S.No.: 01DLSK_CS_AB_01052026

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DBMS

COMPUTER SCIENCE & IT

Date of Test : 01/05/2026

ANSWER KEY ➤

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

DETAILED EXPLANATIONS

1. (a)

Since no condition will be applied on X by Y because Y contain 0 record. So, all the records of X will be present in the output of X/Y which is n.

2. (d)

Given,

$$R_1 = \{(1, 2), (2, 2), (3, 3)\} \text{ and } R_2 = \{(1, 1), (2, 2), (1, 3), (1, 4)\}$$

A. $R_1 \cup R_2$: Presents in R_1 or R_2 or both = {(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (3, 3)}

B. $R_1 - R_2$: Presents in R_1 but not in R_2 = {(1, 2), (3, 3)}

C. $R_1 \cap R_2$: Presents in both R_1 and R_2 = {(2, 2)}

D. $R_2 - R_1$: Presents in R_2 but not in R_1 ={(1, 1), (1, 3), (1, 4)}

Option (d) is answer.

3. (c)

$$\underline{(AC)} \left| \begin{matrix} \underline{(A}B) \\ A \to B \end{matrix} \right| \underline{(A}D) \left| \begin{matrix} \underline{(D}E) \\ D \to E \end{matrix} \right| \underline{DF}$$

Multivalued attribute always combines with key.

4. (c)

R(U V W X Y Z)

{U → V, W → X, Y → Z} Candidate key = {UWY}

U → V,

W → X Partial dependencies

Y → Z

So decomposition R_1(UWY), R_2(UV), R_3(WX) and R_4(YZ) is lossless and dependency preserving decomposition in BCNF.

5. (b)

R(A, B, C, D)

{A → D, B → D, D → BC}

Candidate keys: A

So above relation is in 2NF. Since B → D and D → BC have determinan's (B and D) that are not super keys, the relation is not BCNF.

So,

R_1(A, D)	R_2(B, C, D)
A → D	B → D
	D → BC

Both R_1 and R_2 are dependency preserving with loss less decomposition and in BCNF.

So 2 tables are required.

6. (b)

A domain is defined as the set of all unique values permitted for an attribute. For ex: A domain of date is set of all possible valid date, a domain of integer is all possible whole numbers.

7. **(c)**

For a conflict serializable schedule, the linear ordering of transactions corresponds to topological sorting of the serialization graph. Since there can be multiple such orderings, multiple equivalent serial schedules may exist.

8. **(b)**

S_1 : Selection and projection is not commutative.

S_2 : A consecutive relation condition can be broken up into a cascade of individual relation operation.

So S_2 is true.

9. **(a)**

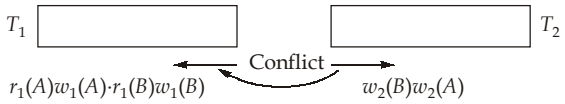
Number of concurrent schedule between T_1 and T_2

$$\frac{(4+2)!}{4!\,2!} = \frac{6!}{4!\,2!} = 15$$

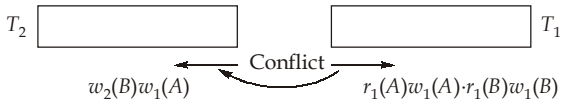
Number of serial schedule = 2!

$\because$ Number of non-serial schedule = 15 – 2 = 13

But, serializable schedule equal to $T_1 \rightarrow T_2$ serial



Serializable schedule equal to $T_2 \rightarrow T_1$ serial



Out of 13 non-serial schedule, none of the schedule equal to serial schedule.

$\because$ Number of non-serial schedule which are serializable = 0.

10. **(b)**

S_1 : If every attribute is prime then it does not necessary that LHS is a key.

Ex: R(ABCD), {AB → D, C → A, D → C}

S_2 : If relation R is in 3NF and every candidate key is simple then R will be in BCNF.

11. **(d)**

$$\boxed{10000 \text{ records}} \left\lfloor \frac{10000}{69} \right\rfloor = 144$$

The next level of the B^+ tree requires = $\left\lfloor \frac{144}{70} \right\rfloor$

= ceil(2.04) = 2 blocks

Next level = 1 blocks

The number of blocks needed is therefore 1000 + 144 + 2 + 1 = 1147 blocks.

12. (b)

P(R, S, T, U, V)

$$F = \{RS \to T, RS \to U, U \to R, ST \to U, ST \to V\}$$

$$\text{Closure of } (RS)^+ = \{R, S, T, U, V\}$$

$$\text{Closure of } (SU)^+ = \{S, U, R, T, V\}$$

$$\text{Closure of } (ST)^+ = \{S, T, U, R, V\}$$

{RS, SU, ST} is the key of P

In functional dependency U → R, U is not the superkey so relation is not in BCNF but in 3NF.

13. (d)

- Checking F → AC. It is essential.
- Checking DG → CE. Since G → D, so, G → CE is minimal.
- Checking BD → A. Since D → F and F → A, so, D → A is minimal.
- Option (b) is false, because minimal attribute cannot have more than one attribute in its R.H.S.
- So option (d) is correct.

