

Ahsanullah University of Science and Technology

Date: 16th March, 2017

Department of Computer Science and Engineering
Third Year, First Semester
Course No: CSE 3103

Final Examination, Fall 2016
Course Title: Database
Full Marks: 70

Time: 3 Hours

[Answer any 5(Five) sets from 7(Seven) sets.]
[Marks allotted are indicated in the right margin within '[]']

- 1.a) What are the advantages of a database over a file system? [5]
 b) Describe different levels of data abstraction. [3]
 c) Database-system implementers have paid much more attention to the ACID properties than have file-system implementers. Why might this be the case? [6]

- 2.a) What do you mean by primary key, candidate key and alternate key? Explain with examples. [3]
 b) Explain different types of mapping cardinalities with appropriate examples. [4]

DHL prides itself on having up-to-date information on the processing and current location of each shipped item. To do this, DHL relies on a company-wide information system. Shipped items are the heart of the DHL product tracking information system. Shipped items can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Items are received into the DHL system at a single retail center. Retail centers are characterized by their type, unique ID, and address. Shipped items make their way to their destination via one or more standard DHL transportation events. These transportation events are characterized by a unique schedule number, a type, and a delivery route.

Create an Entity Relationship diagram that captures this information about the DHL system. Be certain to indicate identifiers and cardinality constraints.

- 3.a) employee (employee name, street, city) [14]
 works (employee name, company name, salary)
 company (company name, city)
 manages (employee name, manager name)
 Employee Database (Fig: 01)

Consider the Employee Database (fig: 01) above, where the primary keys are underlined. Give an expression in SQL for each of the following queries.

- i. Find the names and cities of residence of all employees who work for "Brac Bank Limited".
- ii. Find the names, street addresses, and cities of residence of all employees who work for "Brac Bank Limited" and earn more than \$10,000.
- iii. Find all employees in the database who do not work for "Brac Bank Limited".
- iv. Find all employees in the database who earn more than each employee of "Midland Bank Limited".
- v. Assume that the companies may be located in several cities. Find all companies located in every city in which "Midland Bank Limited" is located.
- vi. Find the company that has the most employees.
- vii. Find those companies whose employees earn a higher salary, on average, than the average salary at "Brac Bank Limited".

- 4.a) classroom (building, room number, capacity)
 course (course id, title, dept name, credits)
 instructor (ID, name, dept name, salary)
 section (course id, sec id, semester, year)
 teaches (ID, course id, sec id, semester, year)
 student (ID, name, dept name, tot cred)
 takes (ID, course id, sec id, semester, year, grade)
 University Schema (fig:02)

Write the following queries in relational algebra, using the university schema (fig:02).

- i. Find the titles of courses in the Comp. Sci. department that have 3 credits.
- ii. Find the IDs of all students who were taught by an instructor named John, make sure there are no duplicates in the result.
- iii. Find the highest salary of any instructor.
- iv. Find all instructors earning the highest salary (more than one with the same salary).
- v. Find the enrollment of each section that was offered in Fall 2016.
- vi. Find the maximum enrollment, across all sections, in Fall 2016.
- vii. Find the sections that had the maximum enrollment in Fall 2016.

- 5.a) Write down about the design alternative of smaller schema in relational database design. Explain with a lossy-decomposition example. [4]

- b) Write short notes on the following normal forms with necessary examples: [4]

- i. 2NF
- ii. 3NF

- c) We consider the following Article relation:

ID	title	journal	issue	year	startpage	endpage	TR-ID
42	Cuckoo Hashing	JAlg	51	2014	121	122	87
33	Deterministic Dictionary	JAlg	41	2011	69	85	62
33	Deterministic Dictionary	JAlg	41	2011	69	85	56
39	Dictionary in Less Space	SICOMP	31	2011	1	1	133
57	P Vs NP resolved	JACM	51	2008	1	3	99
77	What Godel Missed	SICOMP	51	2008	1	5	98
78	What Godel Missed	Nature	22	2008	22	22	98

It contains information on articles published in scientific journals. Each article has a unique ID, a title, and information on where to find it (name of journal, what issue, and on which pages). Also, if results of an article previously appeared in a "technical report" (TR), the ID of this technical report can be specified. We have the following information on the attributes:

- i. For each journal, an issue with a given number is published in a single year.
- ii. The endpage of an article is never smaller than the startpage.
- iii. There is never (part of) more than one article on a single page.

