Weeks 9-12

DBMS End Term Revision

Answer the questions 8, 9 and 10 on the basis of the following data.

Consider a magnetic disk with 8 platters, 2 surfaces/platter, 1024 tracks/surface, 2048 sectors/track, and 512 bytes/sector. The disk rotates with 6000 revolutions per minute.

8. What is the capacity of the disk? [MCQ : 2 Points]

- ○ 16 GB
- ○ 32 GB
- ○ 32 MB
- ○ 16 MB

Answer the questions 8, 9 and 10 on the basis of the following data.

Consider a magnetic disk with 8 platters, 2 surfaces/platter, 1024 tracks/surface, 2048 sectors/track, and 512 bytes/sector. The disk rotates with 6000 revolutions per minute.

9. What is the minimum number of bits required for addressing all the sectors?

10. Given that the rotational speed of the disk is 6000 revolutions per minute. Consider the seek time is 3ms. What will be the rotational latency?

14) Consider the Binary Search Tree (BST) shown in Figure 2.

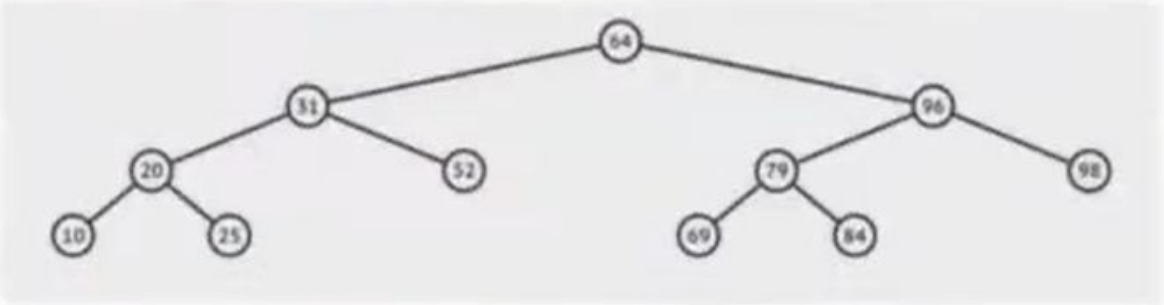

Figure 2: Binary Search Tree (BST)

Which of the following is/are the correct insertion order(s) which will result in the given BST?

- ○ 64, 31, 20, 52, 10, 96, 98, 69, 84, 25, 79
- ○ 64, 31, 20, 52, 10, 96, 25, 79, 84, 98, 69
- ○ 64, 31, 20, 52, 10, 84, 98, 25, 79, 69, 96
- ○ 64, 31, 20, 52, 10, 84, 25, 69, 96, 98, 79

6. The following numbers are inserted into an empty binary search tree in the given order: 61,34,23,45,1,2,3,4,5. What is the height of the resulting binary search tree?

Consider the given table **USER** and answer the questions 12 and 13.

USER(*User_ID,User_name, User_city, User_country, User_skill)*

12) Choose the correct SQL statement from the options to create an index with the name 'idx_userid', for the attribute *User_ID* ***2 points***

- ○ CREATE INDEX AS idx_userid ON USER (User_ID);
- ○ CREATE INDEX idx_userid AS USER (User_ID);
- ○ CREATE INDEX AS idx_userid ON User_ID;
- ○ CREATE INDEX idx_userid ON USER (User_ID);

6) Consider a B-tree based index with order p = 19. Assume each node of the B-tree is 73% full. If the height of the tree is 3, then what is the maximum number of keys that can be accommodated in the given B-tree? ***2 points***

- ○ 38,415
- ○ 8,663
- ○ 12,765
- ○ 68,605

7) Consider the hash functions given below. ***3 points***

$h_1(n) = n \ (mod\ 7),$
$h_2(n) = n^2 + 1 \ (mod\ 7),$
$h_3(n) = 3n + 3 \ (mod\ 7),$
$h_4(n) = floor(\frac{n}{2}) + 2 \ (mod\ 7).$

Identify the hash function(s), that can generate unique hash values for the following search values: 43, 65, 89, 10, 12, 48, 31.

- ☐ $h_1(n)$
- ☐ $h_2(n)$
- ☐ $h_3(n)$
- ☐ $h_4(n)$

9) Consider the table Food(Fid, Fname, Foodtype, Rating). There can only be two types of food - Dessert or Soup. The rating value is an integer in the range 1 to 5. **2 p**

Let the bitmap indexes for columns Foodtype and Rating be as given below:
Foodtype: 1010 for Dessert, 0101 for Soup
Rating: 0101 for 1, 0010 for 2, 0110 for 3, 0000 for 4, 1000 for 5
In order to find the Fname of an item that is a dessert with a rating of 2, which of the following operations will be performed?

