COMPUTER SCIENCE AND APPLICATIONS

PAPER – II

CODE-19

Name & Signature of the Invigilator

.....

.....

OMR Answer Sheet No. :

Roll No. :

(in figures as in Hall Ticket)

Roll Number in words : .....

.....

Question Booklet Sl. No.
190391

Time : 2 Hours] **No. of Printed Pages : 24** **[Maximum Marks : 200**

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page.
2. This paper consists of **one hundred (100)** multiple choice type of questions. **All** questions are compulsory.
3. 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 :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker seal and do not accept an open booklet.
   (ii) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   (iii) After this verification is over, the Test Booklet Number should be entered on the OMR Answer Sheet and the OMR Answer Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the oval as indicated below on the correct response against each item.
   Example: (A) ● (C) (D) where (B) is the correct response.
5. Your responses to the items are to be indicated on the OMR Answer Sheet under Paper – II only. If you mark your response at any place other than in the oval in the OMR Answer Sheet, it will not be evaluated.
6. Rough Work is to be done in the end of this booklet.
7. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
8. You have to return the original OMR Answer Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet and duplicate copy of OMR Answer Sheet on conclusion of examination.
9. Use only Blue/Black Ball point pen.
10. Use of any calculator or any electronic devices or log table etc., are prohibited.
11. There shall be no negative marking.

પરીક્ષાર્થીઓ માટે સૂચનાઓ

1. આ પાનાની ટોચ પર દર્શાવેલી જગ્યામાં તમારો રોલ નંબર લખો.
2. આ પ્રશ્નપત્રમાં બહુવૈકલ્પિક ઉત્તરો ધરાવતા સો (૧૦૦) પ્રશ્નો આપેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.
3. પરીક્ષાની શરૂઆતમાં આપને પ્રશ્નપુસ્તિકા આપવામાં આવશે. પ્રથમ પાંચ (૫) મિનિટ દરમ્યાન તમારે પ્રશ્નપુસ્તિકા ખોલી અને ફરજિયાતપણે નીચે મુજબ પરીક્ષણ કરવું :
   (i) પ્રશ્નપુસ્તિકાનો વપરાશ કરવા માટે આ કવર પૃષ્ઠની ધાર પર આપેલ સીલ સ્ટીકર ફાડી નાખો. કોઈપણ સંજોગોમાં સીલ સ્ટીકર વગરની કે ખુલ્લી પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં.
   (ii) 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.
   (iii) આ ચકાસણી સમાપ્ત થાય પછી, પ્રશ્નપુસ્તિકાનો નંબર OMR જવાબ પત્રક પર લખવો અને OMR જવાબ પત્રકનો નંબર પ્રશ્નપુસ્તિકા પર લખવો.
4. 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) ● (C) (D) કે જ્યાં (B) સાચો જવાબ છે.
5. 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.
6. કાચું કામ (Rough work) પ્રશ્નપુસ્તિકાના અંતિમ પૃષ્ઠ પર કરવું.
7. જો આપ OMR જવાબ પત્રક નિયત જગ્યા સિવાય અન્ય કોઈપણ સ્થાને, આપનું નામ, રોલ નંબર, ફોન નંબર અથવા એવું કોઈ ચિહ્નક જેનાથી તમારી ઓળખ થઈ શકે, અંકિત કરશો અથવા અભદ્ર 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 કરવામાં આવશે.
8. પરીક્ષા સમય પૂરો થઈ ગયા બાદ ઓરીજીનલ OMR જવાબ પત્રક જે તે નિરીક્ષકને ફરજિયાત સોંપી દેવું અને કોઈ પણ સંજોગોમાં તે પરીક્ષા ખંડની બહાર લઈ જવું નહીં. પરીક્ષા પૂર્ણ થયા બાદ ઉમેદવાર ઓરીજીનલ પ્રશ્નપુસ્તિકા અને OMR જવાબ પત્રકની ડુપ્લિકેટ કોપી પોતાની સાથે લઈ જઈ શકે છે.
9. માત્ર કાળી / ભૂરી બૉલ પૉઈન્ટ પેન વાપરવી.
10. કેલ્ક્યુલેટર,લૉગ ટેબલ અને અન્ય ઈલેક્ટ્રૉનિક યંત્રોનો ઉપયોગ કરવાની મનાઈ છે.
11. ખોટા જવાબ માટે નકારાત્મક ગુણાંકન પ્રથા નથી.