Perform normalization into BCNF and state the resulting relations. Here ID and TR-ID are primary keys, {journal, issue} is a candidate key, and functional dependencies are as shown below:

1. $ID \rightarrow TR-ID$
2. $journal, issue \rightarrow year$
3. $ID \rightarrow startpage, endpage, journal, issue$
4. $issue \rightarrow year, title$
5. $ID \rightarrow title, journal, year$
6. $TR-ID \rightarrow startpage, endpage, journal, issue$

3
6.a) Briefly explain the state diagram of Transaction. Consider a database for an airline where the database system uses snapshot isolation. Describe a particular scenario in which a nonserializable execution occurs, but the airline may be willing to accept it in order to gain better overall performance. [6]

- b) What are the basic steps of query processing? In a disk there are 125 blocks of code and to build the program it requires 210 seeks. Time to transfer a block of code and time for one individual seek are 7ms and 11ms respectively. What is the cost of the query processing? Here ignore the CPU cost.
c) What is the difference between RAID (1+0) and RAID (0+1). Write some short notes on Storage Area Network (SAN) and Network Attached Storage (NAS). [4]

7.a) Consider the following set of key values to create B+ tree: [12]

(2, 3, 5, 7, 11, 17, 19, 23, 29, 31)

Assume that the tree is initially empty and values are added in ascending order. Construct B+ trees for the cases where the number of pointers (value of pointer is n) that will fit in one node is as follows:

- i. Four
- ii. Six
- iii. Eight

Using the final B+ tree of 7(a)(i), show the form of the tree after each of the following series of operations:

- iv. Insert 9
- v. Delete 23
- vi. Delete 19

b) What is the difference between a clustering index and a secondary index? [2]

4
Ahsanullah University of Science and Technology

Date: 24.09.2016
Department of Computer Science and Engineering
3rd Year, 1st Semester, Final Examination, Spring 2016
Course No: CSE3103 Course Title: Database

Time : 3 hours

Full Marks : 70

[There are seven questions carrying a total of 14 marks each. Answer any five questions including the question no. four. Marks allotted are indicated in the right margin.]

1. a) What is data abstraction in a DBMS? Discuss the different levels of data abstraction. (4)
b) What are the roles of a database administrator? (4)
c) Discuss the advantages of a database management system over file management system. (6)
2. a) 'Every primary key is a candidate key in a database management system'. Explain with an example. (4)
b) With necessary examples, explain the role of a weak and a strong entity set. (4)
c) Consider the following plan on an 'on-campus social networking system'. The System can have users registered with an email address. A user can have other users of the system as friends. The system maintains a friend-list for each of its users. A user can post status texts anytime. The system preserves all the status texts posted by a user. A user can set permission on his/her posted status as 'public', 'friends-only', 'only me', etc. Any user can post comments on the status of his/her friends. A user can create photo albums and upload any number of photos there. He/she can set permission on a photo album as well as on any individual photos similarly as the status post. Friends of a user can give a 'like' status, post comments on any photo album or on individual photos.

Draw an E-R diagram that can capture the above scenario in a DBMS.

3. a) Based on the following relations, evaluate the given Relational Algebra expressions and show the output of the expression. (4)

Stadiums		
StadNo	StadiumName	Location
1	Shcr-e-Bangla National Stadium	Dhaka
2	MA Aziz Stadium	Chittagong
3	Sylhet Divisional Stadium	Sylhet
4	Khan Shaheb Osman Ali Stadium	Dhaka

Clubs		
ClubNo	ClubName	Club
1	Abahani	C1
2	Brothers	C2
3	Mohammedan	C3
4	Dhanmondi	C4
5	Kalabagan	C5

Games		
StadNo	Club1	Club2
1	C1	C3
2	C1	C2
2	C4	C1
2	C4	C2
3	C4	C3
4	C2	C3

- i) $\Pi_{\text{StadiumName}}(\text{Stadiums}) - \Pi_{\text{StadiumName}}(\sigma_{\text{Location} <> 'Dhaka'})$
ii) $\Pi_{\text{StadiumName}}(\sigma_{\text{Stadiums.StadNo} = \text{Games.StadNo} \wedge (\text{Clubs.ClubNo} = \text{Games.Club1} \vee \text{Clubs.ClubNo} = \text{Games.Club2})} (\text{Stadiums} \times \text{Games} \times \text{Clubs}))$

- b) Write an equivalent Relational Algebra (RA) expression for the following (4)

(5)

query. Explain the operations executed by the RA expression. Use the tables in the Q. 3(a).