- ○ Logical AND operation on 0101 and 0010
- ○ Logical AND operation on 1010 and 0010
- ○ Logical OR operation on 1010 and 0010
- ○ Logical XOR operation on 1010 and 0010

5) Which of the following precedence graphs represents a schedule that is not conflict serializable?

All the above

10. Consider the following schedule **S** with three transactions T1, T2 and T3: [NAT:1 points]

S: $R2(B); R1(B); R1(A); W1(A); R3(C); W3(C);$

The number of serial schedule for given schedule **S** is....

11. Consider the following schedule **S** with four transactions T1, T2, T3,T4: [Subendu:MCQ-2 points]

S: $R3(A); W2(A); R1(A); W1(A); R3(B); W4(B);$

Where, Ri(A) denotes a read operation by transaction Ti on a data item A, Wi(A) denotes a write operation by transaction Ti on a data item A.
What is the possible number of conflict serializable schedule of the above schedule **S**.

- ○ 4
- ○ 3
- ○ 1
- ○ 0

Consider the given schedules $\mathbf{S}_1$ and $\mathbf{S}_2$ given below and the following assumptions :

$W_i(a)$ means that transaction T_i is performing a write operation on data item (a).

$R_i(a)$ means that transaction T_i is performing a read operation on data item (a).

Com_i means that transaction T_i has committed.

$\mathbf{S}_1 : R_1(A), R_3(C), W_2(B), R_2(A), W_1(B), W_3(C),$

$\mathbf{S}_2 : R_1(A), R_2(B), W_1(C), R_3(B), R_3(C), W_2(B), W_3(A),$

Which of the above schedules can be two-phase lockable?

Illustrative Example

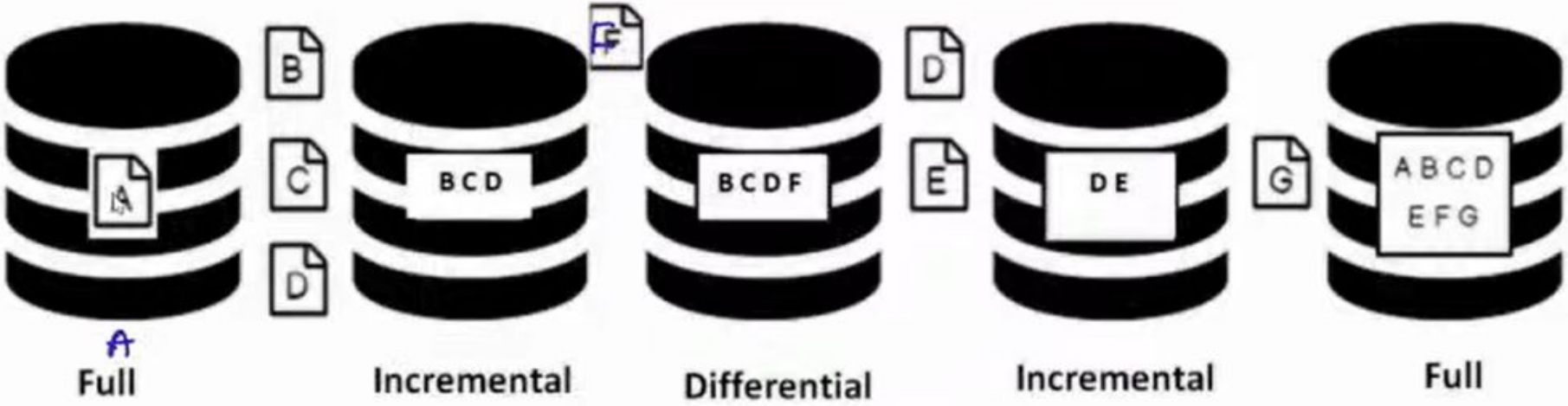

Figure: Backup Types

23. Consider a state of transactions as shown in Figure 3.

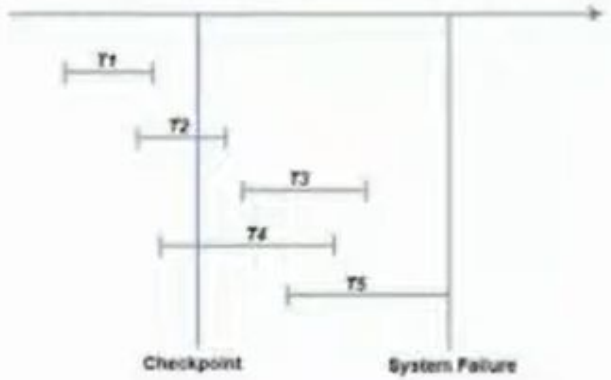

Figure 3: **State of Transactions**

According to the above figure, which among the following statement(s) is/are correct?
[MSQ:2 Points]
Ans: [redacted]

