DATABASE TEST 2

Number of Questions: 35 **Section Marks: 30**

Directions for questions 1 to 35: Select the correct alternative from the given choices.

1. If the database operations in a transaction do not update the database but only retrieve data, what is that transaction called?
(A) Write-only operation (B) Read-only operation
(C) Named data item (D) Granularity

2. Consider the 2 interleaved transactions T_1 and T_2:

T_1	T_2
$r_1(x)$	
$w_1(x)$	
	$r_2(x)$
$r_1(y)$	
$w_1(y)$	
	$r_2(y)$
C_1	
	C_2

Which of the following is schedule for the above?
(A) $r_1(x), r_2(x), w_1(x), r_1(y), w_1(y), r_2(y), C_1, C_2$
(B) $r_1(x), w_1(x), r_2(x), r_1(y), w_1(y), r_2(y), C_1, C_2$
(C) $r_1(x), w_1(x), r_2(x), r_1(y), w_1(y), r_2(y), C_2, C_1$
(D) $r_1(x), w_1(x), r_2(x), r_1(y), r_2(y), w_1(y), C_1, C_2$

3. Two operations in a schedule are said to have conflict if
I. They belong to different transactions.
II. They access the same data item.
III. Atleast one of the operations is write operation.
IV. Atleast one of the operations is Read operation.
Which of the following is TRUE?
(A) I and II only (B) II and III only
(C) I, II and III only (D) II, III and IV only

4. A Non recoverable schedule must contain which of the following conflict?
(A) RR conflict (B) RW conflict
(C) WR conflict (D) WW conflict

5. Consider the given schedule:

T_1	T_2
$r_1(x)$	
$w_1(x)$	
$r_1(y)$	
C_1	
	$r_2(x)$
	$w_2(x)$
	C_2

The given schedule is
(A) Cascadeless schedule
(B) strict schedule
(C) Non-serial schedule
(D) Non-Recoverable schedule

6. In a schedule, transactions can neither read nor write an item 'X' until the last transaction that wrote X has committed or Aborted, what is that schedule?
(A) Cascadeless schedule (B) Strict schedule
(C) Recoverable schedule (D) Non serial schedule

7. Consider the given schedule

T_1	T_2
$R(x)$	
$x = x - N$	
$w(x)$	
	$r(x)$
	$w(x)$
$r(y)$	

What is the number of WR conflicts present in the given schedule?
(A) 0 (B) 1
(C) 2 (D) 3

8. Which of the following protocol is based on locking data items to prevent concurrent transactions from interfering with one another, and enforcing an additional condition that guarantees serializability?
(A) 1 PL (B) 2 PL
(C) 3 PL (D) 4 PL

9. In Random access, for accessing a disk block on a disk, what is the Rotational delay if disk rotates at 10000 rpm (rotations per minute)?
(A) 6 m/sec (B) 9 m/sec
(C) 3 m/sec (D) 12 m/sec

10. Whenever 2 independent 1:N relationships A:B and A:C are mixed in the same relation, then which of the following is TRUE?
(A) A Transitive Dependency may arise
(B) A Partial Dependency may arise
(C) A Multi-valued Dependency may arise
(D) None of the above

11. Which of the following is TRUE about 2NF?
(A) A relation schema R is in 2 NF, if every non prime attribute A in R is not partially dependent on any key of R.
(B) If the primary key contains a single attribute, the test need not be applied at all.
(C) Test for 2NF involves testing for functional dependencies whose left-hand side attributes are part of the primary key.
(D) All the above

12. Consider the following *FD*'s:
$X \rightarrow Y$
$WY \rightarrow Z$
If pseudo transitive rule is applied on given *FD*'s, what is the result?
(A) $X \rightarrow Z$ (B) $XW \rightarrow Z$
(C) $XY \rightarrow Z$ (D) $XWY \rightarrow YZ$

13. What is the average time to access a specific Record in a file using sequential scan (Linear search) on unordered file? (Assume that there are '*b*' blocks)
(A) $b/2$ (B) b
(C) $\log_2 b$ (D) $2b$