COMPUTER SCIENCE AND APPLICATIONS

Paper – II

1. Determine the logical nature of the following compound proposition :

$(P \rightarrow Q) \wedge (Q \rightarrow P)$.

Which of the following best describes this expression ?

(A) Contradiction (B) Absurdity (C) Contingency (D) Tautology

2. Which of the following is logically equivalent to the statement :

$\neg (P \vee (Q \wedge R))$?

(A) $\neg P \wedge \neg Q \wedge \neg R$ (B) $\neg P \wedge (\neg Q \vee \neg R)$

(C) $(\neg P \vee \neg Q) \vee \neg R$ (D) $(\neg P \vee \neg Q) \wedge \neg R$

3. Which of the following is logically equivalent to the statement :

"It is not true that for every element x in domain D, there exists an element y in D such that P(x, y) holds.", that is, $\neg(\forall x \in D)(\exists y \in D)\ P(x, y)$?

(A) $(\forall y \in D)(\exists x \in D) \neg P(x, y)$ (B) $(\exists x \in D)(\exists y \in D) \neg P(x, y)$

(C) $(\exists x \in D)(\forall y \in D) \neg P(x, y)$ (D) $(\forall x \in D)(\forall y \in D) \neg P(x, y)$

4. Let R be a relation on set A = {1, 2, 3, 4 }, defined by aRb if and only if $a^2 = b^2$.

Which property does R satisfy ?

(A) Reflexive (B) Symmetric (C) Transitive (D) All of these

5. Which one of the following statements is true about bipartite graphs ?

(A) Every bipartite graph is complete

(B) A graph is bipartite if and only if it contains no cycles

(C) A graph is bipartite if it contains only even-length cycles

(D) A graph is bipartite if and only if it has no odd-length cycles

6. Consider the following well-formed formulas :

$F_1 : P \Rightarrow \neg P$

$F_2 : (P \Rightarrow \neg P) \vee (\neg P \Rightarrow P)$.

Which statement is correct ?

(A) F_1 is satisfiable, F_2 is valid (B) F_1 is unsatisfiable, F_2 is satisfiable

(C) F_1 is unsatisfiable, F_2 is valid (D) F_1 and F_2 are both satisfiable

7. In a class of 30 students, 12 like mathematics, 18 like physics and 5 like both. If a student is selected at random, what is the probability the student likes either mathematics or physics ?

(A) 5/30 (B) 25/30 (C) 13/30 (D) 17/30

8. Which algorithm is commonly used to solve integer linear programming problems by progressively adding linear constraints ?

(A) Simplex method (B) Cutting-plane method

(C) Bellman-Ford algorithm (D) Dijkstra's algorithm

9. Which of the following is the correct prefix expression for the infix expression ?

$(a + b * (c - d))\uparrow e$

(Assume $\uparrow$ denotes exponentiation.)

(A) $\uparrow + a*b - c\ d\ e$ (B) $\uparrow + a*b - d\ c\ e$

(C) $\uparrow - * + a\ b\ c\ d\ e$ (D) $\uparrow * + a\ b - c\ d\ e$

10. What is domain of function $f(x) = x^{-1}$ for it to be defined everywhere on domain ?

(A) $(2, \infty)$ (B) $(-\infty, \infty)$ (C) $[0, \infty)$ (D) $(-\infty, \infty) - \{0\}$

11. Which of the following Boolean expression is equivalent to $(A + B)(A + C)$?

(A) A + BC (B) AB + AC (C) A + B + C (D) A + BC + AC

12. The binary number $(1011110.10101)_2$ is equivalent to _____ in hexadecimal and _____ in octal.

(A) 5D.AC and 137.42 (B) 5E.B4 and 135.50

(C) 5E.A8 and 136.52 (D) 5F.A5 and 136.45

13. If a microoperation R3 $\leftarrow$ R1 – R2 is executed using only a single adder and no subtractor, which of the following microoperations can emulate it ?

