Institute of Information and Communication Technology
BSc in Software Engineering; January 2019; DBMS; Term Test 1; Marks: 20; Time: 40 minutes

Consider the following relational schema and write SQL query to answer the following questions (any ten):

classroom(building, room_number, capacity)
department(dept_name, building, budget)
course(course_id, title, dept_name, credits)
instructor(ID, name, dept_name, salary)
section(course_id, sec_id, semester, year, building, room number, time slot id)
teaches(ID, course_id, sec_id, semester, year)
student(ID, name, dept_name, tot cred)
takes(ID, course_id, sec_id, semester, year, grade)
advisor(s_ID, i_ID)
time_slot(time_slot_id, day, start_time, end time)
prereq(course_id, prereq_id)

1. Find the names of all departments with instructor, and remove duplicates.
2. Find the course ID, semester, year and title of each course offered by the Comp. Sci. department .
3. Find the names of all instructors who have a higher salary than some instructor in 'Comp. Sci'.
4. Find the names of all instructors with salary between $90,000 and $100,000.
5. Find the names of all departments whose building name includes the substring 'Watson'.
6. Give a 5 percent salary raise to instructors whose salary is less than average.
7. Update all instructors with salary over $100,000 receive a 3 percent raise, whereas all others receive a 5 percent raise.
8. Insert a course CS-437 in the Computer Science department with title "Database Systems", and 4 credit hours.
9. Add all instructors to the *student* relation with tot_creds set to 0.
10. Delete all tuples in the instructor relation pertaining to instructors in the Finance department.
11. Delete all tuples in the *instructor* relation for those instructors associated with a department located in the Watson building.
12. Find all departments where the total salary is greater than the average of the total salary at all departments.

SWE 3/1; DBMS CT#2; Marks: 15; Time: 30 Minutes

Q.1. Consider the **Employee_Info** database of figure 1 and answer the following questions. **(2+3+10)**

```
Employee (EMPLOYEE_ID, FIRST_NAME, LAST_NAME, SALARY,
JOINING_DATE, DEPARTMENT)
Bonus (EMPLOYEE_REF_ID, BONUS_AMOUNT, BONUS_DATE)
Title (EMPLOYEE_REF_ID, EMPLOYEE_TITLE, AFFECTED_FROM)
```

Figure 1: Employee_Info Database

a) What are the appropriate primary keys?

b) Given your choice of primary keys, identify appropriate foreign keys.

c) Write the following query in SQL, using the **Employee_Info** schema.

   i. Write SQL script to create Employee table.

   ii. Write an SQL query to fetch all values of DEPARTMENT from the Employee table.

   iii. Add an Employee whose Employee ID, First Name, Last Name, Salary, Joining Date, and Department are 1001, Abdul, Qauyum, 5000, 1/1/1990, HRM respectively.

   iv. Delete all Employees from the marketing department.

   v. Update the Employee title "Jr. Officer" with "Junior Officer.

SWE 2022(1); 3/1; DBMS; TT#1; Time: 25 Minutes; Marks: 10

A university registrar's office maintains data about the following entities: (a) courses, including number, title, credits, syllabus, and prerequisites; (b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom; (c) students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled.

Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

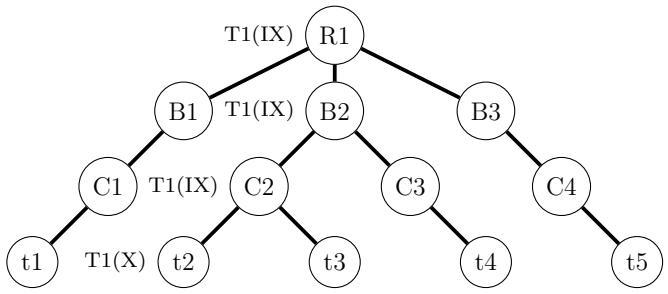
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Mashrafe** Total Marks#**20**

1. Define **Ordered Index** and **Sparse Index**. 2

2. Describe the **RAID Level 2** and **5**. 2

3. Suppose, three timestamps T_{11}, T_{22}, T_{33} have the values **15**, **20** and **25** respectively. Describe the **Wound-wait** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T2 request a **shared lock(S)** on **R1**.

   (*ii*) T3 request an **exclusive lock(X)** on tuple **t3**.

   (*iii*) T2 request an **exclusive lock(X)** on **t4**.

   (*iv*) T4 request a **shared lock(S)** on **C1**.

   (*v*) T3 request a **shared lock(S)** on **t5**.

