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DBMS

COMPUTER SCIENCE & IT

Date of Test : 07/08/2026

ANSWER KEY ➤

- | | | | | |
|--------|---------|---------|---------|---------|
| 1. (b) | 7. (a) | 13. (a) | 19. (d) | 25. (b) |
| 2. (d) | 8. (b) | 14. (d) | 20. (c) | 26. (a) |
| 3. (a) | 9. (c) | 15. (b) | 21. (d) | 27. (b) |
| 4. (a) | 10. (a) | 16. (c) | 22. (a) | 28. (c) |
| 5. (b) | 11. (a) | 17. (a) | 23. (d) | 29. (b) |
| 6. (c) | 12. (c) | 18. (b) | 24. (a) | 30. (c) |

DETAILED EXPLANATIONS

1. (b)

The common attribute between the two relations is 'R' which is the primary key of one of the two relations hence acting as a foreign key in another relation.

Since r_1 has 1500 tuples which mean that there will be 1500 different values for R. R_2 has 2000 tuples. Hence those 1500 'R' on r_1 would be associated to 2000 'R' of r_2 .

Hence, the maximum size of join $r_1 \bowtie r_2 = 2000$.

2. (d)

(1) Consider relation $AB \rightarrow C, B \rightarrow D, R(A, B, C, D)$

Key : AB

R is in 3NF, but not in BCNF.

(2) Consider another relation $A \rightarrow BC, B \rightarrow E (A, B, C, E)$

Key : A,

R is in 2NF but not in 3NF.

(3) Consider another relation $A \rightarrow C, B \rightarrow D, R(A, B, C, D)$

Key : AB:

R is not in 2NF.

3. (a)

- Select operation in SQL is equivalent to the projection operation in relation algebra, except that select in SQL contain duplicates.
- A SQL query can have a 'having' clause only if it has a 'group by' clause.
- Operator 'between' can't be used between main query and the subquery.
- If two relations R and S are joined, then the non-matching tuples of both R and S are ignored in natural join.

4. (a)

Since the data item is written by an uncommitted transaction there are chances that, it might abort. Hence if another transaction reads the data item and commit, the schedule will be irrecoverable.

5. (b)

$${}^nC_{n-2} \Rightarrow \frac{n(n-1)(n-2)!}{(n-2)! \times 2} = \frac{n(n-1)}{2} \text{ Candidate keys.}$$

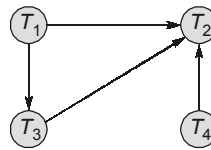
If every $(n-2)$ attributes are Candidate keys

then every $(n-1)$ and n attributes are also Superkeys

$$\begin{aligned} \text{Total Super keys} &= {}^nC_{n-2} + {}^nC_{n-1} + {}^nC_n \\ &= {}^nC_{n-2} + n + 1 \\ &= \frac{n(n-1)}{2} + n + 1 \end{aligned}$$

6. (c)

The precedence graph of the given schedule is



Therefore schedule is equivalent to

T_1, T_4, T_3, T_2 and T_1, T_3, T_4, T_2

7. (a)

Option (a) returns all the tuples where Rollno of Student matches with Rollno in Library.

8. (b)

A student can enroll one or more course.



A course can be enrolled by one or more students.



Option (b) is correct. It is a many to many relation with total participation at one end.

9. (c)

- If every attribute is prime then (partial key $\rightarrow$ non key) and (non key $\rightarrow$ non key) is not possible. So, relation is always in 2NF as well as in 3NF.
- If every candidate key is simple (having exactly 1 attribute), then (partial key $\rightarrow$ non key) not possible. Hence, relation is in 2NF.
- Assume a relation $R(ABC)$ with following functional dependencies:
 $R(ABC)$
 $\{AB \rightarrow C, C \rightarrow A\}$
 Candidate keys are AB and BC
 $AB \rightarrow C$ is in BCNF but $C \rightarrow A$ not in BCNF.

10. (a)

According to Atomicity either all operations of transaction are reflected properly in database, or none are. So, here transaction fails in middle so, Atomicity is fail.

11. (a)

$$r_i = \Pi_{r_i}(U) \text{ implies that } t[R_i] \in r_i, 1 \leq i \leq n.$$

Thus,

$$t[R_1] \bowtie t[R_2] \bowtie t[R_3] \dots \bowtie t[R_n] \in r_1 \bowtie r_2 \dots \bowtie r_n$$

By the definition of natural Join,

$$t[R_1] \bowtie t[R_2] \bowtie \dots \bowtie t[R_n] = \pi_a[\sigma_\beta(t[R_1] \times t[R_2] \times \dots \times t[R_n])]$$

where condition β is satisfied if values of attributes one tuple. The Cartesian product of single tuples generates one tuple. The selection process is satisfied because all attributes with the same name must have the same value since they are projection from the same tuple. Finally, the projection clause removes duplicate attribute name.

