NOC24-CS75
Data Base Management System

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Revision Session

Question 1

Identify a valid primary key for the relation paper info from the given instance.

(a) paper id

(b) paper id, corresponding Author

(c) conference id, corresponding Author

(d) paper id, conference id

paper_info

paper_id	corresponding_Author	conference_id	Area
1005	Steven	1654	HCI
2134	Dave	1654	HCI
367	Himani	6743	5G
1005	Steven	6743	5G
4987	Himani	6743	HCI

Solution - 1

Solution: (d)

A primary key needs to uniquely identify each record in a table. So option (d) is the correct option. Other options are incorrect as these attributes do not identify each tuple uniquely.

Question - 2

A designer maintains the following instances.

What is a possible output if the following SQL Query is executed?

SELECT COUNT(LOC) FROM Project, Module GROUP BY LOC;

a) 8
   4
b) 12
c) 2
   1
d) 3

Project	
PID	PName
A1B	WEB2
A2B	Stockly
A3B	TOD2
A4B	TOD3

Module		
PID	FileName	LOC
A1B	F12	500
A3B	F15	1000
A5B	F65	1000

Solution - 2

Solution: (a)

COUNT() on LOC with GROUP BY LOC will return 8, 4 for the respective counts of “1000” and “500”.

PID	PName	PID	FileName	LOC
A1B	WEB2	A1B	F12	500
A2B	Stockly	A1B	F12	500
A3B	TOD2	A1B	F12	500
A4B	TOD3	A1B	F12	500
A1B	WEB2	A3B	F15	1000
A2B	Stockly	A3B	F15	1000
A3B	TOD2	A3B	F15	1000
A4B	TOD3	A3B	F15	1000
A1B	WEB2	A5B	F65	1000
A2B	Stockly	A5B	F65	1000
A3B	TOD2	A5B	F65	1000
A4B	TOD3	A5B	F65	1000

Question - 3

Consider the following relation instance:

Number_Tab	
Num1	Num2
4	5
5	7
6	7
7	8
3	4

Both attributes `Num1` and `Num2` are integers and do not have null values. `Num1` is the primary key of the table and `Num2` is the foreign key of the same table, `Number_Tab` and references with `on delete cascade` constraints. A tuple `(Num1, Num2)` will be in the table only if Num1 $\leq$ Num2. Which of the following is possible if the tuple `(5, 7)` is deleted from the table?

a) The deletion of `(5, 7)` will be prohibited.

b) Tuple `(4, 5)` and `(3, 4)` also will be deleted.

c) Tuple `(6, 7)` and `(7, 8)` also will be deleted.

d) Only tuple `(7, 8)` will be deleted.

Solution - 3

Solution: (b)

In the Number Tab(Num1, Num2), where Num1 is the primary key, and Num2 is the foreign key which is referencing the primary key Num1 of its own relation. Now if we delete tuple (5,7) then tuple (4,5) should also be deleted (as 5 in the tuple (4,5) references to 5 in the tuple (5,7) which no longer exists; hence, the referencing tuple should also be deleted), and as (4,5) is deleted, tuple (3,4) should also be deleted for the same reason. Therefore, in total, 3 rows have to be deleted if the tuple (5,7) is deleted.

Question - 4

Given the schema (primary key is underlined)

budget(month, expense)

describe the result obtained by the following query.

```
SELECT MAX(expense) AS exp FROM budget
WHERE expense < (SELECT MAX(expense) FROM budget);
```

a) Finds the highest expense from budget.

b) Finds second highest expense from budget.

c) Finds all expenses from budget that are less than the highest expense.

d) Finds all expenses from budget that are equal to the highest expense.

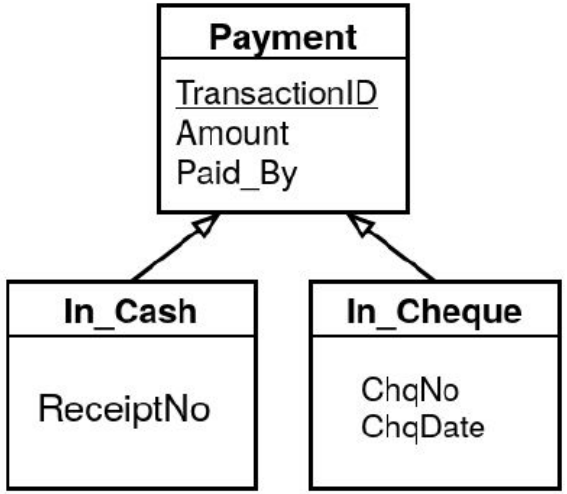
Solution - 4

Solution: (b)

There is a sub-query in SQL which finds the maximum budget from the table and then compares the budget which is less than the maximum budget to find the second highest budget.