5. Draw the state diagram of a **Transaction**. 2

6. What is **Conflict Serializable**? Suppose, a data is in **logical block (i) 91** where the **number of disks (n)** is **8**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 4$ and $L_2 = 5$, number of pointer in one node, $n = 4$. 5

-End-

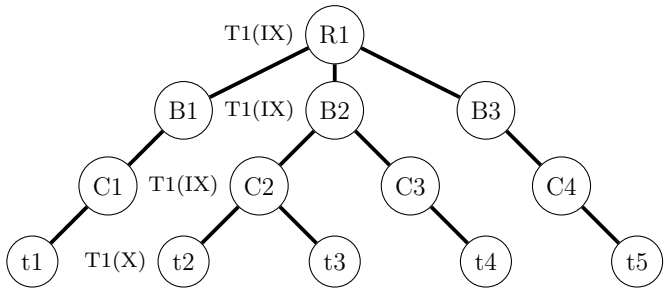
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Tamim** Total Marks#**20**

1. Define **Densed Index** and **Hashed Index**. 2

2. Describe the **RAID Level 3** and **4**. 2

3. Suppose, three timestamps T_{11}, T_{22}, T_{33} have the values **15**, **20** and **25** respectively. Describe the **Wait-Die** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T3 request a **shared lock(S)** on **R1**.

   (*ii*) T2 request an **exclusive lock(X)** on tuple **t4**.

   (*iii*) T2 request an **exclusive lock(X)** on **t3**.

   (*iv*) T4 request a **shared lock(S)** on **C4**.

   (*v*) T3 request a **shared lock(S)** on **t1**.

5. Briefly describe **ACID Property**. 2

6. Define **Conflict Equivalent**. Suppose, a data is in **logical block (i) 44** where the **number of disks (n)** is **4**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 1$ and $L_2 = 8$, number of pointer in one node, $n = 4$. 5

-End-

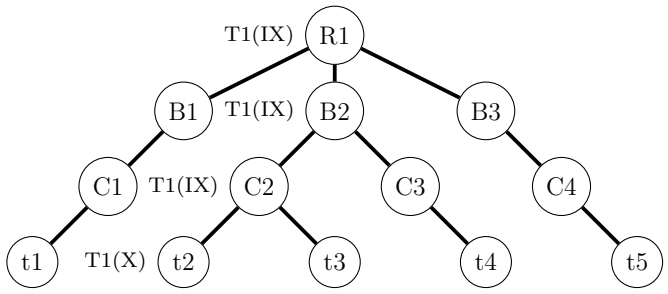
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Shakib** Total Marks#**20**

1. Define **Ordered Index** and **Densed Index**. 2

2. Describe the **RAID Level 0** and **6**. 2

3. Suppose, three timestamps T_{23}, T_{36}, T_{42} have the values **17**, **22** and **34** respectively. Describe the **Wound-wait** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T5 request a **shared lock(S)** on **R1**.

   (*ii*) T3 request an **exclusive lock(X)** on tuple **t3**.

   (*iii*) T4 request an **exclusive lock(X)** on **C3**.

   (*iv*) T4 request a **shared lock(S)** on **C4**.

   (*v*) T3 request a **shared lock(S)** on **B1**.

5. Draw the state diagram of a **Transaction**. 2

6. Define **Access Time**. Suppose, a data is in **logical block (i) 62** where the **number of disks (n)** is **16**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 3$ and $L_2 = 6$, number of pointer in one node, $n = 4$. 5

-End-

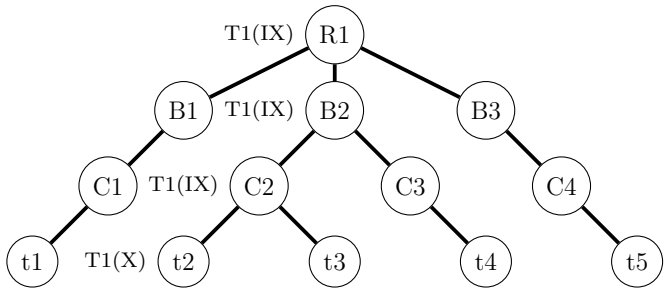
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Mushfiq** Total Marks#**20**

1. Define **Sparse Index** and **Hashed Index**. 2

2. Describe the **RAID Level 1** and **5**. 2

3. Suppose, three timestamps T_{23}, T_{36}, T_{42} have the values **17**, **22** and **34** respectively. Describe the **Wait-die** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T4 request a **shared lock(S)** on **C3**.

   (*ii*) T3 request an **exclusive lock(X)** on tuple **t3**.

   (*iii*) T2 request an **exclusive lock(X)** on **R1**.

   (*iv*) T4 request a **shared lock(S)** on **B3**.

   (*v*) T3 request a **shared lock(S)** on **t1**.

5. Describe and visualize **2PL** Protocol. 2

6. Define **Deadlock**. Suppose, a data is in **logical block (i) 72** where the **number of disks (n)** is **8**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 2$ and $L_2 = 7$, number of pointer in one node, $n = 4$. 5

-End-

Shahjalal University of Science and Technology | Department of Computer Science and Engineering

CSE 333 (Database Systems) | Term Test **2** | Time : **30 minutes** | Full Marks : **20** | 10-04-2022

Answer all the questions

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1. What is the purpose of normalization ? Are there any disadvantages of this ? **3**
2. Find the canonical cover of the set of FDs : **B → A, AD → C, C → ABD** **7**
3. Consider the relation - **R(UVWXYZ), FDs : UV → W, WX → UY, Y →Z**
   a. Identify the highest normal form of the relation. Show the steps. **4**
   b. Decompose the relation into BCNF if not already in BCNF. **4**
   c. Is the decomposition dependency preserving ? Why ? **2**