'Show the list of club names who have played in all the stadiums in Dhaka'.

c) Explain the following in terms of Relational Algebra expressions with examples. (6)

i) Project ii) Rename iii) Full outer Join.

4. Write down the necessary SQL queries for the following questions based on the database schemas given below. The attribute names used in the schema have their usual meaning. (14)

Courses(CourseNo, CreditHour, DepartmentName)
Department(DepartmentName, DeptTitle)
Student (StudentId, StudentName, DepartmentName)
CourseEnrollment (StudentId, SemesterId, CourseNo)
ClassRooms (RoomNo, FloorNo, BlockNo)
ExamSchedule (CourseNo, SemesterId, ExamDate, RoomNo)

- i) Show the name of the students who have taken 4 credit-hour courses in the 'Spring 2014' semester.
- ii) Show the list of the students who have not enrolled in any course in the 'Spring 2016' semester.
- iii) Show the name of the students who have exams on the date: '13-08-2016' in the 'Spring 2016' semester. Use nested sub-queries if applicable.
- iv) Show the total number of classrooms in the BlockNo 'A'.
- v) Show the course-wise total number of enrolled students in the 'Fall 2015' semester.
- vi) Show the examination room numbers of the student bearing ID no: '2101' in the 'Fall 2016' semester.
- vii) Show the IDs of those students who have taken all the courses offered by the 'CSE' department.

5. a) What is the difference between a primary and secondary indices? Show with an example. (4)

b) Given the following data for an attribute A in a database table T_i , create a $B+$ Tree index using the bulk loading technique. Assume that, any node of the tree can store a maximum of two search key values. (5)

22, 11, 29, 26, 15, 4, 1, 7, 10, 12, 21, 40, 14, 61, 42, 67, 23, 33

c) Given the following data for an attribute B in a database table T , store them sequentially using the extendable hashing technique. The hash function converts the data into a 5 digit binary number and takes the rightmost n -number of bits to select a destination bucket. Initially start with $n=1$. Assume that, the bucket capacity $f_r = 3$. (5)

31, 2, 6, 5, 1, 11, 15, 19, 12, 21, 26, 36, 34, 18, 8, 62, 4, 56, 14

(6)

6. a) 'A Secondary index is a dense index.' Explain. (4)
b) Discuss the Shadow-copy technique used to implement atomicity by the transaction manager of a DBMS. (4)
c) What are the different ways to detect if a parallel scheduling of multiple transactions is valid for execution? Show with necessary examples. (6)

7. a) What are the goals of database normalization? Explain with necessary examples. (4)
b) Describe the query processing steps performed by a database management system. (4)
c) Given the following schema and functional dependencies, sequentially derive a set of relations which are 3NF compatible. (6)

$R (A, B, C, D, E, F, G, H, K, L)$

Candidate Keys: (A, D), (A, G)

Primary Key: (A, D)

Multivalued attribute : H

Functional Dependencies:

$A \rightarrow H$
 $A, D \rightarrow B, C$
 $A \rightarrow E$
 $D \rightarrow F, G$
 $F \rightarrow G$
 $K \rightarrow L$
 $A, D \rightarrow K, L$

(7)

Date: 15/03/16

Ahsanullah University of Science and Technology
 Department of Computer Science and Engineering
 Third Year, First Semester, Final Examination, Fall 2015
 Course No: CSE3103 Course Title: Database

Time : 3 hours

Full Marks : 70

[There are 7 (seven) questions carrying a total of 14 marks each. Answer any 5 (five) questions.
 [Marks allotted are indicated in the right margin.]