- ○ The transactions T1 and T2 can be ignored.
- ○ The transactions T3 and T4 needs to be redone
- ○ The only transaction that needs to be undone are T4 and T5.
- ○ The only transaction that needs to be undone is T5.

24. Consider a RAID-4 system with 5 disks which stores the following data shown in Figure 4:

Disk-1	Disk-2	Disk-3	Disk-4	Disk-5	
0100	1000	---	0001	1001	Block A
0100	1101	---	1101	0000	Block B
0100	0101	---	0010	0110	Block C

Figure 4: **RAID-4 data**

According to the figure, Disk-3 has crashed. Identify the correct data present in the three blocks of Disk-3. Also, assuming that the binary values represent 8 bit ASCII code, identify the correct data word present inside the RAID-4 storage system. Consider the following statements and identify the correct statements.

1. Block A: 0100, Block B: 0100, Block C: 0101
2. Block A: 1011, Block B: 1011, Block C: 1010
3. Block A: 0100, Block B: 1011, Block C: 1010
4. The word is: 'HAMMER'
5. The word is : 'hammer'

Note:

- *Assuming block size is 4 bits.*
- *Disk-5 is the parity disk.*
- *The ASCII value of 'A' is 65 and 'a' is 97.*

- ○ Statements 2 & 4
- ○ Only statement 3
- ○ Statements 1 & 4
- ○ Statements 3 & 5

Answer questions 11 and 12 on the basis of the given data.
A RAID-5 storage system with similar arrangement of parity blocks as described in slide 55.16 is used for storing the following data

DISK-1	DISK-2	DISK-3	DISK-4	DISK-5	
0100	XXXX	0100	0001	0101	Block 1 row
0101	XXXX	0100	0100	0001	Block 2 row

Figure 3: RAID-5 data

11)According to the figure, disk-2 has crashed. What data is present in the two blocks of disk-2?
Note: Assume block size is 4 bits

block 1: 0100, block 2: 0100

block 1: 0101, block 2: 0100

block 1: 0001, block 2: 0100

block 1: 0001, block 2: 0001

12) Assume that the binary values represent 8 bit ASCII code. What is the data word present inside this RAID-5 storage system?

- ○ IITM
- ○ IITB
- ○ DATA
- ○ DBMS

Consider the information given on relation **project** and relation **allotment** in Table 1, and answer the questions 11 and 12.

Relation	Number of records	Number of blocks
project	2,000	200
allotment	9,000	600

Table 1: Information on **project** and **allotment**

11. Consider worst-case memory availability. Assuming **allotment** as outer relation, identify the correct cost estimate for the **nested-loop join** of **allotment** and **project**.

1,200,200 block transfers and 2,200 seeks

1,800,600 block transfers and 9,600 seeks

120,200 block transfers and 400 seeks

120,600 block transfers and 1200 seeks

Consider the information given on relation **project** and relation **allotment** in Table 1, and answer the questions 11 and 12.

Relation	Number of records	Number of blocks
project	2,000	200
allotment	9,000	600

Table 1: Information on **project** and **allotment**

12. Consider worst-case memory availability. Assuming **allotment** as outer relation, identify the correct cost estimate for **block nested-loop join** of **allotment** and **project**.

1,200,200 block transfers and 2,200 seeks

1,800,600 block transfers and 9,600 seeks

120,200 block transfers and 400 seeks

120,600 block transfers and 1200 seeks

2. Consider the relational algebra expression given below:

$\prod_{name}(\prod_{roll\_no,name}(\prod_{section,roll\_no,name}(student)))$

Choose the equivalent relational algebra expression. [MCQ: 1 Point]

- ○ $\prod_{section}(\prod_{roll\_no}(\prod_{name}(student)))$
- ○ $\prod_{roll\_no}(student)$
- ○ $\prod_{section}(student)$
- ○ $\prod_{name}(student)$