14. In which hashing technique, a type of directory, an array of '2^d' bucket addresses is maintained, where '*d*' is called the global depth of the directory?
(A) Internal Hashing (B) Extendible Hashing
(C) Separate Chaining (D) Static Hashing

15. Assume that, a primary index is built on a file with 45 blocks, what is the number of block accesses required to search for a specific Record in a file (Using Binary search)?
(A) 45 (B) 23
(C) 6 (D) 7

16. Consider the given 2 schedules:
S_a: $r_1(x), w_1(x), r_2(x), w_1(x), w_2(x), r_1(y), C_1, C_2$
S_b: $r_1(x), w_1(x), r_2(x), w_2(x), r_1(x), C_1, C_2$
Which of the following is TRUE?
(A) Both are conflict serializable
(B) Only S_a is conflict serializable
(C) Only S_b is conflict serializable
(D) Both are not conflict serializable

17. Consider the given transaction T_1, that follows 2-phase Locking protocol:

T_1
1. Read – Lock(X)
2. Read – item (X)
3. Write – Lock(Y)
4. Unlock(X)
5. Read – item(Y)
6. Y = X + Y
7. Write – item(Y)
8. Unlock(Y)

Which of the following is TRUE?
(A) Record 1 to Record 3 is Growing phase
(B) Record 4 to Record 8 is shrinking phase
(C) Record 1 to Record 4 is Expanding phase
(D) Both (A) and (B)

18. Consider a disk with track size 70 Kbytes and it rotates at 3600 rpm, what is the transfer rate in bytes/m sec?
(A) 3500 (B) 3600
(C) 4200 (D) 4500

19. What is the time required to transfer consecutively '*k*' non contiguous blocks that are on the same cylinder, where '*S*' is seek time, '*rd*' is rotational delay and '*btt*' is block transfer time?
(A) $S + (k * (rd + btt))$ msec
(B) $(S + rd + btt)$ msec
(C) $S + rd + (k * btt)$ msec
(D) $S + (k * rd) + btt$ msec

20. What is the estimate for transferring consecutive blocks (include interblock gap), the disk manufacturer provides a bulk transfer rate (btr) that takes the gap size into account when reading consecutively stored blocks (B), and the gap size is *G* bytes?
(A) btr = $(B/(B + G))$ * tr bytes/msec
(B) btr = $(B/(B + G))$ bytes/msec
(C) btr = $(B + G)$ + tr bytes/msec
(D) btr = $((B + G)/B)$ + tr bytes/msec

21. Match the following:
I. 1 NF
II. 2 NF
III. 3 NF
P. No Non key attribute should be functionally dependent on a part of the primary key.
Q. Relation should have no nonatomic attributes or nested relations.
R. Relation should not have a non key attribute functionally determined by another non key attribute.
(A) I–P, II–Q, III–R
(B) I–Q, II–P, III–R
(C) I–Q, II–R, III–P
(D) I–R, II–Q, III–R

22. Consider the given Relation EMP and given functional dependencies:
$F = (E \rightarrow N$
$P \rightarrow A, L$
$E P \rightarrow H)$
Which of the following is Incorrect closure set with respect to *F*?
(A) $E^+ = \{E, N\}$
(B) $P^+ = \{P, A, L\}$
(C) $\{EP\}^+ = \{E, N, P, A, L, H\}$
(D) $\{EH\}^+ = \{E, N, H, P, A\}$

23. Consider the functional dependencies given in the above question, EMP Relation is in which Normal Form?
(A) 1 NF (B) 2 NF
(C) 3 NF (D) BCNF

24. Consider the given 2 tables:
Person

Name	Mobile
Anil	9848463 9440072
Raj	9004432

Student

SName	Project	
	P No.	Hours

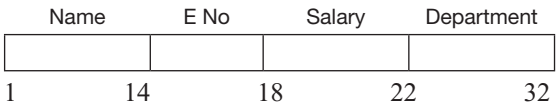
Which of the following is TRUE?
(A) Both tables are in 1 NF
(B) Both tables are not in 1 NF
(C) Person is in 1 NF but not student
(D) Person is in 2 NF and student is in 1 NF

25. Consider the schema $R(ABCDE)$ and functional dependencies $A \rightarrow BE$, $C \rightarrow D$, then the decomposition of R into $R_1(ABE)$, $R_2(CD)$ is
(A) Dependency preserving and lossless join.
(B) Dependency preserving and not lossless join.
(C) Lossless join but not dependency preserving.
(D) Not Dependency preserving and Not lossless join.