Question - 5

Consider the following Entity Relationship Diagram:



If `n[Payment]` is the number of attributes present in the relational schema of `Payment`, `n[In_Cash]` is the number of attributes present in the relational schema of `In_Cash` and `n[In_Cheque]` is the number of attributes present in the relational schema of `In_Cheque`, which of the following options can NOT be true?

a) `n[Payment] = 6`

b) `n[In_Cheque] = 6`

c) `n[In_Cash] = 4`

d) `n[In_Cheque] = 3`

Solution - 5

Solution: (a) and (b)

(a) is incorrect since Payment cannot inherit attributes of In_Cash and In_Cheque
(b) is incorrect because the maximum attributes In_Cheque can have even after inheriting all the attributes from Payment is 5
(c) is correct since In_Cash can inherit all 3 attributes from Payment to have 4 attributes.
(d) is correct since In_Cheque can inherit only the key of Payment to have 3 attributes.

Question - 6

Consider the following instances:

University			
UName	Branch	Capacity	Fees
JFTT	Bangalore	15000	200000
KSSL	Bangalore	40000	500000
JFTT	Jalandhar	5000	200000
LKUniversity	Kolkata	2000	100000
LKUniversity	Mumbai	2000	150000

Consider the Relational Algebra on these given instances:

$$\Pi_{\texttt{UName,Branch,Capacity}}(\texttt{University}) \div (\Pi_{\texttt{Branch,Capacity}}(\sigma_{\texttt{Fees}<=200000}\texttt{University}) \cap \Pi_{\texttt{Branch,Capacity}}(\sigma_{\texttt{Capacity}>2000}\texttt{University}))$$

Solution - 6

Solution: JFTT

UName	Branch	Capacity
JFTT	Bangalore	15000
KSSL	Bangalore	40000
JFTT	Jalandhar	5000
LKUniversity	Kolkata	2000
LKUniversity	Mumbai	2000

Bangalore	15000
Jalandhar	5000

Question - 7

Consider the relational schema

CourseAssignments (AssignmentNo, QNo, Topic, Marks, QType)

with the following Functional Dependencies:

$$\text{AssignmentNo} \rightarrow \text{Topic}$$

$$\text{Topic} \rightarrow \{\text{Marks}, \text{AssignmentNo}\}$$

$$\{\text{Topic}, \text{QNo}\} \rightarrow \text{QType}$$

Which of the following is not a prime attribute of CourseAssignments?

a) QNo

b) Topic

c) QType

d) AssignmentNo

Solution - 7

Solution: (c)

The candidate keys of CourseAssignments are {QNo, AssignmentNo} and {QNo, Topic}.
Prime attribute is an attribute that is part of any candidate key.

Question - 8

Consider the relational schema GameRepo (GameName,GameType,Developer,PlayedBy) with the following Functional Dependency

GameName,GameType → Developer

GameType → PlayedBy

Developer → GameName

Identify the possible number of superkeys of GameRepo.

a) 4 b) 6 c) 8 d) 10`

Solution - 8

Solution: (b)

Explanation: The candidate keys of GameRepo are {GameType, GameName}, {GameType, Developer}.

Superkeys: {GT, GN}, {GT, GN, P}, {GT, GN, D}, {GT, GN, D, P}

{GT, D}, ~~{GT, D, GN}~~, {GT, D, P}, ~~{GT, D, GN, P}~~

Question - 9

Consider the following instance of the relation `MonthlyExpense(Budget, Month, Expense, Salary)`

MonthlyExpense			
Budget	Month	Expense	Salary
10000	Jan	15000	50000
10000	Feb	15000	50000
10000	Jul	15000	50000
20000	Feb	15000	50000
30000	Feb	10000	100000
10000	Feb	10000	100000

Which of the following Functional Dependencies hold for `MonthlyExpense`?

a) {Budget, Month} → Expense

b) {Expense, Month} → Budget

c) Budget → Salary

d) Expense → Salary

Solution - 9

Solution: (d)

Question - 10

Consider the relation Fig(FNo,Page,Colored,Dimensions) with the following Functional Dependencies:

FD1: FNo,Page → Colored

FD2: Colored → Dimensions

FD3: Dimensions → FNo

Identify the number of candidate keys and the highest normal form of Fig.

Solution - 10

Solution: Fig has 3 candidate keys and is in 3NF

Candidate keys: {Page, FNo},{Page, Colored}, {Page, Dimensions}

Prime attributes: {Page, FNo, Colored, Dimensions}

1NF: Yes

2NF: Since all attributes are prime, there is no non-prime attribute that is determined by a proper subset of a candidate key.