(A) R3 $\leftarrow$ R1 + R2 (B) R3 $\leftarrow$ R1 + COM R2 + 1

(C) R3 $\leftarrow$ R2 – R1 (D) R3 $\leftarrow$ COM R1 + R2

14. In the instruction format of the 16-bits basic computer, how many bits are used for the address field ?

(A) 4 (B) 8 (C) 12 (D) 16

15. Which of the following is usually NOT a characteristic of CISC CPU design ?
    (A) Microprogrammed Control Unit
    (B) Variable Instruction Length
    (C) Execution time is multiple clock cycle per instruction
    (D) Small Instruction Set

16. Consider a pipeline with five stages (IF, ID, EX, MEM, WB). An instruction writes to register R1 in the WB stage. Which pipeline stage of the next instruction requires the updated value of R1 to avoid a data hazard ?
    (A) IF stage (B) ID stage (C) EX stage (D) MEM stage

17. What is the primary purpose of cache coherence protocols in multiprocessor systems ?
    (A) To reduce cache misses
    (B) To increase speed of searching cache
    (C) To maintain cache consistency
    (D) To share cache among processors

18. Which of the following is NOT a common DMA transfer mode ?
    (A) Cycle Stealing (B) Transparent DMA
    (C) Burst Mode (D) Interrupt-driven DMA

19. What is the primary function of the Memory Management Unit (MMU) ?
    (A) To allocate the memory to process
    (B) To translate virtual addresses to physical addresses
    (C) To manage I/O devices
    (D) To transfer data from disk to memory

20. Which of the following statements about cache mapping is correct ?
    (A) Direct mapping allows a memory block to occupy any location in the cache
    (B) Fully associative mapping restricts a memory block to a single cache line
    (C) Set-associative mapping balances flexibility and complexity by allowing blocks to map to a subset of cache lines
    (D) In direct mapping, the cache uses tags to compare against all cache lines simultaneously

21. Loader is responsible for loading _____ into memory during program running.

(A) Source files
(B) Object files
(C) Executable files
(D) Library files

22. When an array is passed as an argument to a function, what gets actually passed ?

(A) Address of last element of array
(B) Value of first element in array
(C) Value of last element in array
(D) Base address of array

23. What will be the output of the following C code ?

```
void main()
{
   int a = 1, b = 0, c = 5;
   int x = a && b && c++;
   printf("%d", c);
}
```

(A) 0 (B) 5 (C) 6 (D) 1

24. Which feature of OOP promotes code reusability ?

(A) Abstraction
(B) Encapsulation
(C) Inheritance
(D) Polymorphism

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

```
int main()
{
      int x = 5, y = 5, z;
      x = ++x; y = – –y;
      z = x++ + y– –;
      cout << z;
      return 0;
}
```

(A) 10
(B) 11
(C) 12
(D) 13

26. What will be the output of the following Java code ?

```
class leftshift_operator
{
        public static void main(String args[])
        {
                byte a = 64;
                int i;
                byte b;
                i = a << 2;
                b = (byte) (a << 2);
                System.out.print(i + " " + b);
        }
}
```

(A) 0 64
(B) 64 0
(C) 0 256
(D) 256 0

27. Which of the following is NOT related to XML ?

(A) SAX
(B) DLL
(C) DTD
(D) XPath

28. Which operations is used to zoom in or out around any axis on a three-dimensional object from its original position ?

(A) Scaling
(B) Rotation
(C) Shearing
(D) Translation

29. While plotting a line with end points (20, 10) and (30, 18) using Bresenham's Line Drawing Algorithm, which of the following pixels will NOT be a point on the line ?