By the definition of decomposition, $U = R_1 \cup R_2 \cup \dots \cup R_n$, what mean that all attributes of t are in $t[R_1] \bowtie t[R_2] \bowtie \dots \bowtie t[R_n]$.

That is, t is equal to result of this join. Since t is any arbitrary tuple in u .

$$u \subseteq r_1 \bowtie r_2 \bowtie \dots \bowtie r_n$$

12. (c)

In this query, we can explicitly show the sequence of operations, giving a name to each intermediate relation. 1st intermediate will have SSN of all the managers, 2nd intermediate will have SSN of all the employees with dependents. 3rd intermediate will have those department managers who don't have any dependent. Final result will give the name of those department managers who have no dependents.

13. (a)

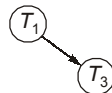
Select Eid $\leftarrow$ employee age max than 30
 From Emp E
 where age > 30 and
 not Exists (select Pid $\leftarrow$ all the project id whose project name is database
 From project P
 where Pname = 'database' and
 not exist (select Pid $\leftarrow$ the P.id where Eid is not in work relation
 from works W
 where W.Eid = E.Eid
 and W.Pid = P.Pid))

14. (d)

T_1	T_2	T_3
$r(A)$	$r(A)$	
$r(A)$ commit		$w(A)$
	commit	$r(A)$ commit

While preparing the precedence graph, we only consider the committed transactions.

Hence



Hence, the schedule is conflict serializable. Since it is conflict serializable, hence view serializable too. Checking, the strict recoverability of the schedule, since transaction T_3 is updated the value written by an uncommitted transaction T_2 . Hence, the schedule is not strict recoverable schedule.

15. (b)

According to 2PL, if lock conversion is allowed, then upgrading of locks must be done during expansion phase, and degrading of locks must be done in the shrinking phase.

$\therefore S_2$ is true.

Lock upgradation is not allowed in shrinking phase therefore S_1 is False.

16. (c)

If (4, 3) is deleted then 4 is the primary key but in (2, 4), (6, 4) and (3, 4), 4 is the foreign key so these must be deleted.

The primary key for (2, 4), (3, 4) and (6, 4) is 2, 3 and 6 respectively must be deleted but in (5, 2) and (7, 2) with primary key 5 and 7 is the foreign key also deleted and (9, 5) is also deleted because 5 is primary key which is already deleted.

17. (a)

The following conflicts leads to respective problems

WR conflict : Reading uncommitted data.

RW conflict : Unrepeatable read.

WW conflict : Overwriting uncommitted data.

18. (b)

Y and Z uniquely determine X and Y uniquely determine Z.

The hence $YZ \rightarrow X$ and $Y \rightarrow Z$ are the only FD's satisfied by the given relation.

19. (d)

Checking $QS \rightarrow P$, $Q^+ = Q$, $S^+ = S$, Hence $QS \rightarrow P$ is essential.

Checking $WS \rightarrow R$, $WS \rightarrow T$

$W^+ \rightarrow WVSRT$, Hence it can be decomposed to $W \rightarrow R$, $W \rightarrow T$

So, the dependencies remained are

$W \rightarrow V$, $W \rightarrow S$, $T \rightarrow S$, $W \rightarrow R$, $W \rightarrow T$, $QS \rightarrow P$

Now, $\{W \rightarrow T, T \rightarrow S\}$ by transitive rule $W \rightarrow S$ can be obtained.

Hence minimal cover is : $W \rightarrow V$, $T \rightarrow S$, $W \rightarrow R$, $W \rightarrow T$, $QS \rightarrow P$

20. (c)

Consider the following instance of the relation Employee

Employee		
E-id	Ename	Salary
1	Akbar	10000
2	Birbal	30000
3	Anand	3000
4	Anand	2000
5	Suresh	15000
6	Ramesh	25000

When the given query is executed then E-id 3, 4 are having same name and their total salary is less than 10000 will be return. The output will be -

Ename	Salary
Anand	5000

21. (d)

- Maximum number of tuple for $R \cup S$ is $n + m$.
- Maximum number of tuple for $R \cap S$ is $\min(m, n)$.
- Maximum nubmer of tuple for $\sigma_C(R) \times S$ is $m \times n$.
- Maximum number of tuple for $\sigma_L(R) - S$ is n .

22. (a)

Queries 1 will returns pairs of Sids such that the supplier with the first Sid charges more for some part than the supplier with the second Sid. Which is possible by the condition that is when two supplier id is different but part id is same and charges of first supplier is more than second supplier.