26. Consider a relation $R(A, B, C, D, E)$ with the following Dependencies:
$A \rightarrow C$
$BCD \rightarrow E$
$DE \rightarrow B$
Identify the candidate keys from the following options?
(A) AD, ADB (B) ADB, ADC
(C) ADB, ADE (D) ADC, ADE

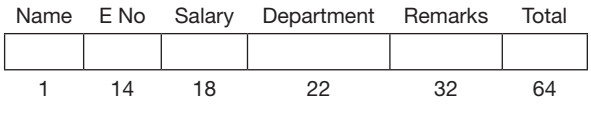
27. Consider the Functional Dependencies given in the above question, which of the following are "Prime Attributes"?
(A) $ABCD$ (B) $ABCE$
(C) $ABDE$ (D) $ACDE$

28. Consider a file with fixed length records, one sample record is given below,



The file contains 32000 records, and it is stored on a disk with block size 1024 Bytes, what is the blocking factor?
(A) 16 (B) 32
(C) 64 (D) 128

29. Consider a file with Fixed length Records, one sample record is given below.



The file contains 30000 records, what is the number of blocks required to store the file, on a disk with block size 2048 bytes?
(A) 648 (B) 840
(C) 938 (D) 968

30. Construct a B-tree with 6, 4, 5, 9, 7, 2 values, order of B-tree is $P = 3$, what is the maximum number of node splits?
(A) 1 (B) 2
(C) 3 (D) 4

31. Consider a disk with block size $B = 512$ bytes, number of tracks per surface is 400, this disk pack consists of 16 double sided disks, How many cylinders are there?
(A) 100 (B) 200
(C) 400 (D) 800

Common Data Questions 32 and 33:
Consider the given schedules
S_1: $r_1(P), r_2(R), r_1(R), r_3(P), r_3(Q), w_1(P), C_1, w_3(Q), C_3, r_2(Q), w_2(R), w_2(Q), C_2$
S_2: $r_1(P), r_2(R), r_1(R), r_3(P), r_3(Q), w_1(P), w_3(Q), r_2(Q), w_2(R), w_2(Q), C_1, C_2, C_3$.

32. Which of the following is/are Recoverable schedule(s)?
(A) Only S_1 (B) Only S_2
(C) Both S_1 and S_2 (D) Neither S_1 nor S_2

33. Which of the following is/are "cascadeless" schedules(s)?
(A) Only S_1
(B) Only S_2
(C) Both S_1 and S_2
(D) Neither S_1 nor S_2

Linked Answer Questions 34 and 35:
Consider the given table:

Student

Sname	Course	Department
Arun	C_1	D_1
Arun	C_2	D_1
Arun	C_1	D_2
Arun	C_2	D_2

34. Student table has multivalved dependencies, which of the following is correct 4 NF Decomposition?
(A) Student 1 (Sname, course)
Student 2 (Course, Department)
(B) Student 1 (Sname, Department)
Student 2 (course, Department)
(C) Student 1 (sname, course)
Student 2 (sname, Department)
(D) Student 1 (sname, course)
Student 2 (sname, Department)
Student 3 (Course, Department)

35. Which of the following is TRUE, for the above identified correct answer?
(A) student 1 $\bowtie$ student 2, returns student table
(B) student 1 X student 2 returns student table
(C) student 1 $\bowtie$ student 2 returns student table
(D) None of the above

Answer Keys

1. B	**2.** B	**3.** C	**4.** B	**5.** A	**6.** B	**7.** B	**8.** B	**9.** C	**10.** C
11. D	**12.** B	**13.** A	**14.** B	**15.** D	**16.** D	**17.** D	**18.** C	**19.** A	**20.** A
21. B	**22.** D	**23.** A	**24.** B	**25.** B	**26.** C	**27.** C	**28.** B	**29.** C	**30.** B
31. C	**32.** A	**33.** A	**34.** C	**35.** A					