1. a) What is a Database Management System (DBMS)? (2)
 b) What is data abstraction in a DBMS? Discuss the different levels of data abstraction. (3)
 c) Explain the two-tier and three-tier database application architecture. (4)
 d) What are the advantages of a DBMS over a traditional file-processing system? Discuss in brief. (5)

2. a) What do you mean by a *weak-entity* and a *strong-entity set*? Explain with an example. (3)
 b) Explain the following Relational Algebra expressions with any examples.
 i) Project. ii) Theta Join. (3)
 c) Based on the following relations, evaluate the subsequent Relational Algebra expressions and show the output relations. (4)

Employee:

name	address	salary
A	Dhaka	12000
B	Rajshahi	11000
C	Comilla	12457

Branch:

bname	Estd_date	City
Motijheel	2/2/2007	Dhaka
Tcigaon	4/6/2006	Dhaka
Shamoli	2/1/2007	Sylhet

EmpAllocation:

name	bname	from	to	active
A	Motijheel	2/2/2007	3/2/2011	No
B	Tejgaon	4/6/2006	7/2/2014	Yes
C	Motijheel	2/1/2009	2/2/2012	No
A	Shamoli	12/2/2011	12/7/2013	Yes
C	Shamoli	12/6/2013	2/2/2016	Yes
A	Tejgaon	2/2/2014	2/6/2015	No
B	Shamoli	12/6/2009	12/8/2010	No

- i). $\Pi_{name}(\text{Employee}) - \Pi_{name}(\sigma_{\text{city}=\text{"Sylhet"}(\text{Branch.bname} = \text{EmpAllocation.bname})} (\text{Branch} \times \text{EmpAllocation}))$
- ii). $\Pi_{\text{Employee.salary}} (\sigma_{\text{Employee.salary} > \text{d.salary}} (\text{Employee} \times \rho_d (\text{Employee})))$
- d) Write the equivalent Relational Algebra expressions for the following queries. (4)
 Use the relations presented in the question 2(c).

(8)

- i). Find the name of those employees who have worked in all the branches.
- ii). Find the name, and address of those employees who are currently active in any branch of the 'Dhaka' city.

3. a) How does indexing a database improve the overall performance of a Database Management System? (2)
- b) 'Secondary database indices must be dense'. Explain. (2)
- c) Given the following data for an attribute A in a database table T, create a B+ Tree index sequentially. Assume that any node of the tree can store a maximum of two search key values. (5)

1, 4, 16, 25, 9, 20, 13, 15, 10, 11, 12

- d) Given the following data for an attribute B in a database table T, store them sequentially using the extendable hashing technique. The hash function converts the data into an 8 digit binary number and takes the rightmost n-number of bits to select a destination bucket. Initially start with n = 1. Assume that, the bucket capacity $f_r = 3$. (5)

3, 23, 15, 5, 21, 9, 6, 30, 8, 19, 25, 36, 4, 10

4. a) Explain the necessity of database normalization in database designing. (3)
- b) How can you decompose a single relation into a set of relations to achieve the third normal form (3NF)? (2)
- c) Given the following relational schema and functional dependencies, derive a set of relations which are 1NF, 2NF and 3NF compatible. (5)

$R(A,B,C,D,E,F,G,H,K)$, Primary Key: (A,H), Candidate Keys : (A,B), (A,E), (E,F). Here, G and F are multi-valued attributes.

Functional Dependencies:

$$\{A, H\} \rightarrow B$$

$$\{A, H\} \rightarrow C$$

$$\{A, H\} \rightarrow F$$

$$A \rightarrow D$$

$$H \rightarrow E$$

$$C \rightarrow B$$

$$A \rightarrow G$$

$$B \rightarrow K$$

$$\begin{array}{l} 3 \\ 2 \\ \hline 1 \end{array} \quad \begin{array}{l} 2 \\ 1 \\ \hline 1 \end{array} = 1$$

$$\begin{array}{l} 2 \\ 1 \\ \hline 1 \end{array} = 1$$

$$\begin{array}{l} 1 \\ 1 \\ \hline 1 \end{array} = 1$$

$$\begin{array}{l} 1 \\ 1 \\ \hline 1 \end{array} = 1$$

$$\begin{array}{l} 1 \\ 1 \\ \hline 1 \end{array} = 1$$

Show each of the steps of the normalization process sequentially with your remarks.