3NF: Since all attributes are prime, the RHS will always be the part of some key.

BCNF: In FD2 and FD3, the LHS is not a super key.

Question - 11

Consider the following relation: ClothesShop(ClothType, CColor, Designer, ShopID) with the following functional dependencies:

FD1: ClothType → CColor

FD2: {Designer, CColor} → ShopID

According to the rule of pseudo-transitivity, which of the following functional dependencies can be derived?

a) CColor → ShopID

b) {ClothType, CColor} → ShopID

c) {ClothType, Designer} → ShopID

d) ClothType → ShopID

Solution - 11

Solution: (c) {ClothType, Designer} → ShopID

Explanation: According to the rule of pseudo transitivity.

If X → Y

and YZ → W

then, XZ → W

ClothType (X) → CColor (Y)

{Designer (Z), CColor (Y)} → ShopID (W)

Question - 12

Determine the highest Normal Form of the relation `Restaurant(Dish, Chef, Table, Price)` having the following complete set of functional dependencies.

`Dish` $\rightarrow$ `Chef, Table`

`Table` $\rightarrow$ `Price`

a) 1 NF

b) 2 NF

c) 3 NF

d) BCNF

Solution - 12

Solution: 2NF

Candidate key: {Dish}
Prime attribute: {Dish}

1NF: Yes
2NF: No non-prime attribute is determined by a proper subset of a candidate key.
3NF: Table → Price does not satisfy any of the following conditions

a. RHS should be a subset of LHS
b. LHS is a superkey
c. RHS is part of some key

Question - 13

A file organization is sequential and unspanned (one block can store only whole records). The disk block size is 512 bytes. Each record of the file is 32 bytes long and the block pointer size is 12 bytes. How many records can be stored in one block?

a) 17

b) 16

c) 15

d) 14

Solution - 13

Solution: (c)

The file organization is unspanned. So one block can store *n* whole records and one block pointer.

$32\ n + 12 \leq 512 \Rightarrow n = 15$

Question - 14

Suppose that the record of a book in a library is 300 bytes long. The details of the disk storage is as follows. The disk unit rotates at 7200 rpm (revolutions per minute). The data transfer rate of the disk is 75000 bytes per second whereas seek time is 20 milliseconds. One block contains 5 such records of the book. If a student asks to know the details of a given book, how much time will be required to know that?

a) Approx. 441 milliseconds

b) Approx. 44 milliseconds

c) Approx. 24 milliseconds

d) Approx. 4 milliseconds

Solution - 14

Solution: (b)

Explanation:

Seek time = 20 milliseconds = 20/1000 sec = 0.02 sec

Average Rotational delay = 1/2r minutes = 60/ (2*7200) sec = 1/240 sec = 0.00416

Block transfer time = 5*300/data transfer per second = 1500/75000 sec = 0.02

So, Access time = seek time + Rotational delay + Block transfer time

= 0.02 + 0.00416 + 0.02 =0.04416 sec = 44 milliseconds

Question - 15

What is the availability of a Database Management System having the following reliability parameters?

Mean Time Between Failure (MTBF) = 36 days

Mean Time to Repair (MTTR) = 18 hours

a) 20.01%

b) 64.25%

c) 97.95%

d) 99.02%

Solution - 15

Answer: (c)

Explanation: Mean time between failures is not the average time that the system is working and then fail. It is the average time between failures.

Mean time between failures (MTBF) = total uptime / number of failures.

Mean time to repair is the average time taken to repair the system after failure.

Mean time to repair (MTTR) = total down time/number of failures.

Availability = Total uptime / (total uptime + total downtime)

= MTBF/(MTBF+MTTR)*100 = 36*24/(36*24 + 18) *100 = 97.95 %

Question - 16

Suppose that a Database Management System uses the Most Recently Used (MRU) strategy as its buffer replacement policy. Further, suppose that the system allocates 4 free buffer blocks for execution of a query to be used as a buffer. Assume that a query requires to access the following disk blocks in that order to complete its execution:

9,5,1,2,5,3,5,4,2,3,5,3,2,1,2,5,1,9,5,1

Calculate the number of block replacements (when all blocks are full, a residing block is replaced with a required block) required to complete the query.

