C 3368 (Pages : 8) Name.....

Reg. No.....

Ph.D. ENTRANCE EXAMINATION, APRIL 2021

COMPUTER SCIENCE

Time : Two Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 2 *marks.*

1. Which one is called non-probability sampling ?

   (a) Quota sampling.

   (b) Cluster sampling.

   (c) Systematic sampling.

   (d) Stratified random sampling.

2. What are the conditions in which Type-I error occurs ?

   (a) The null hypotheses get accepted even if it is false.

   (b) The null hypotheses get rejected even if it is true.

   (c) Both the null hypotheses as well as alternative hypotheses are rejected.

   (d) None of the above.

3. What is the major attribute of Correlation Analysis ?

   (a) Association among variables.

   (b) Difference among variables.

   (c) Regression among variables.

   (d) Variations among variables.

4. Convert the following infix expressions into its equivalent postfix expressions :

   (A + B ^ D)/(E – F) + G

   (a) (A B D ^ + EF– / G +). (b) (A B D + ^EF– / G +).

   (c) (A B D ^ + EF/– G +). (d) None of the mentioned.

5. A B-tree of order 4 and of height 3 will have a maximum of ——— keys.

   (a) 255. (b) 63.

   (c) 127. (d) 188.

Turn over

6. Which one of the following array elements represents a binary min heap ?

   (a) 12 10 8 25 14 17.
   (b) 8 10 12 25 14 17.
   (c) 25 17 14 12 10 8.
   (d) 14 17 25 10 12 8.

7. In time division switches, if each memory access takes 100 ns and one frame period is 125 ms, then maximum number of lines that can be supported is :

   (a) 625.
   (b) 1250.
   (c) 2300.
   (d) 318.

8. The binary address 10101111 11000000 11110000 00011101 belongs to :

   (a) Class A.
   (b) Class B.
   (c) Class C.
   (d) Class D.

9. In CRC if the data unit is 1101011011 and the divisor is 10011 then what is dividend at the receiver ?

   (a) 11010110110000.
   (b) 11010110111110.
   (c) 1101011011.
   (d) 11010110111001.

10. The lexical analysis for a modern computer language such as java needs the power of which one of the following machine models in a necessary and sufficient sense ?

    (a) Finite state automata.
    (b) Deterministic pushdown automata.
    (c) Non-deterministic pushdown automata.
    (d) Turing machine.

11. What the does the given CFG defines ?

    $S \rightarrow aSbS \mid bSaS \mid e$ and w denotes terminal

    (a) wwr.
    (b) wSw.
    (c) Equal number of a's and b's.
    (d) None of the mentioned.

12. A turing machine operates over :

(a) Finite memory tape.
(b) Infinite memory tape.
(c) Depends on the algorithm.
(d) None of the mentioned.

13. The relational algebra expression equivalent to the following tuple calculus expression :

$\{t / t \in R \wedge (t[A] = 10 \wedge t[B] = 200\}$ is :

(a) $(A)\, \sigma (A = 10 \vee B = 20)(r)$.

(b) $(B)\, \sigma (A = 10)(r) \cup \sigma (B = 20)(r)$.

(c) (C) $\sigma\ (A = 10)\ (r)\ \cap\ \sigma\ (B = 20)\ (r)$.

(d) (D) $\sigma\ (A = 10)\ (r) - \sigma\ (B = 20)\ (r)$.

14. For a database relation R (a, b, c, d) where the domains of a, b, c and d include only atomic values, and only the following functional dependencies and those that can be inferred from them hold :

$a \rightarrow c$.

$b \rightarrow d$.

The relation is in ————.

(a) First normal form but not in second normal form.
(b) Second normal form but not in third normal form.
(c) Third normal form.
(d) BCNF.

15. Consider a hash table of size seven, with starting index zero, and a hash function $(7x + 3)$ mod 4. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence 1, 3, 8, 10 is inserted into the table using closed hashing ? Here "————" denotes an empty location in the table.

(a) 3, 10, 1, 8, —, —, —.
(b) 1, 3, 8, 10, —, —, —.
(c) 1, —, 3, —, 8, —, 10.
(d) 3, 10, —, —, 8 —, —.

16. Study the following program :

```
main ( ) ;
{printf("Hello World!");
main( ) ; }
```

What will be the output of this program ?

(a) Wrong statement.

(b) It will keep on printing Hello World !.

(c) It will Print Hello World! once and terminate.

(d) None of these.

17. From the following program :

```
main ( )
{
    char x [10], *ptr = x ;
  scanf ("%s", x) ;
  change(&x [ 4]) ;
}
 change(char a[ ])
{
  puts(a)/
}
```

If abcdefg is the input, the output will be :

(a) abcd. (b) abc.

(c) efg. (d) Garbage.

18. If a function is friend of a class, which one of the following is wrong ?

(a) A function can only be declared a friend by a class itself.

(b) Friend functions are not members of a class, they are associated with it.

(c) Friend functions are members of a class.

(d) It can have access to all members of the class, even private ones.

19. The ——— addressing mode is similar to register indirect addressing mode, except that an offset is added to the contents of the register. The offset and register are specified in the instruction.

    (a) Base indexed.