Shahjalal University of Science and Technology | Department of Computer Science and Engineering

CSE 333 (Database Systems) | Term Test 1 | Time : **30 minutes** | Full Marks : **20** | 07-03-2022

Answer all the questions

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1. What are the properties that a primary key should have ? **2**
2. Briefly describe the roles of a database administrator. **3**
3. Consider the following relational database schema consisting of the following relation schemas -

customer (c_id, c_name, c_city)
shop (s_id, s_name, s_city)
product (p_id, p_price, p_rating), p_name)
order (o_id, c_id, s_id, p_id)
availability (s_id, p_id)

Answer the following questions using relational algebra queries : **5x3 = 15**

a) Find product ids with rating more than 3.5 that the customer with c_id 150 has ordered.
b) Find the order ids with prices less than 10$.
c) Find the shop names for the shops that are located in the same city as the customer with c_id 150.
d) Find customer names for those who do not have any product orders.
e) Find the product ids and names that are available in all the shops.

Term Test # 1

CSE333 **Total Marks: 20** **Time: 30 minutes**

1. Check the statements below. If the statement is false, write the correct version. *1 × 3*
   a. Alternate key is created when there is no natural candidate key.
   b. By normalizing a database schema properly it is possible to eliminate data redundancy completely.
   c. Users do not need to know how data is stored on a physical level to use a DBMS system properly.
2. Answer all the questions. *3 × 3*
   a. Can multiple canonical covers exist for the same relationship set? Discuss with example.
   b. Give a scenario where insertion anomaly occurs.
   c. What are the roles of a database administrator?
3. Consider a table of 6 attributes *(A, B, C, D, E, F)* . These attributes abide by the functional dependencies stated below. *4 + 4*

   R(ABCDEF):

   $A \rightarrow E$, $B \rightarrow D$,
   $C \rightarrow D$, $BC \rightarrow F$,
   $D \rightarrow F$, $E \rightarrow F$,
   $D \rightarrow BC$

   Find the canonical cover for the given relationship set.
   After that, reduce the table you got upto 3rd normal form.

Group B

Q4 Write the following queries in SQL using the following relations: 5*5

student(std_id, reg_no, name, session, credit_fee, id_dept_degree)
course(course_id, title, session, semester, course_code, credit)
course_registration(id_course_reg, std_id, course_id, is_approved, marks)
department(id_dept, dept_code, dept_name)
degree(id_degree, degree_type, degree_category, total_semester)
degree_offered_by_dept(id_dept_degree, id_dept, id_degree)

i. List the students of 2014 session who have registered for more than 2 courses.
ii. Deduct 15 percent marks of all student who have taken 'CSE333' (course_code) and got more than 70 marks.
iii. Find the total completed (marks>=40) credits as total_credit for the student whose registration number is 2014331099.
iv. Find the students whose name contains 'm' in rightmost 3rd character.
v. List the registration no, name and credit fee of all students of 'CSE' department sorted with registration no in descending order. [Use only subquery]

Q5 a) What is B+ tree? Construct B+ tree for the following set of key values: 10
(2, 3, 5, 7, 11, 17, 19, 23, 29, 31)
Assume that the tree is initially empty and values are added in ascending order and the number of pointers in one node is FOUR.

b) Consider the following two transactions:

T1	T2
Read (A); *Read (B);* *If A = 0 then B := B+1;* *Write (B);*	
	Read (B); *Read (A);* *If B = 0 then A := A+1;* *Write (A);*

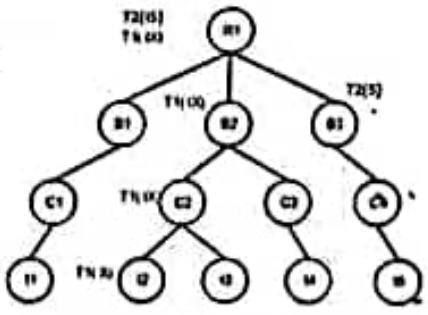
Add Lock and unlock instructions to transaction T1 and T2, so that they observed two phase locking protocol. Can the execution of these transactions result in dead lock? Justify your answer. 4+4

c) What is the difference between Block Level Stripping and Bit Level Stripping? In Block Level Stripping, find out the location of Physical Block and Disk of Logical Block 11 where the no of disk is 4. 4+3

Q6 a) Briefly explain wait-die and wound-wait scheme. Suppose six transactions $T_1, T_2, T_3, T_4, T_5, T_6$ having timestamps 10, 15, 20, 25, 30, 35.
Now if $T_6 \rightarrow T_2$, then what would be the scenario in wait-die & wound-wait scheme? 5+5

b) Draw the lock compatibility matrix for multiple granularity. Suppose, transaction T1 holding an X lock on tuple t2. What would happen if: 4+6

i. transaction T3 request an Exclusive (X) lock on C3.
ii. transaction T4 request a Shared (S) lock on C4.
iii. transaction T5 requests an Exclusive (X) lock on t5.



c) Consider the following schedule where 10 percent balance transferred from account A to B:

```
T1:  lock-X(A);
     read (A);
     temp = A * 0.1;
     A = A - temp;
     write (A);
     unlock-X(A);
     lock-X(B);
     read (B);
     B = B + temp;
     write (B);
     unlock-X(B);
```

Now, verify whether the transaction is in 2PL, if yes state the reason. Otherwise rewrite T1 and make it to observe 2 PL.