(A) (24, 14)
(B) (25, 14)
(C) (26, 15)
(D) (28, 16)

30. What will be the final coordinates after rotation of the point P(2, 3, 4) at 90° about X-axis ?

(A) 2, –4, –3
(B) –2, –4, –3
(C) –2, 4, 3
(D) 2, –4, 3

31. What does logical data independence refer to ?

(A) Ability to change physical storage without affecting the logical schema

(B) Ability to change the application program without changing the database

(C) Ability to change the logical schema without affecting external schemas

(D) Ability to change view definition without affecting table

32. Consider the following relations P(X, Y, Z), Q(X,Y,T) and R(Y,V)

P

X	Y	Z
X1	Y1	Z1
X1	Y1	Z2
X2	Y2	Z2
X2	Y4	Z4

Q

X	Y	T
X2	Y1	2
X1	Y2	5
X1	Y1	6
X3	Y3	1

R

Y	V
Y1	V1
Y3	V2
Y2	V3
Y2	V2

How many tuples will be returned by the following relational algebra query ?

$\Pi_X(\sigma_{(P.Y = R.Y \wedge R.V = \text{"V2"})}(P \times R))-$

$\Pi_X(\sigma_{(Q.Y = R.Y \wedge Q.T > 2)}(Q \times R))$

(A) 0

(B) 1

(C) 2

(D) 3

33. If for two attributes A and B, Domain of A is subset of Domain of B; then which of the following is always true ?

(A) A is Foreign Key and B is Primary Key

(B) B is Foreign Key and A is Primary Key

(C) A is Foreign Key and B is Candidate Key

(D) B is Foreign Key and A is Candidate Key

34. Consider the table Employee (Id, Name, Salary, Department). Which of the following SQL query filters out the departments with 5 or fewer employees (with salary > 50000) ?

(A) SELECT department, COUNT(*)
FROM employees
WHERE salary > 50000
GROUP BY department
HAVING COUNT(*) < = 5;

(B) SELECT department, COUNT(*)
FROM employees
WHERE salary > 50000
GROUP BY department
HAVING COUNT(*) > 5;

(C) SELECT department, COUNT(*)
FROM employees
WHERE salary > 50000 AND COUNT(*) < = 5;

(D) SELECT department, COUNT(*)
FROM employees
WHERE salary > 50000 AND COUNT(*) > 5;

35. Consider a MongoDb collection of documents with fields : _id, name, cellphone and city. Which of the following method is correct to include only name and city in output ?

(A) db.employees.find({}, {name: 1, city: 1})

(B) db.employees.find({}, {_id: 1, name: 0, cellphone: 1, city: 0})

(C) db.employees.find({}, {name: 1, cellphone: 0, city: 1})

(D) db.employees.find({}, {_id: 0, name: 1, city: 1})

36. If a relation R is decomposed into R1 and R2, we say the decomposition is lossless if

(A) The intersection of R1 and R2 is a null set

(B) R1 and R2 have no common attributes

(C) The intersection of R1 and R2 is a key of either of them

(D) The intersection of R1 and R2 is not a key of either of them

37. In a MapReduce job, what is the purpose of the combiner function ?

(A) It processes input data before it is sent to the mappers

(B) It reduces the amount of data transferred between the mapper and reducer

(C) It performs a final aggregation of the output data

(D) It initializes the MapReduce job configuration

38. Match the following and select a most appropriate option.

a. Define the structure and allowed content of XML documents	1. SAX
b. To transform XML documents into other formats	2. DTD/XML Schema
c. An event-driven parser	3. XSLT
d. A language for navigating and selecting nodes in an XML document	4. XPath

(A) a-2, b-3, c-1, d-4 (B) a-3, b-4, c-1, d-2

(C) a-2, b-1, c-3, d-4 (D) a-4, b-1, c-3, d-2

39. Which of the following algorithms does NOT explicitly build a predictive model during the training phase ?

(A) Logistic Regression

(B) Support Vector Machine

(C) Naive Bayes

(D) K-Nearest Neighbours

40. In a Write-Ahead Logging (WAL) protocol, which of the following must happen before an actual database write ?

(A) A checkpoint must be taken

(B) The transaction must acquire a commit lock

(C) The log record must be written to stable storage

(D) All dirty pages must be flushed to disk

41. Which one of the following statements is false ?

(A) Divide by zero is an object link time error usually detected and handled by the operating system.

