rightarrow Sa|b$
  - (B)  $S \rightarrow aSb|ab$
  - (C)  $S \rightarrow bS|b$
  - (D)  $S \rightarrow a|b$
72. Which of the representations of the language L, with w as strings and a, b as symbols of the alphabet, is regular ?
- (A) The set of strings of balanced parentheses.
  - (B) The set of strings of the form  $ww^R$ .
  - (C) The set of strings, containing an equal number of a's and b's.
  - (D) The set of strings, starting and ending with same character.





73. The language  $\{a^m b^m, m > 0\}$  can be recognised by
- (A) A non-deterministic finite state automaton, but not by a deterministic finite state automaton
  - (B) A deterministic pushdown automaton, but not by a non-deterministic finite state automaton
  - (C) A non-deterministic pushdown automaton but not by a deterministic pushdown automaton
  - (D) A non-deterministic turing machine but not by deterministic turing machine
74. Which of the following is false about Deterministic Finite Automata ?
- (A) Empty string transitions are not allowed.
  - (B) The transition from a state is to a single particular next state.
  - (C) It usually requires more states as compared to equivalent Non-Deterministic Finite Automata.
  - (D) There cannot be more than one accepting state.
75. Which of the following is the correct regular set expressing  $(0 + \epsilon) (1 + \epsilon) ?$
- (A)  $L = \{0, 1, 10, 100, 1000, 10000, \dots\}$
  - (B)  $L = \{1, 01, 10, 010, 0010, \dots\}$
  - (C)  $L = \{\epsilon, 0, 1, 01\}$
  - (D) None of the above
76. Among the following statements :
- i. The pumping lemma can be used to prove that a language is not regular.
  - ii. If a language satisfies the pumping lemma, then it must be regular.
- (A) i and ii are false
  - (B) i and ii are true
  - (C) i is false, ii is true
  - (D) i is true, ii is false



77. Among the following statements :

- i. A 1-tape Turing machine can emulate a k-tape Turing machine.
- ii. A non-deterministic Turing machine can be converted to a deterministic Turing machine.
- iii. The tape of the Turing machine is finite.
- iv. The transition table (action table) of a Turing machine is finite.

- (A) i, ii, iii are true
- (B) i, ii, iv are true
- (C) i, iii, iv are true
- (D) ii, iii, iv are true

78. A grammar has the following productions :

$$S \rightarrow aSSb|a|bSa$$

Which of the following string is in the language that is generated by this grammar ?

- (A) aabbaabb
- (B) bbbaabbbaa
- (C) babbbabba
- (D) aaaaabb

79. Consider the following statements :

- i. A grammar in Greibach Normal Form (GNF) can be right recursive.
- ii. Any context-free grammar can be converted to GNF.

Which one of the following is correct ?

- (A) i and ii are false
- (B) i and ii are true
- (C) i is false, ii is true
- (D) i is true, ii is false



**80.** A language  $L$  is such that

- i. An algorithm tells in finite time if a string  $s$  is in the language.
- ii. An algorithm tells in finite time if a string  $s$  is not in the language.

Which of the following is correct ?

- (A)  $L$  is recursive and recursively enumerable.
- (B)  $L$  is not recursive and not recursively enumerable.
- (C)  $L$  is not recursive, but recursively enumerable.
- (D)  $L$  is not recursively enumerable, but recursive.

**81.** Which one is true for the Congestion Control mechanism that regulates the transmission rate ?

- (A) Congestion control mechanism is implemented in the transport layer.
- (B) One of the protocols to control congestion is the Routing Information Protocol.
- (C) Congestion Control mechanism implemented in the network layer.
- (D) Both (B) and (C)

**82.** Which layer is the communication layer that connects the IoT devices with WAN ?

- (A) Application
- (B) Network
- (C) Sensor
- (D) Internet

**83.** Which data link layer protocol is not used for the noisy channel ?

- (A) Stop-and-wait
- (B) Stop-and-Wait ARQ
- (C) Go-back-N ARQ
- (D) Selective Repeat ARQ



84. A multiplexing technique that could use maximum bandwidth for a slot to transmit digital signals and used in applications like ISDN and PSTN is

- (A) WDM
- (B) FDM
- (C) TDM
- (D) PDM

85. A network security mechanism that controls the movement of packets across the network on the basis of protocols, screening rules, IP addresses and ports as well as higher throughput compared to proxy gateways is

- (A) Firewall Filtering
- (B) Packet Filtering
- (C) IP Filtering
- (D) Stateful Firewall

86. List – 1 and List – 2 contains port number and its purpose respectively.

**List – 1**

**List – 2**

- |        |                              |
|--------|------------------------------|
| m. 22  | i. By DHCP for sending       |
| n. 110 | ii. By POP3                  |
| o. 67  | iii. By SSH for secure login |
| p. 443 | iv. By HTTPS                 |

Which pair from the following one is the correct matching pair ?