Shahjalal University of Science & Technology
Department of Computer Science & Engineering
3rd Year 1st Semester Final Examination – May 2017 (Session 2014-2015)
Course No: CSE-333 Course Title: Database Management System

Credits: 3.0 Full Marks: 100 Time: 3 Hours

[Answer any four questions taking two from each group]

Group A

Q1 a) Define True/False. If false, give correct answer. 5

i. If (course_code, credit) is a super key, then course_code is also a super key.
ii. If age of an employee can be calculated from date_of_birth, then date_of_birth is a component attribute.
iii. Database administrators use physical level of abstraction.
iv. If advisor relationship is many-to-one from instructor to student, then instructor_id will be the primary key.
v. 'Selection' operation in relational algebra is similar to 'where' clause in SQL.

b) What are the abstraction levels of data? Explain briefly four significant differences between file processing system and DBMS. 2+8

c) Compare between ER model and Relational model. 4

d) Define following terms with example: 2*3

i. Domain Constraints ii. Instance iii. Referential Integrity

Q2 a) Define Schema. Explain with diagram: weak entity set, many-to-one, total participation 1+2*3

b) Consider the following database schema:

employee(person_name, street, city)
works(person_name, bank_name, salary)
bank(bank_name, city)
manages(person_name, manager_name)

Give and expression in the relational algebra for each of the following: 3*6

i. Find the name and city of each employee who works for 'Sonali Bank'.
ii. Find the total salary of all employees in each Bank.
iii. Show the number of banks that are situated in 'Sylhet' city.
iv. List the employee names and salary of all employees of 'Sonali Bank' who gets less than 50k.
v. List the ~~employee~~ names of all managers in 'Sonali Bank' whose salary is above 1 lac BDT.
vi. Find the number of employees with unique employee names in 'Sylhet' city.

Q3 a) Define with example: multi-valued attribute, derived attribute 1.5*2

b) Suppose advisor is a relationship between student(std_id, name, cgpa) and instructors(inst_id, emp_code). Draw the E-R diagram showing mapping cardinality with cardinality limits [1..h] and identify the primary key for the following statements: 3.5*2

i. An instructor may advise at most one student and a student may have at most one advisor.
ii. An advisor may advise at most one student but a student may have many advisors.

c) What are the difference between third normal form and BCNF? 5

d) Define Functional Dependency. Compute the closure of the following set F of functional dependencies for relation schema r (A, B, C, D, E).

$A \rightarrow BC$
$CD \rightarrow E$
$B \rightarrow D$
$E \rightarrow A$

List the candidate keys for r. 5

e) Fill in the gaps or determine True or False. If false, give correct answer. 5

i. If X→Y and WY→Z, then WX→Z is called ___ rule.
ii. If X→Y and Y→Z, then x→Z is called ___ rule/axiom.
iii. A functional dependency of the form A → B, where B⊆A then it is called _____ FD.
iv. 2 NF allows transitive dependency.
v. Multi-valued attributes are stored in same relation like other attribute.

Shahjalal University of Science & Technology
Department of Computer Science & Engineering
3rd Year 1st Semester Final Examination – December2018 (CSE2015 Batch)
Course No: CSE-333 Course Title: Database Management System
Credits: 3.0 Full Marks: 100 Time: 3 Hours

[Answer any four questions taking two from each group]

Part A

1 a) What are the differences between procedural DML and non-procedural DML? 4

b) Write the names of different types of database users. What are the basic functions of database administrator? 6

c) Define True/False. If false, give correct answer. 5
   i. The discriminator of a weak entity set is underlined with a solid line.
   ii. Identifying relationship is depicted by double ellipse
   iii. If advisor relationship is many-to-one from instructor to student, then instructor_id will be the primary key.
   iv. DB users who form their request either by using query language or data analysis software is called specialized user.
   v. A composite attribute 'address' is an example of non-atomic values.

d) What is the difference between instance and schema? 2

e) What is the difference between Block Level Stripping and Bit Level Stripping? In Block Level Stripping, find out the location of Physical Block and Disk of Logical Block 11 where the no of disk is 4. 4+4

2 a) Write the following queries in SQL using the following relations: 5*3

student(std_id, reg_no, name, session, credit_fee, id_dept_degree)
course(course_id, title, session, semester, course_code, credit)
course_registration(id_course_reg, std_id, course_id, is_approved, marks)
department(id_dept, dept_code, dept_name)
degree(id_degree, degree_type, degree_category, total_semester)
degree_offered_by_dept(id_dept_degree, id_dept, id_degree)

i. List the students of 2014 session who have registered for more than 2 courses.

