OPERATING SYSTEMS

1)A system contains three programs and each requires three tape units for its operation. The minimum number of tape units which the system must have such that deadlocks never arise is _____.

a)6 b) 7 c)8 d)9

2. If quantum time of Round robin algorithm is large,then it is equivalent to
a)SJF b)FCFS c)Multilevel feedback Queue d) None of these

3. Which one of these will be handled at the HIGHEST priority?

a) Interrupt from Hard Disk(after disk read)

b) Interrupt from Mouse(when clicked)

c) Interrupt from Keyboard(when a key is pressed or released)

d) Interrupt from CPU temperature sensor(CPU temperature is too high)

4. Increasing the RAM of a computer typically improves performance because:

a) Virtual memory increases

b) Larger RAMs are faster

c) Fewer page faults occur

d) Fewer segmentation faults occur

5)Consider the following code fragment:

```
if (fork() == 0)
{ a = a + 5; printf("%d,%d\n", a, &a); }
else { a = a –5; printf("%d, %d\n", a, &a); }
```

Let u, v be the values printed by the parent process, and x, y be the values printed by the child process. Which one of the following is TRUE?

a) u = x + 10 and v = y

b) u = x + 10 and v != y

c) u + 10 = x and v = y

d) u + 10 = x and v != y

DBMS

1. Table A

Id Name Age

----

12 Arun 60

15 Shreya 24

99 Rohit 11

Table B

Id Name Age

----

15 Shreya 24

25 Hari 40

98 Rohit 20

99 Rohit 11

Table C

Id Phone Area

----

10 2200 02

99 2100 01

Consider the above tables A, B and C. How many tuples does the result of the following SQL query contains?

```
SELECT A.id
FROM   A
WHERE  A.age > ALL (SELECT B.age
                    FROM   B
                    WHERE  B. name = "arun")
```

a) 4

b) 3

c) 0

d) 1

2. Let R and S be relational schemes such that R={a,b,c} and S={c}. Now consider the following

queries on the database:

I. $\pi_{R-S}(r) - \pi_{R-S}\left(\pi_{R-S}(r) \times s - \pi_{R-S,S}(r)\right)$

II. $\left\{t \mid t \in \pi_{R-S}(r) \wedge \forall u \in s\left(\exists v \in r\left(u = v[s] \wedge t = v[R-S]\right)\right)\right\}$

III. $\left\{t \mid t \in \pi_{R-S}(r) \wedge \forall v \in r\left(\exists u \in s\left(u = v[s] \wedge t = v[R-S]\right)\right)\right\}$

IV) SELECT R.a, R.b
FROM R,S
WHERE R.c=S.c

Which of the above queries are equivalent?

a) **I and II**

b) **II and III**

c) **III and IV**

d) **I and IV**

3. Consider the following relational schema:
Suppliers(sid:integer, sname:string, city:string, street:string)
Parts(pid:integer, pname:string, color:string)
Catalog(sid:integer, pid:integer, cost:real)
Assume that, in the suppliers relation above, each supplier and each street within a city has a unique name, and (sname, city) forms a candidate key. No other functional dependencies are implied other than those implied by primary and candidate keys. Which one of the following is TRUE about the above schema?

(A) The schema is in BCNF
(B) The schema is in 3NF but not in BCNF
(C) The schema is in 2NF but not in 3NF
(D) The schema is not in 2NF

4. Consider the following log sequence of two transactions on a bank account, with initial balance 12000, that transfer 2000 to a mortgage payment and then apply a 5% interest.

1. T1 start

2. T1 B old=12000 new=10000

3. T1 M old=0 new=2000

4. T1 commit

5. T2 start

6. T2 B old=10000 new=10500

7. T2 commit

Suppose the database system crashes just before log record 7 is written. When the system is restarted, which one statement is true of the recovery procedure?

a) We must redo log record 6 to set B to 10500.

b) We must undo log record 6 to set B to 10000 and then redo log records 2 and 3.

c) We need not redo log records 2 and 3 because transcation T1 has committed.

d) We can apply redo and undo operations in arbitrary order because they are idempotent.

5) SQL allows tuples in relations, and correspondingly defines the multiplicity of tuples in the result of joins. Which one of the following queries always gives the same answer as the nested query shown below:

select * from R where a in (select S.a from S)

(A) Select R.* from R,S where R.a=S.a (D)
(B) Select distinct R.* from R,S where R.a=S.a
(C) Select R.* from R,(select distinct a from S) as S1 where R.a=S1.a
(D) Select R.* from R,S where R.a=S.a and is unique R DS

1)The inorder and preorder traversal of a binary tree are d b e a f c g and a b d e c f g, respectively. The postorder traversal of the binary tree is:

(A) d e b f g c a
(B) e d b g f c a
(C) e d b f g c a
(D) d e f g b c a

2) Which of the following sorting algorithms can be used to sort a random linked list with minimum time complexity?
(A) Insertion Sort
(B) Quick Sort
(C) Heap Sort
(D) Merge Sort

3)The minimum number of comparisons required to determine if an integer appears more than n/2 times in a sorted array of n integers is
(A) (n)
(B) (logn)
(C) (log*n)
(D) (1)

4)Following is an incorrect pseudocode for the algorithm which is supposed to determine whether a sequence of parentheses is balanced:

```
declare a character stack
while ( more input is available)
{
   read a character
   if ( the character is a '(' )
      push it on the stack
   else if ( the character is a ')' and the stack is not empty )
      pop a character off the stack
   else
      print "unbalanced" and exit
}
print "balanced"
```

(A) ((())
(B) ())(()
(C) (()()))
(D) ((()))()
Mention the reason too.