a) 7

b) 8

c) 9

d) 10

Solution - 16

Requirement Details	Buffer Blocks			
9 - not available, 9 will be placed to an empty block	9			
5 - not available, 5 will be placed to an empty block	9	5		
1 - not available, 1 will be placed to an empty block	9	5	1	
2 - not available, 2 will be placed to an empty block	9	5	1	2
5 - available	9	5	1	2
3 - not available, in MRU 5 is just used and will be replaced by 3	9	3	1	2
5 - not available, 3 will be replaced by 5	9	5	1	2
4 - not available, 5 will be replaced by 4	9	4	1	2
2 - available	9	4	1	2
3 - not available, 2 will be replaced by 3	9	4	1	3
5 - not available, 3 will be replaced by 5	9	4	1	5
3 - not available, 5 will be replaced by 3	9	4	1	3
2 - not available, 3 will be replaced by 2	9	4	1	2
1 - available	9	4	1	2
2 - available	9	4	1	2
5 - not available, 2 will be replaced by 5	9	4	1	5
1 - available	9	4	1	5
9 - available	9	4	1	5
5 - available	9	4	1	5
1 - available	9	4	1	5

Number of block replacement here is 8.

Question - 17

If a disk system contains $1,600$ disk drives, and each has a $4,00,000$ hour MTBF (Mean time between failure), how often a drive failure will occur in that disk system?

a) 6400000 hours

b) 400000 hours

c) 400 hours

d) 250 hours

Solution - 17

Answer: (d)

Explanation:

MTBF (array) = MTBF (one disk) / Number of disks in array

So, answer is 400,000 / 1600 = 250 hr

Question - 18

Consider a disk pack with the following specifications: 16 double-sided platters, 256 tracks per surface, 512 sectors per track and 1024 bytes per sector. Which of the following is the correct capacity of disk (approximately)?

a) 512 MB

b) 2 GB

c) 4 GB

d) 8 GB

Solution - 18

Answer: c)

Explanation: Capacity of a track = sector size * number of sectors per track
= 512 * 1024 bytes = $2^9 * 2^{10} = 2^{19}$ **bytes**

Capacity of each surface = capacity of track * number of tracks per surface
= 2^{19} * 256 = $2^{19} * 2^8 = 2^{27}$ **bytes**

Capacity of the disk = capacity of one surface * number of platters * number of side per platter
= 2^{27} * 16 * 2 = 2^{32} **bytes = 4 Gigabytes**

Question - 19

A hash table of length 8 uses open addressing with hash function h(x) = x mod 6, and linear probing. The content of the table after inserting the six key values is shown. What will be the correct order of insertion of keys?

a) 22, 26, 19, 37, 45, 29

b) 26, 22, 37, 19, 45, 29

c) 45, 26, 22, 37, 19, 29

d) 29, 26, 22, 45, 37, 19

0	
1	37
2	26
3	19
4	22
5	45
6	29
7	

Solution - 19

Solution: (b)

Explanation:

In open hashing, the set of buckets is fixed, and there are no overflow chains. In linear probing, if a bucket is full, the system inserts record in the next free bucket.

X mod 6 = 2 when X=26. Bucket will be

		26					

X mod 6 = 4 when X=22. Bucket will be

		26		22			

X mod 6 = 1 when X=37. Bucket will be

	37	26		22			

X mod 6 = 1 when X=19, collision occurs at index position 1. As next available index position is 3. Bucket will be

	37	26	19	22			

X mod 6 = 3 when X=45, but the bucket is allocated, so the record will be inserted to the next free bucket. Allocation of the bucket will be

	37	26	19	22	45		

X mod 6 = 5 when X=29, but the bucket is allocated, so the record will be inserted to the next free bucket. Bucket will be

	37	26	19	22	45	29	

So, option b) is correct.

Question - 20

Consider a hash table with 8 slots. The hash function is h(X) = X mod 8. The collisions are resolved by chaining. Find out the maximum, minimum, and average chain lengths in the hash table. If the keys are inserted in the following order: 3, 18, 29, 25, 30, 43, 52, 67, 70.

a) 3, 0, and 1

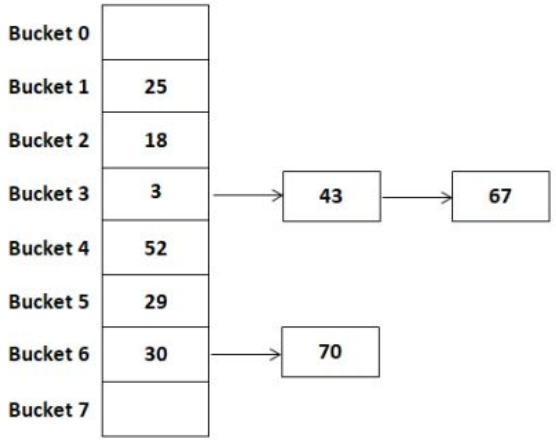
b) 3, 1, and 2

c) 4, 0, and 1

d) 4, 0, and 2

Solution - 20

Answer: a)
Explanation: After inserting the keys, the hash table looks like the following.