ii. Deduct 15 percent marks of all student who have taken 'CSE333' (course_code) and got more than 70 marks.

iii. Find the total completed (marks>=40) credits as total_credit for the student whose registration number is 2014331099.

iv. Find the students whose name contains 'm' in rightmost 3rd character.

v. List the registration no, name and credit fee of all students of 'CSE' department sorted with registration no in descending order. [Use only sub query]

b) Define with example: 5
   single-valued attribute, multi-valued attribute, derived attribute, foreign key, weak entity set

c) Write the differences between generalization and specialization. 5

3 a) How many fundamental operations in relational algebra? Name them along with proper example. 5

b) Consider the following database schema: 5*3

employee(person_name, street, city)
works(person_name, bank_name, salary)

works (person_name , bank_name , salary)

bank(bank_name, city)
manages(person_name, manager_name)

Give and expression in the relational algebra for each of the following:

i) Find the name and city of each employee who works for 'Sonali Bank'.
ii) Find the total salary of all employees in each Bank.
iii) Show the number of banks that are situated in 'Sylhet' city.
iv) List the employee names and salary of all employees of 'Sonali Bank' who gets less than 50k.
v) List the employee names of all managers in 'Sonali Bank' whose salary is above 1lac bdt.
vi) Find the number of employees with unique employee names in 'Sylhet' city.

c) What are the two conditions for performing set operation in Relational algebra? 2

d) What are difference between 3NF and BCNF? 3

Part B

4 a) Compare between ER model and Relational model. 5

b) Suppose advisor is a relationship between student(std_id, name, cgpa) and instructors(inst_id, emp_code). 5*3
Draw the E-R diagram showing mapping cardinality with cardinality limits [l..h] and identify the primary key for the following statements:

i. An instructor may advise at most one student and a student may have at most one advisor.
ii. An advisor may advise at most one student but a student may have many advisors.

c) Define Functional Dependency. Compute the closure of the following set F of functional dependencies for relation schema r (A, B, C, D, E). 5

$A \rightarrow BC$
$CD \rightarrow E$
$B \rightarrow D$
$E \rightarrow A$

List the candidate keys for r.

5 a) Construct a B+ tree step-by-step for the following set of key values: 10

(5, 6, 8, 10, 14, 20, 22, 26, 32, 34)

Assume that the tree is initially empty and values are added in ascending order and the number of pointer in one node, n = 4.

b) What are the properties for BCNF decomposition? Perform BCNF on following schema 7

Movie(MovieTitle, MovieID, PersonName, Role, Payment)

c) How redundancy is achieved in RAID level? Explain the term Striped Data 8

6 a) Define the ACID properties of Transaction. 6

b) When and how Multilevel indices are used? 5

c) When does a schedule called conflict equivalent and conflict serializable? Show with examples 10

d) When and how Multilevel Indices are used? 4

Shahjalal University of Science and Technology
Department of CSE
Mid Term-1
CSE 333: Database Management System
Marks: 20, Time: 30 minutes
(Answer all the questions)

1

Pubs Database State

r(author)

author_id	first_name	last_name
1	John	McCarthy
2	Dennis	Ritchie
3	Ken	Thompson
4	Claude	Shannon
5	Alan	Turing
6	Alonzo	Church
7	Perry	White
8	Moshe	Vardi
9	Roy	Batty

r(author_pub)

author_id	pub_id	author_position
1	1	1
2	2	1
3	2	2
4	3	1
5	4	1
5	5	1
6	6	1

r(book)

book_id	book_title	month	year	editor
1	CACM	April	1960	8
2	CACM	July	1974	8
3	BST	July	1948	2
4	LMS	November	1936	7
5	Mind	October	1950	NULL
6	AMS	Month	1941	NULL
7	AAAI	July	2012	9
8	NIPS	July	2012	9

r(pub)

pub_id	title	book_id
1	LISP	1
2	Unix	2
3	Info Theory	3
4	Turing Machines	4
5	Turing Test	5
6	Lambda Calculus	6

Figure 1: Relational Database Schema

Write the relational algebra for following query

i. Show all books' title only (1)
ii. Select the books which were published before 2012 (1)
iii. Find book title published by "Unix" publication.(2)
iv. How many authors are not book editor (4)
v. Returns the names of all authors who are book editor (4)

2 What is the difference between instance and schema (2)

3 Define data definition language (DDL) and Data manipulation language (DML). What are the differences between procedural DML and non-procedural DML? (6)

Full Marks: 20 Time: 30 minutes

Answer any two questions.

Q1 Why should NULLs in a relation be avoided as much as possible? Consider the following relation (A, B, C, TUPLE#) : (10, b1, c1, 1), (10, b2, c2, 2), (11, b4, c1, 3), (12, b3, c4, 4), (13, b1, c1, 5), (14, b3, c4, 6). Which of the following dependencies *may hold and which cannot hold* in the above relation? If the dependency cannot hold, explain why *by specifying the tuples that cause the violation.* i. $A \rightarrow B$, ii. $B \rightarrow C$, iii. $C \rightarrow B$, iv. $B \rightarrow A$, v. $C \rightarrow A$.