Hints and Explanations

1. Read only operation do not update the database but only retrieves data. Choice (B)

2. Correct schedule is:
$r_1(x), W_1(x), r_2(x), r_1(y), w_1(y), r_2(y), C_1, C_2$
Choice (B)

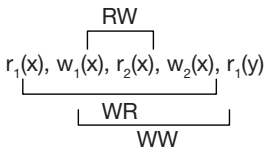
3. Two operations in a schedule are said to have conflict if they satisfy I, II and III.
Choice (C)

4. Recover ability can be decided by the presence of 'RW' conflict in a schedule.
Choice (B)

5. A schedule is said to be cascadeless, if every transaction in the schedule reads only items that were written by committed transactions. Choice (A)

6. More restrictive type of schedule is called a strict schedule, in which transactions can neither read nor write an item 'X' until the last transaction that wrote 'X' has committed or aborted.
Choice (B)

7.



$\therefore$ One WR conflict is present. Choice (B)

8. 2 PL (2 phase Locking protocol) ensures serializability.
Choice (B)

9. If the speed of disk rotation is 'P' revolutions per minute (rpm), then the average rotational delay 'rd' is given by
$rd = (1/2) * (1/P)$ min $= (60 * 1000)/(2 * P)$ msec
$rd = 3$ msec Choice (C)

10. If 2 independent 1:N relationships A:B and A:C are mixed in the same Relation, a multi valued Dependency may arise. Choice (C)

11. All the statements are TRUE.
Choice (D)

12. $X \rightarrow Y$
$WY \rightarrow Z$
$XW \rightarrow Z$
Choice (B)

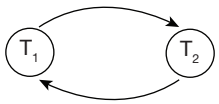
13. The average access time in block accesses to find a specific record in a file with 'b' blocks on unordered file is '$b/2$'. Choice (A)

14. Hashing Technique that allows Dynamic File expansion is extendible hashing, Choice (B)

15. First search will be conducted on primary index. By using binary search,
$\Rightarrow \lceil \log^{45} \rceil \cong 6$ block accesses
6 block accesses in primary index + 1 block access in original file.
$\therefore$ 7 block accesses. Choice (D)

16. S_a: $r_1(x), w_1(x), r_2(x), w_1(x), w_2(x), r_1(y), C_1, C_2$

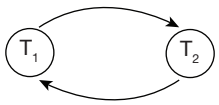
Precedence Graph:



$\therefore$ 'S_a' is not conflict serializable, since cycle is present in Precedence graph.

S_b: $r_1(x), w_1(x), r_2(x), w_2(x), r_1(x), C_1, C_2$

Precedence Graph:



$\therefore$ S_b is not conflict serializable, since cycle is present in precedence graph. Choice (D)

17. **Expanding or growing phase:** During which new locks on items can be acquired but none can be released. **Shrinking phase:** During which existing locks can be released but no new locks can be acquired.
Choice (D)

18. Transfer rate = $(70 \times 1000)/(60 \times 1000/3600)$

$$\frac{70 \times 1000}{\frac{1000}{60}} = \frac{70 \times 60 \times 1000}{1000} = 4200 \text{ bytes/msec}$$

Choice (C)

19. To transfer consecutively 'k' non contiguous blocks that are on the same cylinder, we need approximately,
$S + (k * (rd + btt))$ msec. Choice (A)

20. Transferring consecutive blocks (including inter block gap)

$\Rightarrow$ btr = $(B/(B + G))$ * tr bytes/msec Choice (A)

21. I – Q, II – P, III – R is correct match. Choice (B)

22. $\{EH\}^+$ cannot determine P and A. Choice (D)

23. The key for EMP is $\{EP\}$ and the functional Dependencies. $E \rightarrow N$

$P \rightarrow A$, L are partial dependencies.