Hence, the maximum chain length = 3
The minimum chain length = 0
The average chain length = 1
Hence, option a) is the answer.

Question - 21

Suppose, a system uses B+ tree indexing for storing its records. If the minimum size of one block is 780 bytes, the size of one key is 8 bytes, record pointer is 4 bytes, and one block pointer is 12 bytes long, what will be the order of a leaf node (maximum possible number of key value with record pointer pairs) ?

a) 65

b) 64

c) 97

d) 195

Solution - 21

Solution: b)

Explanation:

Record pointer size, r = 4 bytes

Key value size, V = 8 bytes

Disk block ptr, p = 12 bytes

One block size = 780 bytes

Order of leaf node= n

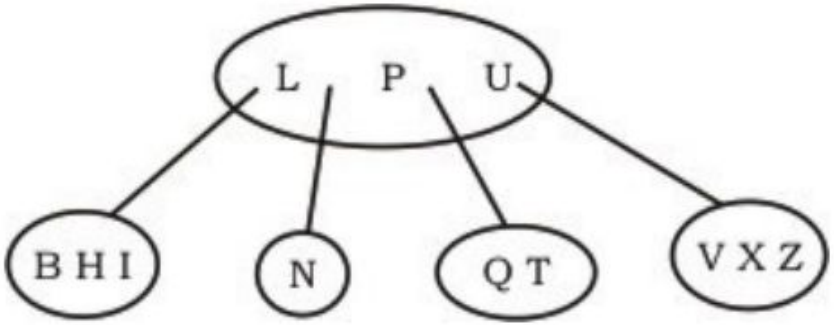
A leaf node in B+ tree contains at most n key values, at most n record pointers and one block pointer.

As one block size = n*V + n*r + p
8n + 4n + 12 <= 780

Order of leaf node,
n = (one block size - p)/(V+r)
= (780 - 12)/(8+4) = 64

Question - 22

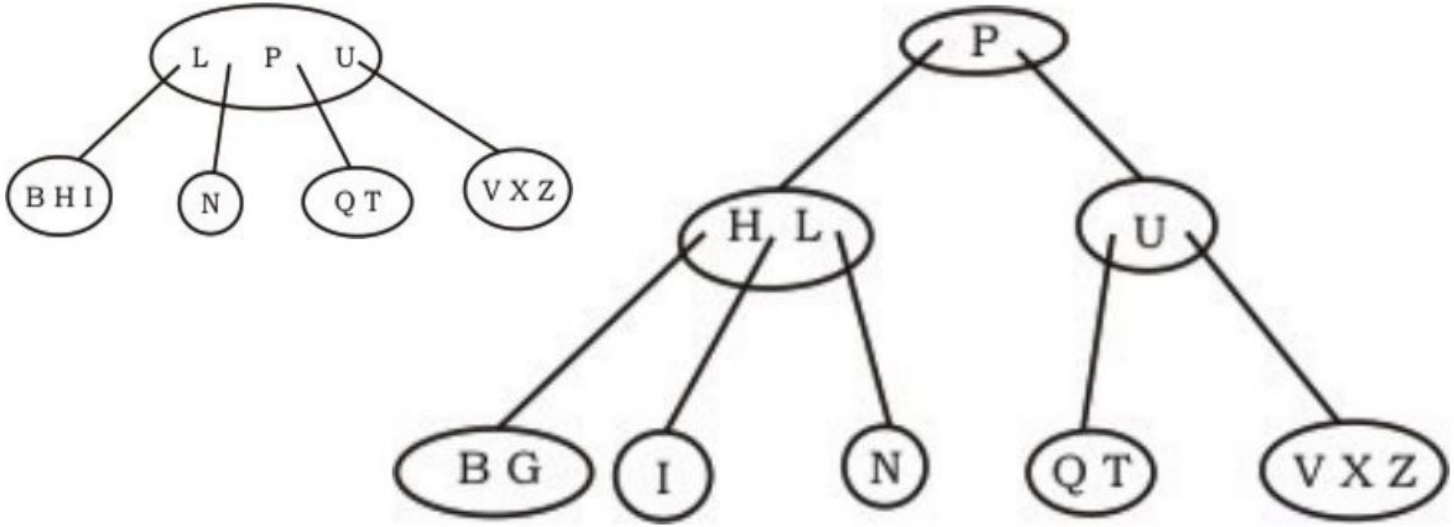
Consider the following 2-3-4 tree, in which each data item is inserted in the alphabetical order of letters.