Does the above relation have a potential candidate key? If it does, what is it?

Q2. Specify the following queries on the COMPANY relational database schema (discussed in the text book) using the relational operators: i) Retrieve the names of all employees in department 5 who work more than 10 hours per week on the ProductX project. ii) List the names of all employees who have a dependent with the same first name as themselves. iii) For each project, list the project name and the total hours per week (by all employees) spent on that project.

Q3. Specify the following queries in SQL on the COMPANY relational database schema (discussed in the text book) : i) Find the names of all employees who are directly supervised by 'Franklin Wong'. ii) For each project, list the project name and the total hours per week (by all employees) spent on that project iii) For each department, retrieve the department name and the average salary of all employees working in that department.

Q4. Design an ER schema for the Sonali Bank. Each bank can have multiple branches, and each branch can have multiple accounts and loans. Each customer may have single/shared accounts and may take loan without having any account. State assumptions you make.

works (person_name , bank_name , salary)

bank(bank_name, city)
manages(person_name, manager_name)

Give and expression in the relational algebra for each of the following:

i) Find the name and city of each employee who works for 'Sonali Bank'.
ii) Find the total salary of all employees in each Bank.
iii) Show the number of banks that are situated in 'Sylhet' city.
iv) List the employee names and salary of all employees of 'Sonali Bank' who gets less than 50k.
v) List the employee names of all managers in 'Sonali Bank' whose salary is above 1lac bdt.
vi) Find the number of employees with unique employee names in 'Sylhet' city.

c) What are the two conditions for performing set operation in Relational algebra? 2

d) What are difference between 3NF and BCNF? 3

Part B

4 a) Compare between ER model and Relational model. 5

b) Suppose advisor is a relationship between student(std_id, name, cgpa) and instructors(inst_id, emp_code). 5*3
Draw the E-R diagram showing mapping cardinality with cardinality limits [l..h] and identify the primary key for the following statements:

i. An instructor may advise at most one student and a student may have at most one advisor.
ii. An advisor may advise at most one student but a student may have many advisors.

c) Define Functional Dependency. Compute the closure of the following set F of functional dependencies for relation schema r (A, B, C, D, E). 5

$A \rightarrow BC$
$CD \rightarrow E$
$B \rightarrow D$
$E \rightarrow A$

List the candidate keys for r.

5 a) Construct a B+ tree step-by-step for the following set of key values: 10

(5, 6, 8, 10, 14, 20, 22, 26, 32, 34)

Assume that the tree is initially empty and values are added in ascending order and the number of pointer in one node, n = 4.

b) What are the properties for BCNF decomposition? Perform BCNF on following schema 7

Movie(MovieTitle, MovieID, PersonName, Role, Payment)

c) How redundancy is achieved in RAID level? Explain the term Striped Data 8

6 a) Define the ACID properties of Transaction. 6

b) When and how Multilevel indices are used? 5

c) When does a schedule called conflict equivalent and conflict serializable? Show with examples 10

d) When and how Multilevel Indices are used? 4

Shahjalal University of Science and Technology, Sylhet
Database Management System
Marks: 25, Time: 50 Minutes

1 Suppose advisor is a relationship between student(std_id, name, cgpa) and instructors(inst_id, emp_code). 10

Draw the E-R diagram showing mapping cardinality with cardinality limits [l..h] and identify the primary key for the following statements:

i. An instructor may advise at most one student and a student may have at most one advisor.
ii. An advisor may advise at most one student but a student may have many advisors.

2 What are the difference between third normal form and BCNF? 5

3 Write the following queries in SQL using the following relations: 10

student(std_id, reg_no, name, session, credit_fee, id_dept_degree)
course(course_id, title, session, semester, course_code, credit)
course_registration(id_course_reg, std_id, course_id, is_approved, marks)
department(id_dept, dept_code, dept_name)
degree(id_degree, degree_type, degree_category, total_semester)
degree_offered_by_dept(id_dept_degree, id_dept, id_degree)

i. List the students of 2014 session who have registered for more than 2 courses.

ii. Deduct 15 percent marks of all student who have taken 'CSE333' (course_code) and got more than 70 marks.

iii. Find the total completed (marks>=40) credits as total_credit for the student whose registration number is 2014331099.

iv. Find the students whose name contains 'm' in rightmost 3rd character.

v. List the registration no, name and credit fee of all students of 'CSE' department sorted with registration no in descending order. [Use only subquery]

Shahjalal University of Science and Technology
Department of CSE
Mid Term-1
CSE 333: Database Management System
Marks: 20, Time: 30 minutes
(Answer all the questions)