- d) With any examples, show the difference between a primary and secondary data indices in a Database Management System. (4)

5. a) What is a data dictionary in a Database Management System (DBMS)? Define Super Key, Candidate Key and Primary key in terms of a DBMS with examples. (4)
 b) With examples, discuss any two aggregate functions of Structured Query Language. (2)
 c) Given the following relations, write down the corresponding SQL statements for the queries followed. (8)

Student (StudentId, Name, BirthDate, DepartmentName)
 Department (DepartmentName, Title, Location)
 Results (StudentId, CourseNo, Marks, Grade, SemesterID)
 Courses (CourseNo, CourseName, CreditHour, DepartmentName)
 Semester (SemesterID , Semestertitle)

- i) Find the name of the students who have taken those courses which have the 'Programming' keyword in the course name and the credit hour of the courses are between 1.5 and 3 credit. Use nested queries if required.
 ii) Show the Student Id wise average mark of those students who have taken at least four courses. Show the results in descending order of the average mark.
 iii) Show the CourseName of those courses which are offered both in 'Fall 2015' and in 'Spring 2014' semesters.
 iv) Show the Id of those students who have taken all the courses offered by the 'MPE' department.
6. a) Discuss the different mapping cardinalities with necessary examples. (3)
 b) Discuss the components of a Query Processor in a Database Management System. (3)
 c) What do you understand by referential integrity in a DBMS? Explain with an example. (3)
 d) Assume that you are developing a database application for the Management of a residential hotel. (5)

- i) Carefully and thoroughly think the features that a standard residential hotel should deal with the resources of the hotel, customers etc.
 ii) Write down the features that your application should handle.
 iii) Draw an Entity-Relationship diagram with the necessary entity sets, their all possible attributes and relationships among the entities so that your system can store all the necessary data for implementing your expected features of the system.

7. a) Discuss the 'ACID' properties of a transaction in Database Management System. (4)
 b) Discuss with necessary figures, the different states of a transaction. (2)
 c) 'A committed transaction cannot be rolled back'. Comment on it. (2)
 d) Discuss the Shadow Copy technique to achieve the atomicity in a database transaction. (3)

- Q. 6
 e) Can you devise a sequential serial schedule from the following concurrent transaction schedule? Consider that T1 and T2 are two different transactions and A,B,C are separate resources. Comment on your outcome. (3)

T1	T2
read(A) 5	
write(A) 4	read(A) 4
read(B) 20	read(C) 30
write(B) 18	
	write(A) 3
	write(B) 15
read(C) 45	
write(C) 28	
read(C) 28	



conflict on C

(11)

Ahsanullah University of Science and Technology
 Department of Computer Science and Engineering
 Final Examination, Spring 2015
 3rd Year 1st Semester

Date: 17/10/2015

Course No.: CSE 3103 Course Title: Database
 Time: 3 Hours Full Marks: 70

[There are 7 (seven) questions. Answer any 5 (five). Marks are shown in the right margin.]

1. Consider the following information about a university database. Professors have an SSN, a name, an age, a rank, and a research specialty. Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget. Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.). Each project is managed by one professor (known as the project's principal investigator). Each project is worked on by one or more professors (known as the project's co-investigators). Professors can manage and/or work on multiple projects. Each project is worked on by one or more graduate students (known as the project's research assistants). When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one. Departments have a department number, a department name, and a main office. Departments have a professor (known as the chairman) who runs the department. Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job. Graduate students have one major department in which they are working on their degree. Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.
- Draw a Logical Entity-Relationship (ER) diagram, using Crow's Foot Notation, to represent Library data requirements described above.

(14)

2. Show an example where a table is in 3NF, but not in BCNF. Normalize the following table by drawing dependency diagram and identifying all dependencies to derive up to 3NF.

(4+10)

Date	Time	Customer Name	Contact Number	Event /	Person in charge /	Total Persons	Price
12-Aug-10	12.30 PM	Maria Indrawan	04222223333	Lunch	Dora Smith	6	60
12-Aug-10	12.30 PM	John Smith	04113333333	Master Class	Simon Becket	1	120
12-Aug-10	7.00 PM	Mary Joe	95671290	Dinner	Linda Dee	2	150
13-Aug-10	12.30 PM	Lindsay Smith	99031001	Lunch	Dora Smith	4	60
13-Aug-10	12.30 PM	Sunshine Dee	99021900	Lunch	Dora Smith	2	60

3. \ Patient (id, surname, firstname, admissionDate, dr_ID, ward_no)
 \ Ailment(id, name, patientid)

\ Ward (ward_no, ward_name)

\ Doctor(id, ailmentid, surname, firstname, no_of_patients)

For the schema above, write SQL to implement the following queries:

- List the surnames of all patients of Dr Jones.
- List all the doctors who specialize in the ailment suffered by the patient whose surname is Thomas.
- List the ward number and ward name of the ward/s which have the most patients?
- Provide a list of all patients who have not undergone any treatment.