(B) If a variable is defined both globally and locally with the same name, the compiler gives priority to the local variable during the *variable shadowing* part.

(C) The operating system detects the *Null point access* error at run time usually via a segmentation fault or access violation.

(D) The Linker system software performs symbol resolution and relocation and detects errors when it encounters undefined external references usually due to absent or improperly specified libraries.

42. Which one of the following statements is false ?

(A) Linux *namespaces* are kernel feature to create isolated environment for processes.

(B) CPU affinity, also known as Process affinity, improves cache locality.

(C) Atomic operations prevent race conditions only for single variable updation/ modification.

(D) Turnaround time is most affected when time quantum in Round Robin scheduling algorithm is very small.

43. The selection of an in-memory process to use the CPU while the execution of another process is on hold is carried out by the

(A) Dispatcher

(B) Resource Scheduler

(C) Medium Term Scheduler

(D) Short Term Scheduler

44. Which one of the following statements is false for deadlock ?

(A) Mutual exclusion is a necessary condition for deadlock to occur.

(B) Banker's algorithm is used to detect deadlock.

(C) If a resource allocation graph does not contains a cycle, then there is no possibility of the deadlock.

(D) If resource of a process is to be pre-empted, then one of the good solution is to roll-back the process to earlier stage.

45. In a paged memory, the page hit ratio is 0.5. The time required to access a page in secondary memory is equal to 100 ns. The time required to access a page in primary memory is 10 ns. What is the average time to access a page ?

(A) 50 (B) 55

(C) 5 (D) 500

46. Which of the following statements best describes the function of a device controller in I/O systems ?

(A) It buffers data and handles device-specific operations independently of the CPU.

(B) It controls CPU scheduling based on I/O requests.

(C) It translates logical addresses to physical addresses for devices.

(D) It initiates CPU interrupts directly on user request.

47. Which of the following disk scheduling algorithms provides minimum average seek time and high throughput, but does NOT ensure fairness ?

(A) LOOK (B) SCAN

(C) SSTF (D) C-SCAN

48. Which of the following RAID levels provides full usable storage capacity, with no space reserved for redundancy ?

(A) RAID 0 (B) RAID 1

(C) RAID 10 (D) RAID 3

49. When a process attempts to access a memory address beyond its allocated segment and encounters a segmentation fault, who triggered this fault ?

(A) Virtual memory segmentation

(B) Demand paging

(C) File access control

(D) Memory protection via MMU

50. A library database stores information about books that are frequently browsed by subject category (e.g., "Science Fiction", "History") and publication year ranges (e.g., "books from 2020-2024"). Librarians need to generate reports listing all books in specific categories or year ranges. Which file organization would be most appropriate ?

(A) Multi-level indexed organization with indexes on both subject and year

(B) B+ tree organization with composite keys

(C) Static hash file organization on ISBN

(D) Clustered file organization grouped by subject category

51. Which is a formal method ?

(A) Decision tree and decision table

(B) Axiomatic specification

(C) Viewpoint

(D) Architectural representation

52. What is the purpose of writing user stories in agile ?

(A) Requirement elicitation and specification

(B) Designing the architecture

(C) Writing test cases

(D) Designing algorithm

53. Structured analysis uses _____ for requirements analysis.

(A) UML (B) DFD (C) Flow chart (D) Prototype

54. In effective modular design, we

(A) Minimize cohesion and maximize coupling

(B) Maximize cohesion and maximize coupling

(C) Maximize cohesion and minimize coupling

(D) Minimize cohesion and minimize coupling

55. Which is used to measure the impact of a risk in terms of the expected value of the loss ?

(A) Risk control

(B) Risk prioritization

(C) Risk transfer

(D) Risk exposure

56. Suppose an embedded type of software product is to be developed. The estimated lines of source code are 10000. What will be the development effort ? Assume a = 2.8 and b = 1.20.