1

Pubs Database State

r(author)

author_id	first_name	last_name
1	John	McCarthy
2	Dennis	Ritchie
3	Ken	Thompson
4	Claude	Shannon
5	Alan	Turing
6	Alonzo	Church
7	Perry	White
8	Moshe	Vardi
9	Roy	Batty

r(author_pub)

author_id	pub_id	author_position
1	1	1
2	2	1
3	2	2
4	3	1
5	4	1
5	5	1
6	6	1

r(book)

book_id	book_title	month	year	editor
1	CACM	April	1960	8
2	CACM	July	1974	8
3	BST	July	1948	2
4	LMS	November	1936	7
5	Mind	October	1950	NULL
6	AMS	Month	1941	NULL
7	AAAI	July	2012	9
8	NIPS	July	2012	9

r(pub)

pub_id	title	book_id
1	LISP	1
2	Unix	2
3	Info Theory	3
4	Turing Machines	4
5	Turing Test	5
6	Lambda Calculus	6

Figure 1: Relational Database Schema

Write the relational algebra for following query

i. Show all books' title only (1)
ii. Select the books which were published before 2012 (1)
iii. Find book title published by "Unix" publication.(2)
iv. How many authors are not book editor (4)
v. Returns the names of all authors who are book editor (4)

2 What is the difference between instance and schema (2)

3 Define data definition language (DDL) and Data manipulation language (DML). What are the differences between procedural DML and non-procedural DML? (6)

SWE; DBMS TT#3; Marks: 10; Time 25 minutes

1. Define Speedup and Scaleup. Explain some factors that limit Speedup and Scaleup in Parallel Database Architecture. (3+3)

2. What is 2PC? Why it is needed during the transaction in Distributed Database Architecture? (1+3)

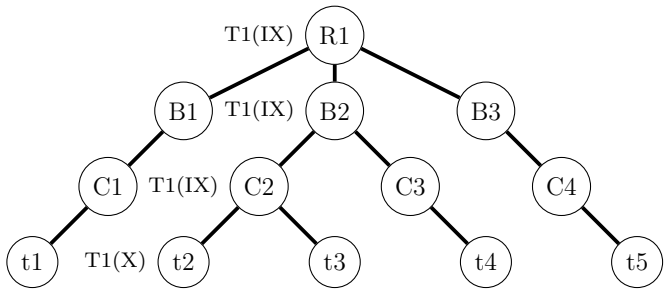
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Mashrafe** Total Marks#**20**

1. Define **Ordered Index** and **Sparse Index**. 2

2. Describe the **RAID Level 2** and **5**. 2

3. Suppose, three timestamps T_{11}, T_{22}, T_{33} have the values **15**, **20** and **25** respectively. Describe the **Wound-wait** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T2 request a **shared lock(S)** on **R1**.

   (*ii*) T3 request an **exclusive lock(X)** on tuple **t3**.

   (*iii*) T2 request an **exclusive lock(X)** on **t4**.

   (*iv*) T4 request a **shared lock(S)** on **C1**.

   (*v*) T3 request a **shared lock(S)** on **t5**.

5. Draw the state diagram of a **Transaction**. 2

6. What is **Conflict Serializable**? Suppose, a data is in **logical block (i) 91** where the **number of disks (n)** is **8**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 4$ and $L_2 = 5$, number of pointer in one node, $n = 4$. 5

-End-

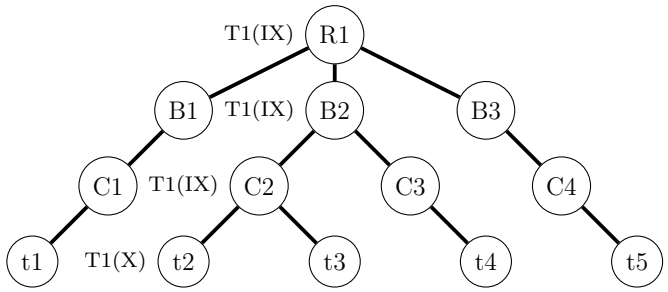
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Tamim** Total Marks#**20**

1. Define **Densed Index** and **Hashed Index**. 2

2. Describe the **RAID Level 3** and **4**. 2

3. Suppose, three timestamps T_{11}, T_{22}, T_{33} have the values **15**, **20** and **25** respectively. Describe the **Wait-Die** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T3 request a **shared lock(S)** on **R1**.

   (*ii*) T2 request an **exclusive lock(X)** on tuple **t4**.

   (*iii*) T2 request an **exclusive lock(X)** on **t3**.

   (*iv*) T4 request a **shared lock(S)** on **C4**.

   (*v*) T3 request a **shared lock(S)** on **t1**.

5. Briefly describe **ACID Property**. 2

6. Define **Conflict Equivalent**. Suppose, a data is in **logical block (i) 44** where the **number of disks (n)** is **4**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 1$ and $L_2 = 8$, number of pointer in one node, $n = 4$. 5

-End-

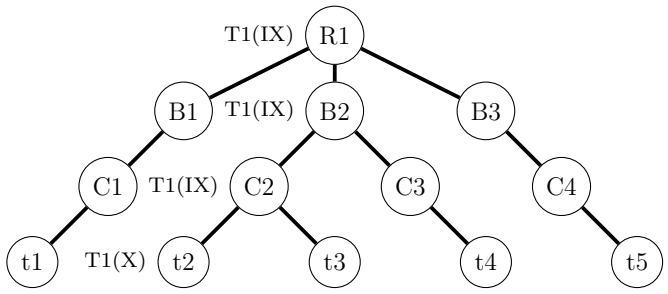
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Shakib** Total Marks#**20**

1. Define **Ordered Index** and **Densed Index**. 2

2. Describe the **RAID Level 0** and **6**. 2

3. Suppose, three timestamps T_{23}, T_{36}, T_{42} have the values **17**, **22** and **34** respectively. Describe the **Wound-wait** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T5 request a **shared lock(S)** on **R1**.

