M.Tech (Computer Science)

Model Question Paper

<u>Part - A</u>

PART–A contains **80 objective type items** of one mark each. You must enter your answers **in the Response Sheet provided)**

Choose the correct answer from the Question Paper and SHADE THE CORRECT RESPONSE viz., A, B, C, D or E) Only one response must be clearly shaded for each question. More than one entry, unclear entries or wrong entries will be considered as wrong answer.

Please DO NOT WRITE your name or Applicant Id or the answer in the QUESTION PAPER BOOKLET.

You can take maximum of 80 minutes to respond to the PART-A.

At the end of **80 minutes**, you must hand over the PART-A booklet along with the response sheet to the invigilator. You will be given Part-B after this.

PART A- Multiple choice Questions (Marks: 80 x 1 = 80)

SAMPLE QUESTIONS

<u>Computer Architecture:</u>

1. Which speedup could be achieved according to Amdahl´s law for infinite number of processors if 5% of a program is sequential and the remaining part is ideally parallel?

    A.10   B. 5   C. 25   D. 50   E. 20

2. Instruction pipelining: After which total execution time is the result of the second task entering the pipeline above ready?

    A. 38 ns   B.33 ns   C. 36 ns   D. 37 ns   E. None of these

3. A program runs on a 2 GHz computer C1 in 10 seconds. If the same program has to run in 6 seconds on a computer C2 which takes 1.2 times more clock cycles than C1 then what should be the clock rate of C2?

    A. 3 GHz   B. 4 GHz   C. 3.6 GHz   D. 4.2 GHz   E. 3.2 GHz

4. Snooping cache protocol: In which case is the main memory not up-to-date?

    A. Write-through caches: After writing to shared data
    B. Write-back caches: Cache data marked as exclusive
    C. Write-back caches: Cache data marked as modified

D. Write-back caches: Cache data marked as shared

E. All the case of C and D.

5. Interrupts can generate (i) when a device or port is ready (ii) when a timer timeouts (iii) on clock inputs in the system (iv) when a software run-time exception condition is detected (v) when a device or port completes its function (vi) when software interrupt instruction to signal execution of ISR is executed (vii) on return from an interrupt service routine (viii) a key is pressed at keypad (ix) a menu is selected from graphic user interface on touch screen.

A. i, ii, iii, iv and v

B. iii, vii and viii

C. all

D. i, iii, v and vii

E. all except iii and vii

Systems:

1. Five batch jobs A through E arrive at a computer centre at almost the same time. They have estimated running times of 10, 6, 2, 4 and 8 minutes. Ignoring process switching overhead and assuming a multi programmed system where each job gets its fair share of the CPU, the mean turnaround time by round robin scheduling is

A. 21   B. 22   C. 23   D. 24   E. 25

2. Consider the decimal virtual address 20000. The virtual page number and offset for a 8-KB page is

A. (2, 3615)

B. (4, 3616)

C. (4, 3615)

D. (2, 3616)

E. (3, 3616)

3. OPTAB is generally organized as a

A. Dynamic Hash table

B. Doubly Linked List

C. Static Hash table

D. Binary Search tree

E. Dynamic STACK

4. The only parts of the program that require modification at load time are those that specify --- addresses.

A. PC-Relative   B. Base-relative   C. Immediate

D. Direct   E. All of the above

5. One of the following is not machine-independent compiler optimization technique:

A. Elimination of common sub expression

B. Removal of loop invariants

C. "Reduction in strength" strategy

D. Loop unrolling and jamming

E. Re-arranging quadruples before generating machine code.

Computer Networks :

1. Which of the following statement is correct?

    Buffering is:

    A. the process of temporarily storing the data for small variation in device speeds
    B. a method to reduce cross-talks
    C. a method to reduce routing overhead
    D. the storage of data within the transmission medium until the receiver is ready to receive.
    E. Permanent storage for routing tables

2. Match the following:

P: SMTP	1.Application Layer
Q: BGP	2. Transport Layer
R: TCP	3.Data Link Layer
S: PPP	4. Network Layer
	5. Physical Layer

    A. P-2,Q-1,R-3,S-5
    B. P-1,Q-4,R-2,S-3
    C. P-1,Q-4,R-2,S-5
    D. P-2,Q-4,R-1,S-3
    E. P-1,Q-3,R-2,S-4

3. Consider the a network with 6 routers R1 to R6 connected with links having weights as shown in the table.

    R1-R2 = 6, R1-R3=3, R2-R3=2, R2-R4=7, R3-R5=9, R4-R5=1, R4=R6=8, R5-R6=4

    All the routers use the distance vector based routing algorithm to update their routing tables. After all the routing tables stabilize, how many links in the networkOne of the header fields in an IP datagram is the Time-to-Live 9TTL) field. Which will never be used for carrying data?

    A. 4
    B. 3
    C. 5
    D. 1
    E. 2

4. Slotted ALOHA

   A. Divides time into discrete intervals
   B. Requires global time synchronization.
   C. Bath (A) and (B)
   D. Collision detection is not present
   E. Works efficiently with multiple active nodes.