(A) 44.38 PM

(B) 15.85 PM

(C) 2.8 PM

(D) 3.36 PM

57. Which of the following are the direct measures ?

i. Size

ii. Effort

iii. Schedule

iv. Quality

(A) Both i and iv only

(B) Both ii and iv only

(C) Both ii and iii only

(D) i, ii and iii only

58. Which is NOT a testing tool ?

(A) Selenium

(B) JUnit

(C) LoadRunner

(D) Django

59. Which testing is conducted in case of maintenance or reengineering type of projects ?

(A) Benchmark testing

(B) Shadow testing

(C) Stress testing

(D) Load testing

60. Deltas are maintained during

(A) Configuration identification

(B) Configuration change control

(C) Configuration version control

(D) Configuration auditing

61. Which of the following statements about tree structures and their representations is incorrect ?

(A) In every tree, the number of leaf nodes is always greater than the total number of internal nodes with right siblings combined.

(B) The postfix expression a b + c * d e – / f + is equivalent to the infix expression : (((a + b) * c) / (d – e)) + f.

(C) Array of pointers representation may waste memory when most nodes have few children.

(D) In linked list representation of a tree, accessing the n^{th} child takes O(n) time.

62. Which of the following statements about graph representations and algorithms is incorrect ?

(A) In a graphs, adjacency list representation is generally more memory-efficient than an adjacency matrix.

(B) For a directed acyclic graph with 5 nodes, the maximum and minimum number of arcs is 10 and 0 respectively.

(C) Kruskal's algorithm is one of the algorithms to construct a minimal spanning trees having time complexity of O(E log E), where E is the number of edges.

(D) A spanning tree remains minimal even after adding an edge that creates a cycle, as long as the new edge's weight is less than or equal to all other edges in that cycle.

63. Which one of the following statements is true ?

(A) A tree is always a cyclic graph.

(B) Dijkstra's algorithm gives correct result on a directed acyclic graph with a negative edges weights.

(C) A binary tree with an inorder traversal that produces a sorted list is a valid Binary Search Tree.

(D) The maximum height of a Binary Search Tree with n nodes is n + 1.

64. Which of the following design techniques stores intermediate results to avoid redundant computations ?

(A) Greedy

(B) Branch and Bound

(C) Dynamic Programming

(D) Divide and Conquer

65. Which one of the following statements is true ?

(A) Parallel Merge sort has a complexity of $O(n^2 \log n)$.

(B) Parallel Radix sort has a complexity of $O(n + m)$, where m is the number of digits.

(C) Quick sort suffer from stack overflow.

(D) Breadth-First search algorithm guarantees the shortest path in any weighted graph.

66. Which of the following priority queue operations is used most frequently in Dijkstra's algorithm ?

(A) Increase the priority of a vertex

(B) Extract the vertex with the minimum distance

(C) Delete the vertex with the lowest key

(D) Remove the vertex with the maximum distance

67. Which of the following statements is incorrect about a Branch and Bound design paradigm (i.e. technique) ?

(A) It is not suitable for solving the Travelling Salesman problem.

(B) It explores the different solution paths with cost estimation.

(C) A Priority Queue data structure is commonly used to implement Branch and Bound best-first search.

(D) It is effective for solving Job Scheduling problems.

68. Which one of the following statements is true for the types of algorithm ?

(A) Approximation algorithms are designed for sorting problems.

(B) Randomized algorithms are always run faster than Greedy algorithms for any input.

(C) Approximation algorithms are used for solving NP-hard problems.

(D) Prim's algorithm is an example of Randomized algorithm.

69. Which one of the following statements is false ?

(A) A comparison tree for sorting n distinct elements has n*n leaves.