   (*ii*) T3 request an **exclusive lock(X)** on tuple **t3**.

   (*iii*) T4 request an **exclusive lock(X)** on **C3**.

   (*iv*) T4 request a **shared lock(S)** on **C4**.

   (*v*) T3 request a **shared lock(S)** on **B1**.

5. Draw the state diagram of a **Transaction**. 2

6. Define **Access Time**. Suppose, a data is in **logical block (i) 62** where the **number of disks (n)** is **16**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 3$ and $L_2 = 6$, number of pointer in one node, $n = 4$. 5

-End-

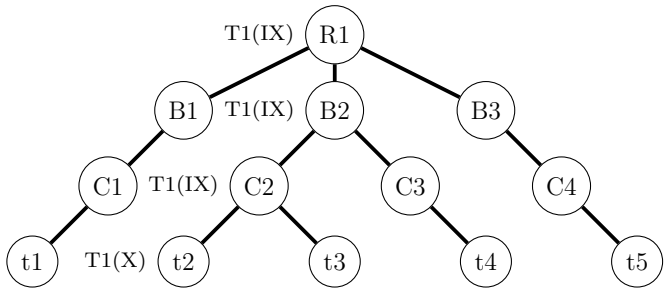
Term Test#**02** Course Code—**CSE 333 (DBMS)** Date—**May 2, 2019**
Time—**40 Minutes** Set—**Mushfiq** Total Marks#**20**

1. Define **Sparse Index** and **Hashed Index**. 2

2. Describe the **RAID Level 1** and **5**. 2

3. Suppose, three timestamps T_{23}, T_{36}, T_{42} have the values **17**, **22** and **34** respectively. Describe the **Wait-die** Deadlock Prevention Scheme and illustrate the scheme using these timestamps. 3

4. Suppose, transaction **T1** holding an **X lock** on tuple **t2**.



   Apply the following locks **sequentially** and report whether the lock is **granted** or not. Justify your answer showing the **Compatibility Matrix**. 4

   (*i*) T4 request a **shared lock(S)** on **C3**.

   (*ii*) T3 request an **exclusive lock(X)** on tuple **t3**.

   (*iii*) T2 request an **exclusive lock(X)** on **R1**.

   (*iv*) T4 request a **shared lock(S)** on **B3**.

   (*v*) T3 request a **shared lock(S)** on **t1**.

5. Describe and visualize **2PL** Protocol. 2

6. Define **Deadlock**. Suppose, a data is in **logical block (i) 72** where the **number of disks (n)** is **8**. Calculate the **Physical Block** number and **Disk** number for this data. 2

7. Construct a **B+ Tree** taking first 10 numbers from a series similar to Lucas Series having different base case. Take $L_1 = 2$ and $L_2 = 7$, number of pointer in one node, $n = 4$. 5

-End-

Shahjalal University of Science and Technology
Institute of Information and Communication Technology
BSc (Engg.) in Software Engineering 3rd year 1st Semester Final Exam, 2020
Course: SWE 327 (Database Management System)

Marks: 30; Credit: 3.0

PART A

Q.1. Consider the bank database of figure 1 and answer the following questions. (**2+3+10)**

branch(*branch_name, branch_city, assets*)
customer (*customer_name, customer_street, customer_city*)
loan (*loan_number, branch_name, amount*)
borrower (*customer_name, loan_number*)
account (*account_number, branch_name, balance*)
depositor (*customer_name, account_number*)

Figure 1: Banking Database

a) What are the appropriate primary keys?

b) Given your choice of primary keys, identify appropriate foreign keys.

c) Write the following query in SQL, using the bank schema.

i. Find the name of all branches located in "Dhaka".
ii. Find the names of all borrowers who have a loan in branch "Mirpur".
iii. Find all loan numbers with a loan value greater than BDT100,000.
iv. Find the names of all depositors who have an account with a value greater than BDT60,000.
v. Find the names of all depositors who have an account with a value greater than BDT60,000 at the "Motejheel" branch.

PART B

Q.2. Answer of the following questions. (**7+3+5**)

a. Give a lossless-join, dependency preserving decomposition into 3NF of the following video library schema. Also explain each steps.

member(membershipid, fullname, physicaladdress, saluation)

movierented(membershipid, moviesrented)

b. Explain the difference between a weak and a strong entity set.

c. Design an E-R diagram for keeping track of the exploits of your favorite sports team. You should store the matches played, the scores in each match, the players in each match, and individual player statistics for each match. Summery statistics should be modeled as derived attributes.