$\therefore$ EMP is not in 2NF i.e., it is in 1 NF. Choice (A)

24. Both tables are not in 1 NF, person table has multiple values under mobile column for one name, In student relation, there is another relation project, A relation within a Relation is not allowed in 1 NF. Choice (B)

25. It is Dependency preserving, $A \rightarrow BE$ is in R_1 and $C \rightarrow D$ is in R_2.

Checking for loss less join:

	A	B	C	D	E
R_1(ABE)	*	*			*
R_2(CD)			*	*	

It is Not Loss Less JOIN. Choice (B)

26. $A \rightarrow C$

$BCD \rightarrow E$

$DE \rightarrow B$

L	M	R
AD	BCE	

$\{AD\}^+ = \{ADC\}$

$ADB^+ = \{ADBCE\}$

$ADC^+ = \{ADC\}$

$ADE^+ = \{ADECB\}$ Choice (C)

27. Candidate keys are: ADB, ADE

Prime Attributes are part of any candidate key, $ABDE$

Choice (C)

28. Blocking factor is defined as, the number of records stored on one block.

$$Bfr = \left\lfloor \frac{1024}{32} \right\rfloor = \left\lfloor \frac{2^{10}}{2^5} \right\rfloor = 2^5 = 32 \text{ Records}$$

Choice (B)

29. Blocking Factor

$$= \left\lfloor \frac{2048}{64} \right\rfloor = \left\lfloor \frac{2^{11}}{2^6} \right\rfloor = 2^5 = 32 \text{ records/block}$$

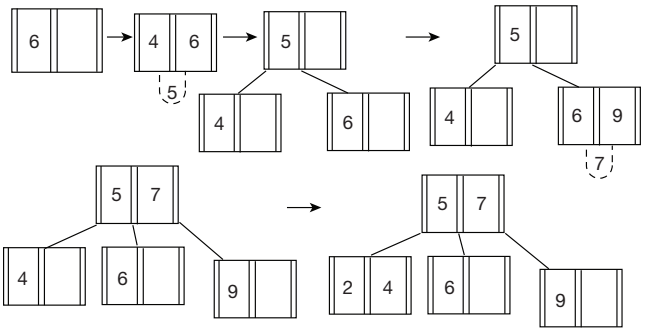
Number of blocks required:

1 block --------- 32 records

x ---------- 30000 records

$$x = \left\lceil \frac{30000}{32} \right\rceil = \lceil 937.5 \rceil = 938 \text{ blocks}$$ Choice (C)

30. Order $P = 3$



$\therefore$ 2 Node splits Choice (B)

31. Cylinders = Number of tracks that is 400 Choice (C)

32. S_1: $r_1(P), r_2(R), r_1(R), r_3(P), r_3(Q), W_1(P), C_1, w_3(Q), C_3, r_2(Q), w_2(R), w_2(Q), C_2$

To check recoverability, search for RW conflict. There is one RW conflict, T_3 is performing write operation so it has to commit first.

$\therefore$ S_1 is Recoverable.

S_2: $r_1(P), r_2(R), r_1(R), r_3(P), r_3(Q), w_1(P), w_3(Q), r_2(Q), w_2(R), w_2(Q), C_1, C_2, C_3$.

T_3 has to commit first but T_2 has committed first.

$\therefore$ S_2 is not a recoverable schedule. Choice (A)

33. S_1:

T_1	T_2	T_3
$r_1(P)$		
	$r_2(R)$	
$r_1(R)$		
		$r_3(P)$
		$r_3(Q)$
$w_1(P)$		
C_1		
		$w_3(Q)$
		C_3
	$r_2(Q)$	
	$w_2(R)$	
	$w_2(Q)$	
	C_2	

S_1 is cascadeless, because, data is taken from committed transactions.

S_2:

T_1	T_2	T_3
$r_1(P)$		
	$r_2(R)$	
$r_1(R)$		
		$r_3(P)$
		$r_3(Q)$
$w_1(P)$		
		$w_3(Q)$
	$r_2(Q)$	
	$w_2(R)$	
	$w_2(Q)$	
C_1		
	C_2	
		C_3

T_3 should commit before T_2
$\therefore$ S_2 is not cascadeless schedule.

Choice (A)

34. Multi valued dependencies:
Sname $\rightarrow\rightarrow$ Course, Sname $\rightarrow\rightarrow$ Department
4NF decomposition is as follows
Student 1(Sname, course)
Student 2(Sname, Department)

Choice (C)

35. Student 1 $\bowtie$ student 2 returns student table.

Choice (A)