(B) The Fast Fourier Transform algorithm evaluates a polynomial at the roots of unity.

(C) Decision tree models can be used to establish lower bounds through reductions.

(D) Merge sort is a comparison based sorting algorithm.

70. Which pair of the sorting algorithms guarantees a worst-case time complexity of $O(n^2)$?

(A) Merge and Selection

(B) Merge and Heap

(C) Heap and Insertion

(D) Selection and Insertion

71. Which one of the following grammars generates a regular language ?

(A) $S \rightarrow aSb \mid \varepsilon$

(B) $S \rightarrow aS \mid bS \mid \varepsilon$

(C) $S \rightarrow SS \mid a \mid \varepsilon$

(D) $S \rightarrow aSbS \mid \varepsilon$

72. Which one of the following statements is false about NFAs ?

(A) An NFA can have multiple transitions for the same input symbol from a given state

(B) Every DFA is also an NFA

(C) NFAs accept a strictly larger class of languages than DFAs

(D) An NFA may include ε-transitions

73. Which statement accurately reflects the limitations of the Pumping Lemma in identifying regular languages ?

(A) It provides a complete proof that a language is regular

(B) It can disprove regularity but cannot prove it

(C) It guarantees context-freeness

(D) It is applicable only for finite languages

74. Which of the following languages can NOT be recognized by any DFA, due to a structural requirement that exceeds finite memory ?

(A) $\{a^n b^n \mid n \geq 0\}$

(B) $\{w \in \{a, b\}^* \mid w \text{ ends with } ab\}$

(C) $\{a^n \mid n \text{ is even}\}$

(D) $\{w \in \{a, b\}^* \mid w \text{ contains no } aa\}$

75. Which of the following correctly classifies $L = \{a^i b^j \mid i \neq j\} \cup \{a^n b^n c^n \mid n \geq 0\}$?

(A) Regular

(B) Context-Free but not Regular

(C) Not Context-Free

(D) Deterministic Context-Free

76. A PDA is designed to accept the language $\{ a^n b^n c^m \mid n, m \geq 0 \}$. What type of stack operations are necessary ?

(A) Store c's, then pop a's

(B) Push b's and c's, pop a's

(C) Push a's, pop on b's, ignore c's

(D) Use two stacks for b's and c's

77. For the statement a = b + c * d, which of the following is a valid three-address code representation ?

(A) t1 = c * d; a = b + t1

(B) t1 = b + c; t2 = t1 * d; a = t2

(C) a = b + (c * d)

(D) c * d = t1; b + t1 = a

78. A single-tape Turing Machine is given a string of the form w#w, where $w \in \{0, 1\}^*$. What must the TM do to verify whether both parts are identical ?

(A) Use the finite control only to compare both halves

(B) Shift left and right repeatedly while marking matched symbols

(C) Use a stack to store the first part of the string

(D) Simulate a DFA on both sides of the delimiter

79. Which of the following illustrates a transformation of a known undecidable problem into another, thereby proving the new problem undecidable ?

(A) Reducing SAT to a DFA equivalence problem

(B) Mapping Halting Problem to Post Correspondence Problem

(C) Converting a context-free grammar to Chomsky normal form

(D) Simulating a DFA with a regular expression

80. Suppose a grammar contains left recursion and common prefixes. Which parsing strategy would most likely fail without grammar transformation ?

(A) SLR (B) Canonical LR

(C) LL(1) (D) LALR

81. A noiseless channel with a bandwidth of 3000 Hz transmitting a signal with two signal levels, what will be the maximum bit rate ?