    (b) Base indexed plus displacement.

    (c) Indexed.

    (d) Displacement.

20. Determine the number of page faults when references to pages occur in the following order : 1, 2, 4, 5, 2, 1, 2, 4. Assume that the main memory can accommodate 3 pages and the main memory already has pages 1 and 2, with page 1 having been brought earlier that page 2. (LRU algorithm used) :

    (a) 3. (b) 5.

    (c) 4. (d) None of these.

21. If $x \in N$ and x is prime, then x is ——— set.

    (a) Infinite set. (b) Finite set.

    (c) Empty set. (d) Not a set.

22. Suppose that R1 and R2 are reflexive relations on a set A. Which of the following statements is correct ?

    (a) R1 $\cap$ R2 is reflexive and R1 $\cup$ R2 is irreflexive.

    (b) R1 $\cap$ R2 is irreflexive and R1 $\cup$ R2 is reflexive.

    (c) Both R1 $\cap$ R2 and R1 $\cup$ R2 are reflexive.

    (d) Both R1 $\cap$ R2 and R1 $\cup$ R2 are irreflexive.

23. Hadoop achieves reliability by replicating the data across multiple hosts and hence does not require ——— storage on hosts.

    (a) RAID.

    (b) Standard RAID levels.

    (c) ZFS.

    (d) Operating system.

24. What does a block in a blockchain consists of ?

(a) Hash point, time stamp, transaction data.

(b) Hash point, IP of owner, transaction data.

(c) Blockchain name, IP of owner, transaction data.

(d) Hash point, time of stamp, IP of owner.

25. What is true about Machine Learning ?

(a) Machine Learning (ML) is that field of computer science.

(b) ML is a type of artificial intelligence that extract patterns out of raw data by using an algorithm or method.

(c) The main focus of ML is to allow computer systems learn from experience without being explicitly programmed or human intervention.

(d) All of the above.

(25 × 2 = 50 marks)

Part B

Answer any **five** *questions.*
Each question carries 10 *marks.*

1. (a) Discuss the three measures of central tendency. Illustrate with examples the process of deciding the suitability of a measure for a particular research purpose.

(5 marks)

(b) Describe the role of ethics in research. What are the dos and don'ts in research ethics ?

(5 marks)

2. What are Maximum Flows and Minimum Cuts ? Explain and prove the Max-Flow Min-Cut Theorem.

(10 marks)

3. Explain Homomorphic filtering with the help of block diagram, equations and transfer function.

(10 marks)

4. Explain the following noise models :

   (i) Gaussian Noise. (2 marks)

   (ii) Impulse Noise. (2 marks)

   (iii) Uniform Noise. (2 marks)

   (iv) Rayleigh Noise. (2 marks)

   (v) Gamma (Erlang) Noise. (2 marks)

5. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds :

Process	*Burst Time*	*Priority*
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

For each of the scheduling algorithms, FCFS, Shortest-Job-First (SJF, non-pre-emptive), Priority (smaller priority number implies higher scheduling priority), and Round Robin (quantum = 1) do the following.

- Draw a Gantt chart to show how these processes would be scheduled.
- Give the turnaround time (total time from first arrival into ready state until cpu-burst is completed) of each process.
- Give the waiting time (total time spent in the Ready state) of each process.
- Give the average waiting time of all the processes.

Which of these scheduling algorithm gives the smallest average waiting time ?

(10 marks)

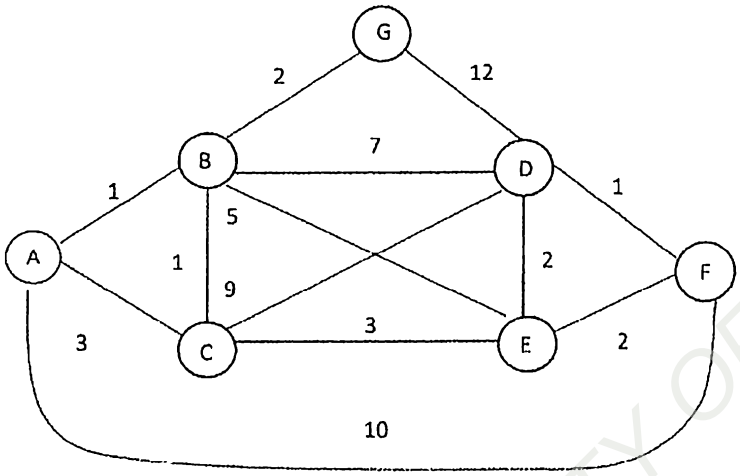
6. What is an AVL Tree ? What the advantages of using an AVL Tree over a Binary Search Tree? Construct an AVL tree by inserting the following elements in the given order.

   63, 9, 19, 27, 18, 108, 99, 81.

(10 marks)

Turn over

7. What is Index ? What are the different operations required to maintain an index file ?



(10 marks)

8. (i) Calculate the single-source shortest paths from A to every other vertex in the following undirected, weighted graph.

(5 marks)

(ii) Compare and contrast between Dijkstra's algorithm and Bellman-Ford algorithm for finding shortest paths.

(5 marks)

[5 × 10 = 50 marks]