If we insert G into the above tree, what will be the total number of nodes in the resultant tree.

Solution - 22

Explanation: The resulting tree after inserting G is shown below. It consists of 8 nodes.



Question - 23

In a B^+ tree, size of a node is generally the same as that of a disk block. Suppose that the size of a block is 2 kilobytes. One index entry is 32 bytes long. What will be the height of the tree of a file with 1 million search key values?

a) 6

b) 5

c) 4

d) 3

Solution - 23

Answer: c)

Explanation: The height of the tree $= \lceil log_{\lceil n/2 \rceil}(K) \rceil$

n = 2 KB / 32 bytes = 64

K = 1000000

The height of the tree $= \lceil log_{\lceil 32 \rceil}(1000000) \rceil \approx 4$

Question - 24

Consider the following **schedule S** involving four transactions T_1, T_2, T_3 and T_4.

T_1	T_2	T_3	T_4
R(X)			
R(Z)			
	W(X)		
		R(Y)	
		W(Y)	
			W(X)
			W(Y)
			W(Z)

R(X) denotes read operation on data item X by **transaction** T_i.
W(X) denotes write operation on data item X by **transaction** T_i.
Identify the possible number of **conflict serializable** schedules of the above **schedule S**.

a) 1

b) 2

c) 3

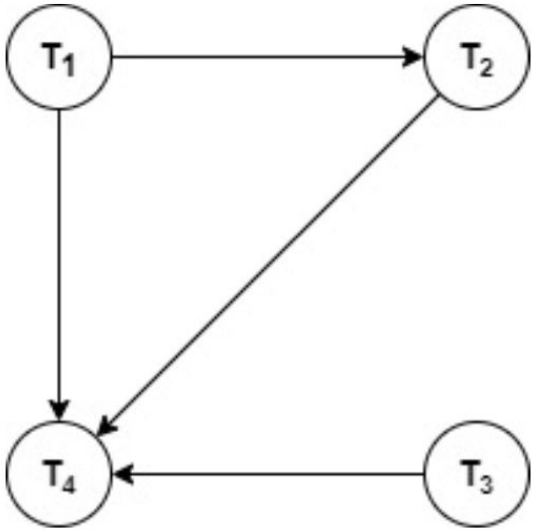
d) 4

Solution - 24

Solution: (c)

Explanation: If we draw the precedence graph of the schedule, we can observe that the graph has no cycle. Hence, the above schedule is conflict serializable schedules.

All possible topological orderings of the above precedence graph will be the possible conflict serializable schedule.



1. T1→T3→T2→T4

2. T1→T2→T3→T4

3. T3→T1→T2→T4

Hence, option c) is correct.

Question - 25

Identify the correct statement(s) about the `lock compatibility matrix` given below, where S denotes a `shared mode lock` and X denotes an `exclusive mode lock`.

	S	X
S	True	False
X	False	False

a) If a transaction holds a `S lock` on a data item, other transaction will not be allowed to obtain a `S lock` on the same data item.

b) If a transaction holds a `S lock` on a data item, other transaction will not be allowed to obtain a `X lock` on the same data item.

c) If a transaction holds an `X lock` on a data item, other transactions can not be allowed to obtain a `S lock` on the same data item.

d) If a transaction holds an `X lock` on an item, other transactions can be allowed to obtain a `S lock` on the same data item.

Solution - 25

Answer: b), c)
Explanation: As per lock based protocols. Refer Module 34 slide 10.

Question - 26

Consider two transactions given below where `lock-X(A)` denotes T_i has obtained an `Exclusive-mode` lock on data item A and `lock-S(A)` denotes T_i has obtained a `Shared-mode` lock on data item A. `read(A)` denotes read operation on data item A by the transaction T_i. `write(A)` denotes write operation on data item A by the transaction T_i.

T_1
lock-S(A)
read(A)
lock-X(B)
read(B)
write(B)
commit
unlock(A)
unlock(B)

T_2
lock-X(A)
read(A)
write(A)
lock-S(B)
read(B)
unlock(A)
unlock(B)
commit

Which of the following statement(s) is/are `true`?

a) T_1 follows the `rigorous two-phase locking protocol` only, but T_2 follows the `strict two-phase locking protocol`.

b) T_1 follows the `rigorous two-phase locking protocol` only, but T_2 follows the `two-phase locking protocol` only.

c) Both T_1 and T_2 follow the `rigorous two-phase locking protocol`.

d) Both T_1 and T_2 do not follow the `rigorous two-phase locking protocol`.

Solution - 26

Answer: b)
Explanation: Transaction T_1 after commit unlocks all `Shared-mode, and Exclusive-mode lock`. That is why, it follows the `rigorous two-phase locking protocol`.