5. DNS is used to locate

   A. MAC address of URL
   B. IP address of URL
   C. Root domain of URL
   D. Domain name of URL
   E. IP addresses of all nodes in Tier-1

Data structures and algorithms:

1. Which of the following data structure is non-linear type?

   A. Strings
   B. Lists
   C. Stacks
   D. Trees
   E. Queues

2. Which of the following data structure is based on the Last In First Out policy

   A. Queue
   B. Stack
   C. Array
   D. Linked List.
   E. Vector

3. For which of the following problems is the greedy approach not optimal.

   i) Travelling Salesman,
   ii) Knapsack,
   iii) Single source shortest path,
   iv) Minimum spanning tree

   A. i only
   B. ii only
   C. iii only
   D. iii and iv
   E. i and ii

4. A binary tree that has n leaf nodes. The number of nodes of degree 2 in this tree is

    A. $\log_2 n$
    B. n
    C. n-1
    D. 2^n
    E. n^2

5. A variable P is called a pointer if

    A. P contains the address of an element in DATA
    B. P points to the address of the first element in DATA
    C. P can store only memory addresses
    D. P contains the DATA and the address of the DATA
    E. none of the above

Object oriented programming :

1. What is the output of this program?

```
#include <iostream>
using namespace std;
int main()
{
char *ptr;
char Str[] = "abcdefg";
ptr = Str;
ptr += 5;
cout << ptr;
return 0;
}
```

    A. efg
    B. cdef
    C. fg
    D. abcd
    E. defg

2. Pick out the correct statement.
    A. A derived class's constructor cannot explicitly invokes its base class's constructor.
    B. A derived class's destructor cannot invoke its base class's destructor.
    C. A derived class's destructor can invoke its base class's destructor.
    D. A base class's destructor can invoke its derived class's destructor.
    E. None of the above

3. Given the following pairs of java method declarations, which of these statements is true?

```
void fly(int distance) {}
    int fly(int time, int speed) {return time*speed;}

void fall(int time) {}
    int fall(int distance) {return distance;}

void glide(int time) {}
    void Glide(int time) {}
```

Select the one valid answer:

A) The first pair of methods will compile correctly and override the method name fly.
B) The second pair of methods will compile correctly and overload the method name fall.
C) The third pair of methods will compile correctly and overload the method name glide.
D) The second pair of methods will not compile correctly.
E) The third pair of methods will not compile correctly.

4. Which one of the following class definitions is a legal definition of a Java class that cannot be instantiated?

Select the one right answer:

A. class Ghost {
   abstract void haunt()
   }
B. abstract class Ghost {
   void haunt();
   }
C. abstract class Ghost {
   void haunt() {};
   }
D. abstract Ghost {
   abstract void haunt();
   }
E. static class Ghost {
   abstract haunt();
   }

5. How many threads are created in this Program?

```
class A extends Thread {
    private int i;
    public void run() {i = 1;}
    public static void main(String[] args) {
      A a = new A();
       a.run();
      System.out.print(a.i);
      }
```

}

A. 0
B. 1
C. 2
D. 3
E. None of the above

Database:

1. When the values in one or more attributes being used as a foreign key in one table must also exist in another table, then we have created a(n):

    A. transitive dependency.
    B. insertion anomaly.
    C. referential integrity constraint.
    D. normal form.
    E. Abnormal form

2. In the relational model, relationships between relations or tables are created by using:

    A. composite keys.
    B. determinants.
    C. candidate keys.
    D. primary keys.
    E. foreign keys

3. The SQL command ON UPDATE CASCADE ensures which of the following?

    A. Normalization
    B. Data Integrity
    C. Materialized Views
    D. No repetition of data.
    E. All of the above

4. Which of the following the HAVING clause does?

    A. Acts like a WHERE clause but is used for groups rather than rows.
    B. Acts like a WHERE clause but is used for rows rather than columns.
    C. Acts like a WHERE clause but is used for columns rather than groups.
    D. Acts EXACTLY like a WHERE clause.
    E. Acts EXACTLY like a GROUP BY clause

5. Which type of join does the following SQL statement represent?

    SELECT   CUSTOMER_T. CUSTOMER_ID, ORDER_T. CUSTOMER_ID, NAME, ORDER_ID
    FROM   CUSTOMER_T,ORDER_T
    WHERE   CUSTOMER_T. CUSTOMER_ID = ORDER_T. CUSTOMER_ID

A. Equi-join
B. Natural join
C. Outer join
D. Cartesian join
E. Join-Join

Mathematics:

1. A line passing through origin (0,0) is a:

   A. subspace of R2
   B. subset of R2
   C. zero vector of R2
   D. inverse vector in R2
   E. Identity vector in R^2

2. Linear span of a set of vectors E from a underlying vector space V is:

   A. smallest subspace containing all the vectors in E
   B. largest subspace containing all the vectors in E
   C. not a subspace of V
   D. V itself.
   E. independent