- (A) m – iii, n – ii, o – i, p – iv
- (B) m – iii, n – iv, o – i, p – ii
- (C) m – iv, n – iii, o – ii, p – i
- (D) m – ii, n – iv, o – iii, p – i



87. Which cipher algorithm generates output string as YSCKRHT GV ALETG LYDHKHFGHPKZ for the input string WELCOME TO GSLET EXAMINATIONS (space to be taken as a part of the string) with key GSLET ?

The order of key alphabet and offset value will be 24315 and 0 respectively can be used as per the requirements of an algorithm as additional input parameter (s).

- (A) Affain cipher
- (B) Playfair cipher
- (C) Rail Fence cipher
- (D) Columnar Transposition cipher

88. Which of the following statements is/are true ?

- I. PageRank is based on eigenvector and eigenvalue computations.
- II. PageRank always converges.
- III. PageRank is based on outlinks.

- (A) III only
- (B) I and II
- (C) II and III
- (D) I and III

89. Which one of the following statements is TRUE for mobile computing ?

- (A) GPRS is a popular protocol of mobile networks.
- (B) CDMA system uses distinctive spreading codes to spread the symbols before transmission.
- (C) IMT-2000 is a 3G wireless communication standard defined by the recommendations of ITU. It specifies that the minimum data transfer rate for 3G is 512 kbps.
- (D) Adjacent cells in a cellular network have the same frequency as per FDMA standard.



90. A firewall may be implemented in
- (A) Bridges used in an intranet
  - (B) Routers which connect intranet to internet
  - (C) Modem
  - (D) Switch
91. Which of the following resolves the Sussman anomaly efficiently ?
- (A) Linear Planning
  - (B) Goal Stack Planning
  - (C) Partial Order Planning
  - (D) Total Order Planning
92. What is the order and defining length of the schema  $*0*1*$  ?
- (A) 0, 1
  - (B) 2, 2
  - (C) 3, 4
  - (D) 5, 3
93. The Schema Theorem states that the schema with
- (A) Above average fitness, short defining length and lower order is more likely to survive crossover and mutation.
  - (B) Above average fitness, long defining length and lower order is more likely to survive crossover and mutation.
  - (C) Below average fitness, long defining length and lower order is more likely to survive crossover and mutation.
  - (D) Above average fitness, long defining length and higher order is more likely to survive crossover and mutation.



94. Which of the following statements is (are) true ?

- I. The Chinese room implements a version of the Turing test.
- II. The Chinese room argument holds that a machine does not understand.
- III. The Chinese room argument is intended to refute weak AI.

- (A) I only
- (B) I and II
- (C) I and III
- (D) II and III

95. Which of the following is false ?

- (A) Greedy algorithm ignores future possibilities and is slower compared to divide-and-conquer.
- (B) Hill-climbing is sometimes called greedy local search.
- (C) A\* algorithm is complete and optimal.
- (D) Fitness function is a feature of the genetic algorithms.

96. Let  $X = \{\text{Vijay, Anup, Bela}\}$ ;  $Y = \{\text{SS, SC, OS}\}$  and define Fuzzy Relations : A : Proficiency and B : Interest, as given in the following tables :

| A     | SS  | SC  | OS  | B     | SS  | SC  | OS  |
|-------|-----|-----|-----|-------|-----|-----|-----|
| Vijay | 0.5 | 0.6 | 0.4 | Vijay | 0.7 | 0.6 | 0.5 |
| Anup  | 0.7 | 0.5 | 0.6 | Anup  | 0.6 | 0.5 | 0.8 |
| Bela  | 0.6 | 0.8 | 0.3 | Bela  | 0.8 | 0.7 | 0.4 |

Then the values of  $(A^c \cup B)$  (Anup, SS) and  $(A^c \cap B)$  (Bela, OS) are

- (A) 0.3 and 0.7
- (B) 0.6 and 0.7
- (C) 0.3 and 0.4
- (D) 0.6 and 0.4



97. Which one of the following functions can qualify as membership function of some Fuzzy set on  $R$  ?

$$A_1(x) = \begin{cases} 5(x-1)+1 & \text{if } \frac{4}{5} < x < 1 \\ 5(1-x)+1 & \text{if } 1 < x < \frac{6}{5} \\ 0 & \text{otherwise} \end{cases}$$

and  $A_2(x) = e^{-(0.5(x-1))}$

- (A) Both  $A_1$  and  $A_2$  qualify (B)  $A_1$  qualifies but not  $A_2$   
(C)  $A_2$  qualifies but not  $A_1$  (D) Neither of  $A_1, A_2$  qualify

98. What is the major challenge for text processing in Natural Language Processing ?

- (A) Handling Ambiguity in sentences  
(B) Handling Tokenization  
(C) Handling POS-Tagging  
(D) Handling Spelling Mistakes

99. Which of the following is not an application area of Natural Language Processing ?

- (A) Machine translation (B) Text summarization  
(C) Grammar checking (D) Driverless cars

100. Many words, such as ring, orange, bat etc., have more than one meaning; we have to select the meaning which makes the most sense in context. This can be resolved by

- (A) Fuzzy logic (B) Word sense disambiguation  
(C) Syntactic analysis (D) Anaphora resolution





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