5)A Priority-Queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is given below:
10, 8, 5, 3, 2
Two new elements ”1‘ and ”7‘ are inserted in the heap in that order. The level-order traversal of the heap after the insertion of the elements is:
(A) 10, 8, 7, 5, 3, 2, 1
(B) 10, 8, 7, 2, 3, 1, 5

(C) 10, 8, 7, 1, 2, 3, 5
(D) 10, 8, 7, 3, 2, 1, 5

ALGORITHMS

1) **Suppose we have a O(n) time algorithm that finds median of an unsorted array. Now consider a QuickSort implementation where we first find median using the above algorithm, then use median as pivot. What will be the worst case time complexity of this modified QuickSort.**

   (A) O(n^2 Logn)
   (B) O(n^2)
   (C) O(n Logn Logn)
   (D) O(nLogn)

2) In a modified merge sort, the input array is splitted at a position one-third of the length(N) of the array. What is the worst case time complexity of this merge sort?

   (A) N(logN base 3)
   (B) N(logN base ⅔)
   (C) N(logN base ⅓)
   (D) N(logN base 3/2)

3) What is the worst case time complexity of following implementation of subset sum problem.

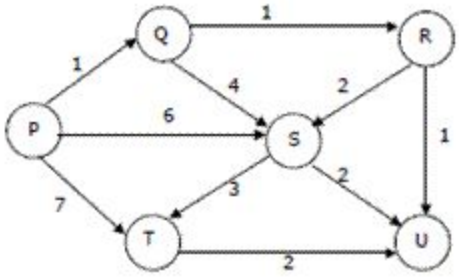
```
// Returns true if there is a subset of set[] with sun equal to given sum
bool isSubsetSum(int set[], int n, int sum)
{
  // Base Cases
  if (sum == 0)
    return true;
  if (n == 0 && sum != 0)
    return false;

  // If last element is greater than sum, then ignore it
  if (set[n-1] > sum)
    return isSubsetSum(set, n-1, sum);

  /* else, check if sum can be obtained by any of the following
     (a) including the last element
     (b) excluding the last element   */
  return isSubsetSum(set, n-1, sum) ||
       isSubsetSum(set, n-1, sum-set[n-1]);
}
```

(A) O(n*2^n)
(B) O(n^2)
(C) O(n^2*2^n)
(D) O(2^n)

4) Suppose we run Dijkstra's single source shortest-path algorithm on the following edge weighted directed graph with vertex P as the source. In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized?



(A) P,Q,R,S,T,U
(B) P,Q,R,U,S,T
(C) P,Q,R,U,T,S
(D) P,Q,T,R,U,S

5) Consider a complete undirected graph with vertex set {0, 1, 2, 3, 4}. Entry Wij in the matrix W below is the weight of the edge {i, j}. What is the minimum possible weight of a spanning tree T in this graph such that vertex 0 is a leaf node in the tree T?

$$W = \begin{pmatrix} 0 & 1 & 8 & 1 & 4 \\ 1 & 0 & 12 & 4 & 9 \\ 8 & 12 & 0 & 7 & 3 \\ 1 & 4 & 7 & 0 & 2 \\ 4 & 9 & 3 & 2 & 0 \end{pmatrix}$$

(A) 7
(B) 8
(C) 9
(D) 10

MISC

1)

A RAM chip has a capacity of 1024 words of 8 bits each (1K × 8). The number of 2 × 4 decoders with enable line needed to construct a 16K × 16 RAM from 1K × 8 RAM is

(A) 4

(B) 5

(C) 6

(D) 7

2) A computer has a 256 KByte, 4-way set associative, write back data cache with block size of 32 Bytes. The processor sends 32 bit addresses to the cache controller. Each cache tag directory entry contains, in addition to address tag, 2 valid bits, 1 modified bit and 1 replacement bit. The number of bits in the tag field of an address is

(A) 11

(B) 14

(C) 16

(D) 27

3) Which of the following DMA transfer modes and interrupt handling mechanisms will enable the highest I/O band-width?

a) Transparent DMA and Polling interrupts

b) Cycle-stealing and Vectored interrupts

c) Block transfer and Vectored interrupts

d) Block transfer and Polling interrupts

4) In an enhancement of a design of a CPU, the speed of a floating point unit has been increased by 20% and the speed of a fixed point unit has been increased by 10%. What is the overall speedup achieved if the ratio of the number of floating point operations to the number of fixed point operations is 2:3 and the floating point operation used to take twice the time taken by the fixed point operation in the original design?
a) 1.155
b) 1.185
c) 1.255
d) 1.285