Transaction T_2 before commit unlocks all locks (`Shared-mode lock, Exclusive-mode lock`). That is why, it does not follow the `strict two phase locking protocol` as well as the `rigorous two-phase locking protocol`. It is following `two-phase locking protocol` only. The first is the growing phase in which it is acquiring locks, the second is one in which it is releasing locks.
Hence, option (b) is correct.

Question - 27

Consider the following two schedules S1 and S2.

S1	
T_1	T_2
R(X)	
W(X)	
COMMIT	
	R(X)
	W(X)
	COMMIT

S2	
T_1	T_2
R(X)	
W(X)	
	R(X)
COMMIT	
	W(X)
	COMMIT

R(X) denotes read operation on data item X by Transaction T_i.
W(X) denotes write operation on data item X by Transaction T_i.

Which of the following statement(s) is/are true for the above two schedules S1 and S2?

a) Both schedules S1 and S2 are Recoverable Schedules.

b) Both schedules S1 and S2 are Cascadeless Schedules.

c) The schedule S1 is Cascadeless Schedule, the schedule S2 is Recoverable Schedule.

d) The schedule S1 is not a Recoverable Schedule, the schedule S2 is Cascadeless Schedule.

Solution - 27

Answer: a), c)

Explanation: `Recoverable Schedule`: If a transaction T_j reads a data item previously written by a transaction T_i , the commit operation of T_i must appear before the commit operation of T_j.

`Cascadeless schedules`: For each pair of transactions T_i and T_j such that T_j reads a data item previously written by T_i, the commit operation of T_i appears before the read operation of T_j.

In S1, T_2 read the data item X was previously written by T_1, T_1 commited before the read(X) and write(X) operation by T_2 . Hence, the schedule is `recoverable schedule as well as cascadeless schedule`.

In S2, T_2 read the data item X was previously written by T_1, T_1 commited after read(X) by T_2 but before the commit of T_2. Hence, the schedule S2 is `recoverable schedule` only.

Hence, options (a) and (c) are correct.

Question - 28

Assume that immediate database modification scheme is followed in this question. Consider the following log records for transactions T0, T1, T2, T3 and T4:

steps	Details of log
1	⟨T0,start⟩
2	⟨T0,A,200,400⟩
3	⟨T1,start⟩
4	⟨T1,B,400,800⟩
5	⟨T1,commit⟩
6	⟨checkpoint{T0} ⟩
7	⟨T2,start⟩
8	⟨T3,start⟩
9	⟨T2,C,800,1600⟩
10	⟨T3,D,500,900⟩
11	⟨T3,commit⟩
12	⟨T4,start⟩
13	⟨T4,E,300,700⟩

If there is a crash just after step 13 and the recovery of the system is successfully completed, identify the **correct** action for the above scenario.

a) After recovery completion, value of A will be 200.

b) After recovery completion, value of C will be 800.

c) After recovery completion, value of D will be 500.

d) After recovery completion, value of E will be 700.

Solution - 28

Answer: a), b)

Explanation: In the `immediate database modification scheme`, during recovery after a crash, a transaction needs to be redone if and only if both $\langle$`T`$_i$`, start`$\rangle$, $\langle$`T`$_i$`, commit`$\rangle$ are present in the log. otherwise undo is required.

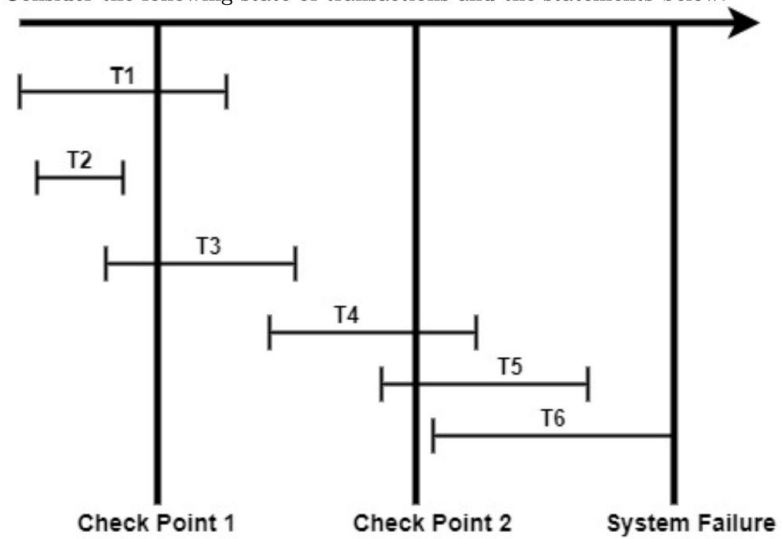
Any transactions that committed before the last checkpoint should be ignored(updates already output to disk due to the checkpoint).

