

Roll No: .....

Name .....

National Institute of Technology Calicut  
Department of Computer Science & Engineering  
CS3002 Database Management Systems  
End Semester Exam (Monsoon Semester 2016)

Max. Marks: 50

Time: 3hr

1. Match the following [2.5]

a. Immediate Update	1. READ WRITE
b. Lost update problem	2. NO UNDO/REDO
c. Deferred Update	3. WRITE WRITE
d. Unrepeatable Read problem	4. UNDO/ REDO
e. Dirty Read Problem	5. WRITE READ
2. Consider a database that is read-only. Suppose serializability needs to be supported. Please list(all) correct statements from the given [1]
  - a. No locking is necessary.
  - b. Only read locks are necessary and they need to be held until the end of transaction.
  - c. Only read locks are necessary but they can be released as soon as the read is complete.
  - d. Both read and write locks are necessary and locking must be done in two phases.
  - e. None of the above.
3. Define the following terms in one sentence: [6]

a) indexing field	b) primary key field	c) clustering field
d) secondary key field	e) dense index	f) nondense (sparse) index.
4. List four DML commands. [1]
5. Draw the three schema architecture of the database system. [1]
6. What is the star property of Bell La Padula Model? [1]
7. State and prove pseudo transitive rule of FDs [1.5]
8. Given the table below, where A, B, C, D and E represent the attributes of the table. Find the functional dependencies F that hold over this relation. [2]

A	B	C	D	E
a1	b1	c1	d1	e1
a1	b2	c2	d1	e2
a1	b3	c1	d1	e3
a2	b1	c1	d2	e4
a2	b2	c2	d2	e5

9. Draw the E/R diagram for the following databases with participation and cardinality constraints
  - a) Design a database for a bank, including information about customer and their accounts.

Information about a customer includes their name, address, phone, and Social Security number. Accounts have numbers, types (e.g, saving, current) and balances. Also record the customer(s) who own an account. [2]

b) Change your diagram so an account can have only one customer. [1]

c) Change your original diagram so that a customer can have a set of addresses (with street-city-state triples) and a set of phone numbers (with area code and number). [1]

10. How do optimistic concurrency control techniques differ from the other concurrency control techniques? Why are they also called validation or certification techniques? [2]

11. Consider the two tables T1 and T2. Show the results of the following operations: [3]

Table T1			Table T2		
A	B	C	J	K	L
d	s	3	h	t	9
d	t	1	f	s	3
e	s	5	g	x	2
f	u	7	d	v	8

a) Select A, J, K from T1, T2 where A=J or B=K;

b)  $T1 \bowtie_{A=J \text{ AND } C < L} T2$

c)  $\{a.B, a.C, b.L \mid T1(a) \wedge T2(b) \wedge a.A = 'e' \wedge a.B \neq b.K\}$

12. For each of the following schedules determine which properties this schedule has. E.g., a schedule may be recoverable and cascade-less. Draw and fill the table in your answer sheet, and write the justification (Without proper justification answers won't consider.)

S1 = r1(C), w1(C), r1(A), w1(A), r2(B), r2(A), w2(B), c2, w1(C), c1 [6]

S2 = w1(A), r1(B), r3(B), w2(A), r2(B), w1(C), c1, w3(B), c2, c3

S3 = r1(A), w1(A), r2(A), w2(A), r3(A), w3(A), r2(B), w2(B), c2, r1(B), w1(B), c1, c3

Schedules	recoverable	cascade-less	conflict-serializable	2PL
S1				
S2				
S3				

13. Consider the following relation R(A, B, C, D, E) and functional dependencies F that hold over this relation.  $F = A, B \rightarrow C$

$C \rightarrow B$

$A, C \rightarrow D, E$

$A, B, D \rightarrow E$

a) Determine all candidate keys of R. [1.5]

b) In which normal form is relation R (recall that a relation can be in multiple normal forms). [1.5]

14. Create a B + Tree of order 3 for the following elements, where elements are inserted in the order  
23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78, 15, 16, 20, 24, 28
- a) Show how the tree will expand & what the final tree will look like. [2]
- b) Delete 59, 56 & 60 in order. [1]
15. Given the relation schema  $R = (A, B, C, D, E)$  and the canonical cover of its set of functional dependencies  
 $F = \{A \rightarrow BC$   
 $CD \rightarrow E$   
 $B \rightarrow D$   
 $E \rightarrow A \}$
- Compute a lossless join decomposition in Boyce-Codd Normal Form for R. Show your steps clearly. [3]
16. A file has  $r = 20000$  *STUDENT* records of fixed length. Each record has the following fields:  
*NAME* (30 bytes), *SSN* (9 bytes), *ADDRESS* (40 bytes), *PHONE* (10 bytes), *BIRTHDATE* (8 bytes), *SEX* (1 byte), *MAJORDEPTCODE* (4 bytes), *MINORDEPTCODE* (4 bytes), *CLASSCODE* (4bytes, integer), and *DEGREEPROGRAM* (3 bytes). An additional byte is used as a deletion marker. The file is stored on the disk and block size  $B = 512$  bytes; [2]
- a) Calculate the record size R in bytes.
- b) Calculate the blocking factor **bfr** and the number of file blocks **b**, assuming an unspanned organization.
17. Consider the following two transactions: [2]

T1:

begin  
 write C  
 read B  
 write C  
 commit

T2:

begin  
 write B  
 read C  
 read C  
 commit

In a DBMS using the two-phase locking algorithm, the transactions will cause deadlocks depends on how they are executed. If the above two transactions are executed concurrently, under what situations can a deadlock occur?

18. Consider the following database schema and example instance for a flight information system: [6]

<b>property</b>					
<u>pId</u>	price	owner	sqrFeet	managedBy	location
1	100,000	Alice	560	Property Pete	Lake View
2	3,400,000	Bob	2,000	Hyde Park Prop	Hyde Park
3	1,200,000	Bob	1,200	Property Pete	Hyde Park
4	5,000,000	Martha	800	Fancy Rentals	Evanston

<b>management</b>		
<u>mgmName</u>	Location	yearlyProfit
Property Pete	Lincoln Park	34,000,000
Hyde Park Prop	Downtown	3,000,000
Fancy Rental	Lake View	25,000,000

<b>maintenance</b>			
<u>cmpName</u>	<u>empName</u>	salary	Location
SuperPlumbing	George	10,000	Lake View
SuperPlumbing	Dave	30,000	Lake View
Carpeting	Keith	15,000	South Chicago

<b>repairs</b>				
<u>cmpName</u>	<u>empName</u>	<u>pId</u>	<u>date</u>	<u>type</u>
SuperPlumbing	George	1	2013-12-12	sink
SuperPlumbing	George	1	2013-12-13	toilet
Carpeting	Keith	4	2012-01-01	paining

- Write a relational algebra expression that returns the names of maintenance personal (empName) that did repair a property in '**Hyde Park**'.
- Write a relational algebra expression that returns the number of repairs for property managed by property management company '**Property Pete**'(cmpName) per location. E.g.,this should return (2, HydePark) if there is a property managed by '**Property Pete**' in **Hyde Park** that has been repaired twice.
- Write an SQL query that returns all owners whose sink's have been repaired, i.e., that own a property where the sink has been repaired.
- Write an SQL query that returns average price of properties in **Lake View** that are between 500 and 800 square feet large.
- Write a TRC & DRC expression that returns the pId, owner, and location of all properties that are larger than 600 square feet (sqrFeet).