3. The dimension of the vector space of all polynomials of degree at most n is:

   A. n   B. n+1   C. 1   D. n-1   E. n^2

4. Which of the following is a linearly dependant set of vector(s):

   A. {1}   B. {(1,2)}   C. {(1,2,3)}   D. {0}   E. None of the above

5. The eigen values of identity transformation are

   A. all real   B. all imaginary   C. all zero   D. transcendental   E. all unity

6. Negation of the statement $p \Rightarrow q$ is
   A. $\sim p \wedge q$
   B. $\sim p \vee q$
   C. $p \wedge \sim q$
   D. $p \vee q$
   E. $q \Rightarrow p$

7. Contrapositive of $p \Rightarrow q$ is
   A. $q \Rightarrow p$
   B. $\sim q \Rightarrow p$
   C. $q \Rightarrow \sim p$
   D. $\sim q \Rightarrow \sim p$
   E. $\sim p \Rightarrow \sim q$

8. The equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ represents a

    A. Hyperboloid
    B. Ellipsoid
    C. Paraboloid
    D. Hyperbolic Paraboloid
    E. Elliptic Cone

9. The domain and range of $f(x, y) = \tan^{-1}\frac{y}{x}$ are

    A. $x \neq 0$ and $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$
    B. $x \neq 0, y \neq 0$ and $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$
    C. $x \neq 0, y \neq 0$ and $\langle -\pi, \pi \rangle$
    D. $x \neq 0$ and $\langle -\pi, \pi \rangle$
    E. $(-\infty, +\infty)$ and $(-\infty, +\infty)$

10 Let $f : [a, b] \to R$ be a continuous function. Also let $f(a) < k < f(b)$. Then there exists a
    $c \in [a, b]$ such that $f(c) = k$ is a consequence of

    A. Mean Value Theorem
    B. Cauchy Mean Value Theorem
    C. Fundamental Theorem of Calculus
    D. Rolle's Theorem
    E. Intermediate Value Theorem

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Part - B

PART B- Short answer questions:

SAMPLE QUESTIONS

1. **short answer questions**

1. [4 marks] For each of the following statements about making a change to a cache design, circle True or False and provide a one sentence explanation of your choice. Assume all cache parameters (capacity, associativity, line size) remain fixed except for the single change described in each question. Please provide a one sentence explanation of your answer.

(A). Doubling the line size halves the number of tags in the cache. (T/F)

(B) Doubling the associativity doubles the number of tags in the cache.   (T/F)

(C) Doubling cache capacity of a direct-mapped cache usually reduces conflict misses. (T/F)

(D) Doubling cache capacity of a direct-mapped cache usually reduces compulsory misses. (T/F)

2. [4 marks] Give the following results for the given binary tree

    a) Preorder traversal   b) Postorder traversal   c) Inorder traversal.
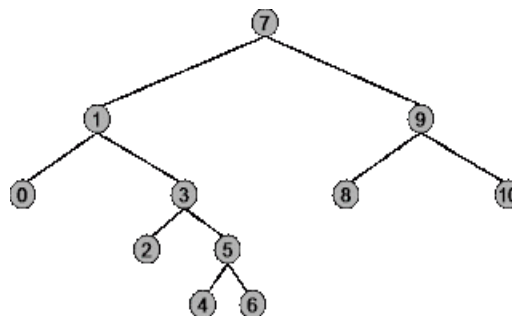
3. [4 marks] Consider the bank database given as:

  branch(bran_name, branch_city, assets)
  customer (customer_name, customer_street, customer _city)
  loan (loan_number, branch_name, amount)
  borrower (customer_name, loan_number)
  account (account_number, branch_name, balance)
  depositor (customer_name, account_number)

  Write an SQL trigger to carry out the following action:
  On delete of an account, for each owner of the account, check if the owner has any
  remaining accounts, and if he/she does not, delete him/her from the depositor relation.

4. [4 marks] Write a brief note on CDMA .

5. [4 marks] Consider a 7200-rpm disk with a track-to-track seek time of 1msec. The disk has
  200 sectors of 512 bytes each on each track. What is the maximum data rate in MB/sec for
  the disk?

6. [5 marks] Find the kernel and image of the linear transformation T: $R^2 \to R^3$ given by

  $T(a, b) = (a, b - a, b).$

7. [5 marks] For the experiment of rolling a die once, the probability distribution for the
  random variable, number of dots on the final upward face, is a discrete uniform probability
  distribution. Determine

  a) the probability function   b) the mean   c) the variance   d) the standard deviation

  e) the parameter   f) P(3≤X<5)   [1+1+1+0.5+0.5+1]

8. [5 marks] Is the following argument valid? Justify your reasoning using propositional logic.

  I.   If it rains, the street will be wet
  II.   The street is wet.
  III.   Therefore it rained.

9. [5 marks] Calculate the volume of the surface $z = x + 2y$ over the rectangle (limits of
  integration) given by $D = (\{x, y\} : 1 \le x \le 2$ and $3 \le y \le 5).$

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