Redo list contains transaction {T3} and undo list contain transactions {T0, T2, T4} and for transaction {T1} no need any action because it is already committed before checkpoint.

As per the process of transaction recovery, options (a) and (b) are correct.

Question - 29

Consider the following state of transactions and the statements below.



1. T_1, T_2 and T_3 can be ignored.
2. T_2 and T_4 can be ignored.
3. T_3, T_4 and T_5 need to be redone.
4. T_4 and T_5 need to be redone.
5. Only T_6 needs to be undone.

Identify the correct group of statements from the options below.

a) 1), 2), 3), 5)

b) 1), 3), 4), 5)

c) 1), 4), 5)

d) 2), 4), 5)

Solution - 29

Answer: c)
Explanation: Any transaction that is committed before the last checkpoint should be ignored. Therefore, T_1, T_2 and T_3 can be ignored (updates already output to disk due to the last checkpoint).
Any transaction that is committed since the last checkpoint, needs to be redone. Hence, T_4 and T_5 are to be redone.
Any transaction that was running at the time of failure, needs to be undone and restarted. Hence, only T_6 is to be undone.
Hence, option (c) is correct.

Question - 30

Let us consider the following statistics for two relations `Professor` and `Appointment_Details`:

- Number of records of `Professor`: $n_{\texttt{Professor}} = 4000$.
- Number of blocks of `Professor`: $b_{\texttt{Professor}} = 50$.
- Number of records of `Appointment_Details`: $n_{\texttt{Appointment\_Details}} = 2000$.
- Number of blocks of `Appointment_Details`: $b_{\texttt{Appointment\_Details}} = 20$.

Let us consider a natural join of `Professor` and `Appointment_Details` relations (`Professor` $\bowtie$ `Appointment_Details`).
Identify the required number of **`block transfers`** in the worst case (enough memory only to hold one block of each relation) using **`Nested-loop join`** and assume `Professor` as the outer relation.

a) 120050 block transfers

b) 120000 block transfer

c) 80050 block transfers

d) 80000 block transfers

Solution - 30

Answer: c)
Explanation: Number of block transfers will be: $4000 \times 20 + 50 = 80050$, if `Professor` is taken as the outer relation.
For more details refer to 38.31 of lecture material.

Question - 31

Consider the following relational schema:

```
Professor(pid, pname, qualification, emailID)
Department(dname, building, budget)
Appointment_Details(pid, dname, date, time)
```

Two query trees are given below.

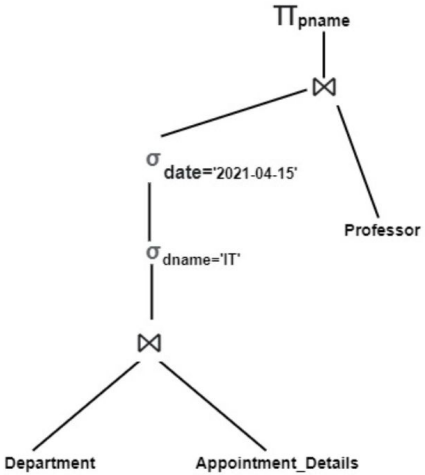


Figure 1:

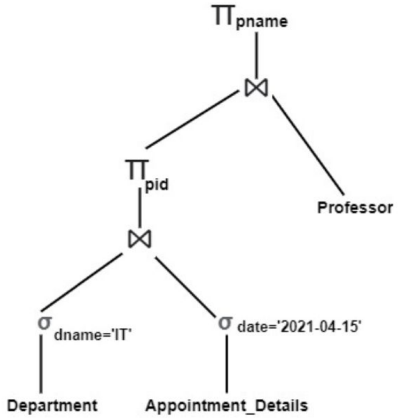


Figure 2:

Identify the correct statement for the above two query trees.

a) Two query trees are equivalent as identical operations (irrespective of their positions) are used in both the trees.

b) Two query trees are not equivalent as selection or projection operation cannot be carried out before or after the natural join operation.

c) Two query trees are equivalent and the query tree of Figure 1 will lead to more efficient query processing.

d) Two query trees are equivalent and the query tree of Figure 2 will lead to more efficient query processing.

Solution - 31

Answer: d)
Explanation: Two query tree is equivalent and Figure 2 will lead to more efficient query processing because performing the selection operation as early as possible reduces the size of the relation to be joined.
If projection with needed attribute is carried out before join, query processing becomes efficient.
Hence, option (d) is correct.