Queries 2 will returns empty set because we compare cost with Sid which is always returns empty set.

23. (d)

Checking $QS \rightarrow P$, $Q^+ = Q$, $S^+ = S$, Hence $QS \rightarrow P$ is essential.

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Hence minimal cover is: $W \rightarrow V$, $T \rightarrow S$, $W \rightarrow R$, $W \rightarrow T$, $QS \rightarrow P$.

24. (a)

$(AB)^+ \rightarrow ABCDEF$

AB is superkey

$A^+ \rightarrow A$

$B^+ \rightarrow B$

AB is candidate key

take those FDs where right hand side is A or B

$F \rightarrow B$, AF is candidate key

other candidate keys are AE, C, D

Minimal candidate keys = C, D

25. (b)

$$(10 + 8)P + (P + 1) \cdot 5 \leq 512$$

$$18P + 5P + 5 \leq 512$$

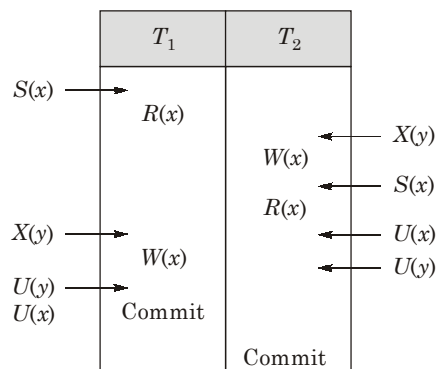
$$23P \leq 507$$

$$P \leq 22.04$$

$$P = 22$$

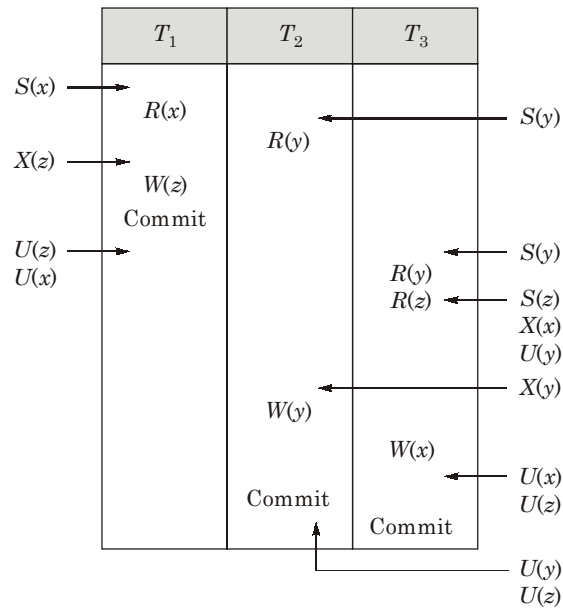
26. (a)

- Check S_1 :



Schedule S_1 is allowed under 2PL.

- Check S_2 :



Schedule S_2 is allowed under 2PL.

27. (b)

1. $R(A, B, C, D)$

$AB \rightarrow C, C \rightarrow D, D \rightarrow A$

Candidate Keys: AB, DB, CB

Relation is in 1NF, 2NF and 3NF since on RHS all are prime attribute are present, but not in BCNF because $AB \rightarrow C$ and $C \rightarrow A$ violates the condition.

2. $R(A, B, C, D)$

$A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow A$

Candidate keys: A, B, C, D

Since all attributes are prime attribute and on LHS single attribute present. So in BCNF.

3. $R(A, B, C, D, E)$

$AB \rightarrow C, C \rightarrow D, D \rightarrow B, D \rightarrow E$

Candidate keys: AB, AD, AC

Here $D \rightarrow E$ is partial dependency hence not in 2NF.

4. $R(A, B, C, D)$

$B \rightarrow C, B \rightarrow D$

Candidate key: AB

Here $B \rightarrow C$ is partial dependency. Hence not in 2NF.

28. (c)

Both query (a) and (b) represent the names of suppliers supplying some red part for less than 100 cost, but query2 is optimized variation of query1.

29. (b)

In option (b)

When Student e with all A grade, for enrollment tuples not having her roll number, LHS is false.

For enrollment tuples having her/his roll number, LHS is true, RHS also true so the implication is true for all e tuples.

When Student e with some non-S grades, for enrollment tuples not having her roll number, LHS is false.

For enrollment tuples having her roll number, LHS is true, but RHS is false for at least one tuple.

30. (c)

- A secondary index has to be dense since the file is not organized according to a secondary index. Otherwise, the index structure does not allow to find all values directly.
- If it were dense, we would have the same number of entries in the second level as in the first level index which defeats the purpose of the second level index.
- Yes, since we can directly access the record.
- Hashing does not support range queries since a hash function needs a specific key value (whereas we don't know the values of A given just $A > a$).

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