(A) 3000 bps (B) 2000 bps

(C) 9000 bps (D) 6000 bps

82. The sharing of a transmission medium and its link by two or more devices is called :

(A) Modulation (B) Multiplexing

(C) Encoding (D) Packeting

83. Suppose 4000 frames are transmitted per second through a link and each slot has 8 bits, the transmission rate of circuit in TDM is

(A) 40 kbps (B) 8 kbps

(C) 32 kbps (D) 500 kbps

84. What is the term for an endpoint of an inter-process communication flow across a computer network ?

(A) Port (B) Machine (C) Pipe (D) Socket

85. How many bits are there in IPv6 ?

(A) 64 (B) 48 (C) 128 (D) 256

86. Which mechanism is NOT implemented in IPv6 ?

(A) Multicast (B) Broadcast (C) Unicast (D) Anycast

87. A DNS response is classified as _____, if the information comes from a cache memory.

(A) Recursive (B) Iterative

(C) Authoritative (D) Unauthoritative

88. The round key is _____ bits and the round input is _____ bits in DES algorithm.

(A) 32, 48 (B) 64, 32 (C) 48, 32 (D) 32, 64

89. GPRS stands for

(A) Gramophone Parcel Radio Service

(B) Global Packet Radio Service

(C) General Parcel Radio Service

(D) General Packet Radio Service

90. Which is NOT an actuator in IoT ?

(A) Arduino (B) An LED

(C) Electric motor (D) A fan

91. In A* search, if the heuristic function is consistent (monotonic), then which of the following is guaranteed ?

(A) A* will always expand the least-cost path at last

(B) A* will never revisit a node

(C) A* will behave identically to DFS

(D) The number of expanded nodes will always be exponential

92. In a zero-sum 2-player board game, the minimax algorithm with alpha-beta pruning explores a subset of the game tree. If the tree is perfectly ordered, how does alpha-beta pruning affect time complexity compared to the original minimax ?
(A) Reduces it to $O(b^{d/2})$, where b is branching factor and d is depth
(B) Makes it linear with respect to depth
(C) Has no effect on time complexity
(D) Causes pruning only when max and min levels are equal

93. In non-monotonic logic, which of the following is true ?
(A) Adding new facts can never change the conclusions
(B) Reasoning always uses fixed rules
(C) Conclusions may be retracted when new information is added
(D) It assumes a closed world

94. A system that combines frame-based representation with rule-based reasoning typically uses :
(A) Rule chaining for direct inference
(B) Slots only for structure, without logic
(C) Frames to organize knowledge and rules to trigger events
(D) Semantic networks for everything

95. In a robot delivery system, the planning agent uses a partial-order planning technique to schedule actions. Which of the following best describes why partial-order planning is advantageous over total-order planning in dynamic environments ?
(A) It ensures the plan uses fewer resources by skipping redundant actions
(B) It delays committing to a specific action order, increasing flexibility
(C) It eliminates the need for preconditions and effects
(D) It always produces a unique optimal plan regardless of action order

96. In genetic algorithms, the primary role of the crossover operator is to :
(A) Introduce completely new genetic material
(B) Preserve best individuals across generations
(C) Combine features of two parents to create better offspring
(D) Remove infeasible solutions from the population

97. A retail company wants to understand natural groupings of customers based on purchase behavior but doesn't have any predefined labels. What is the best machine learning strategy ?

(A) Supervised learning using purchase amount as the target

(B) Unsupervised clustering such as k-means or DBSCAN

(C) Use a decision tree classifier

(D) Perform feature selection using labeled data

98. Which of the following most accurately reflects the goal of Word Sense Disambiguation (WSD) in NLP ?

(A) Assigning part-of-speech tags to ambiguous words

(B) Resolving grammatical inconsistencies in a sentence

(C) Selecting the appropriate meaning of a word based on context

(D) Translating words between languages without ambiguity

99. Which of the following is commonly used to model multi-agent interactions in game-theoretic scenarios ?

(A) Genetic algorithms

(B) Markov Chains

(C) MVC

(D) Nash Equilibrium

100. Let a fuzzy set A be defined on the universe $X = \{x_1, x_2, x_3\}$ as

$A = \{ (x_1, 0.5), (x_2, 0.9), (x_3, 0.7)\}$

Then the height of A is :

(A) 0.5 (B) 0.7

(C) 0.9 (D) 2.1

Space for Rough Work

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