14. (a)

R(A, B, C, D, E, F)

$$(AF)^+ = ABCDEF$$

$$(D)^+ = ABCDEF$$

Only two candidate key for relation R.

15. (a)

$P \cup Q$

Maximum = $p + q$ if both relation is disjoint then maximum possible tupple is $p + q$.

Minimum = max(p, q) if one relation is result of another.

16. (b)

$$\text{Disk block size} = 5000 \text{ records}$$

$$\text{Block size} = 10 \text{ records or } 15 \text{ (keys + Pointers)}$$

Sparse index at 1st level. So number of disk block at 1st level is number of block in database.

$$\text{Data base} = \frac{5000}{10} = 500 \text{ blocks}$$

$$1^{st} \text{ level} = \left\lceil \frac{500}{15} \right\rceil = \lceil 33.33 \rceil = 34 \text{ blocks}$$

$$2^{nd} \text{ level} = \left\lceil \frac{34}{15} \right\rceil = \lceil 2.26 \rceil = 3 \text{ blocks}$$

$$3^{rd} \text{ level} = 1 \text{ block}$$

$$\text{Total} = [500 + 34 + 3 + 1] \text{ blocks} = 538 \text{ blocks}$$

17. **(c)**

Gate:

x	y
0	1
1	2
2	3
3	2
4	5

After the query (2, 3) is deleted but due to on delete cascade (1, 2), (0, 1), (3, 2) will be deleted additionally. So, 3 tuples extra deleted.

18. **(c)**

NOT EXISTS (empty) returns true.

19. **(b)**

$|\pi_{Cid}(\sigma_{dept = 'EE'}\ (Course)| = 0.$

$\pi_{Sid,Cid}$ (Enrolled) / π_{Cid} (empty tuples in Dept)

All the distinct Sid will be in the result.

20. **(a)**

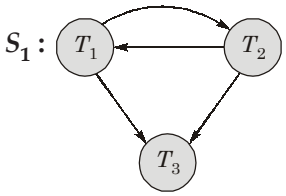
Relation X(P, Q, R, S, T)

X_1(PQR) and X_2(PST)

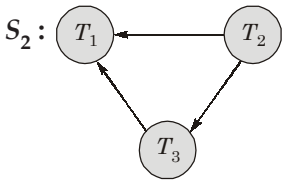
P is the common attribute and key for X_1 so decomposition is lossless join.

But is not dependency preserving because Q → S, RS → T is not covered.

21. **(b)**



Precedence graph contain cycle so not conflict serializable.



It contain no cycle so conflict serializable.

22. **(b)**

{A | ∃S ∈ Sailors ∃R ∈ Reserves (R.sid = S.sid ∧ R.bid = 210 ∧ A.sname = S.sname)} gives the name of sailors who have reserved boat 210.

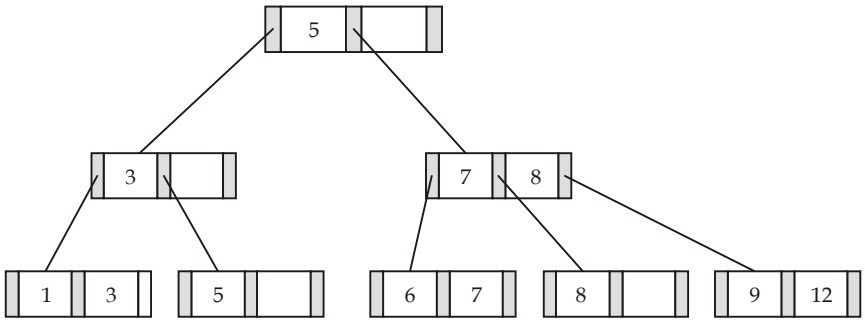
23. **(d)**

Schedule is not allowed under both basic time stamp and Thomas Write rule.

24. **(b)**

SQL query return the pid's of parts that are supplied by atleast five suppliers.
Inner query returns the count value and outer query checks that the count is greater than 4 or not. If it is greater the tuple will be printed.

25. **(a)**



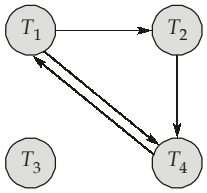
3 + 7 + 8 = 18 at height 1.

26. **(b)**

B tree eliminates the redundant storage of search key because in B tree every node have similar structure.
Non leaf node also contain record pointer.

27. **(d)**

Precedence graph of schedule S



Not conflict serializable also not view serializable.

28. **(d)**

I. A prime attribute of a relation schema R is an attribute that appears in some candidate key of R.
II. If every candidate key of a relation is simple, then it will always be in 2NF but not always be in 3NF because transitive dependency may be present.

29. **(a)**

Both time stamp ordering and 2 phase locking protocol ensure conflict serializable but only time stamp ordering protocol provides freedom from deadlock.

30. **(a)**

- A record at all transaction and the corresponding changes to the database is recorded a log.
- 2PL ensure conflict serializability and also suffer from starvation.
- Conservative 2PL free form the deadlock.
- Time-stamp concurrency control algorithm is a non-lock concurrency control method. In time-stamp based method, deadlock cannot occur as no transaction ever waits.

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