(3+3+4+4)

4. a. Which anomalies may occur with redundant data? Discuss with example.
 b. How can you solve multi-valued attribute problem in database design? Show with example.
 c. Why does it yield current values when derived attributes are not stored in database? Give an example.

(4+5+5)

5. a. A matchmaking agency wishes to match couples on the basis of interests they share in common. Member of couple's basic info like name, address is recorded. The interests might include activities such as reading poetry, watching movie or football, photography, dancing etc. The agency also wishes to record the number of years a person has been involved in a particular interest as well as their personal rank for the interest (rank will be a number from 1, 2, 3, 4, 5 - where 1 is a major interest for the person and 5 is minor interest).

Write the SQL statements needed to create the table that contains the attributes "number of years" and "personal rank". Your schema should include a primary key definition, as well as appropriate referential integrity references and also one example of a column check constraint.

- b. Create three users U1, U2, and U3 and assign them INSERT and UPDATE privileges respectively on T1 and T2 tables. Do this by assigning the users a role of "Officer". Then transfer these privileges to another role named "Manager". In addition, offer the privilege to delete on table T2 to Manager.

(6+8)

6. a) Consider the following relational schema:

Sailors (sid, sname, rating, age)

Reservation (sid, bid, date)

Boats (bid, bname, color)

(8)

Now write relational algebra for the following queries and also draw expression tree for all queries.

- Find names of sailors who've reserved boat #103
- Find names of sailors who've reserved a red boat
- Find sailors who've reserved a red or a green boat
- Find sailors who've reserved a red and a green boat

Tsname (6

(13)

b) Define Transaction and Concurrency. Write ACID properties of a Transaction. (3)

c) What is "dangling tuples"? Explain "dangling tuples" with an example in respect to Outerjoin. (3)

a) Explain conflict-serializability and conflict-equivalent with examples. (3)

b) Convert the following schedule S to a serial one by swapping the non-conflict actions. Show all the steps in your answer. (4)

S: r1(A) w1(A) r2(A) w2(A) r1(B) w1(B) r3(A) r2(B) w3(A) w2(B) r3(B)

c) What is hot-swapping? Explain how does a buffer manager work? (1+3 = 4)

d) With an example show that "LRU" strategy is bad for database access? (3)

(14)

Date: 30.11.15

Ahsanullah University of Science and Technology
Department of Computer Science and Engineering

Final Examination Fall 2014

3rd Year 1st Semester

Course No.: CSE 3103 Course Title: Database

Time: 3 Hours Full Marks: 70

[There are 7 (seven) questions. Answer any 5 (five). Marks are shown in the right margin.]

1. A library keeps records of current loans of books to borrowers. Each borrower is identified by a borrower number and each copy of a book by an accession number (library may have more than one copy of any given book). The name and address of each borrower is held so that communications, such as overdue loan reminders, can be sent when necessary.

The information held about books is the title, author's name/s, publisher's name, publication date, international standard book number (ISBN - a unique book identifier), purchase price, classification (reference or fiction), and number of pages. A given book may be written by a number of different authors, however the library regards a book as only being published by a single publisher. The library assigns its own unique in-house codes for authors and publishers.

A book may cover a number of different subjects, and the borrowers can use an on-line catalogue system to select texts by subject as well as title and author's name.

There is a restriction on the number of books a borrower may have on loan at any one time and the loan period. These limits depend on the borrower's classification (junior, adult, or organisation). When a book is borrowed, the return date is automatically recorded based on the current date and the borrower's classification. Other borrowers, pending their return, may reserve books out on loan. The date on which the reserve was placed is recorded. A special borrower's status flag is maintained - borrowers who hold overdue books or who have reached their loan limit, are flagged to prevent further borrowings.

Draw a Logical Entity-Relationship (ER) diagram, using Crow's Foot Notation, to represent Library data requirements described above.

14

(D)

Why the normalization technique is used in database design? Normalize the following table by drawing dependency diagram and identifying all dependencies to derive up to 3NF. Show the schema in 3NF.

(3+8+3)

Attribute Name	Sample Value	Sample Value	Sample Value	Sample Value	Sample Value
INV_NUM	211347	211347	211347	211348	211349
PROD_NUM	AA-E3422QW	QD-300932X	RU-995748G	AA-E3422QW	GH-778345P
SALE_DATE	15-Jan-2010	15-Jan-2010	15-Jan-2010	15-Jan-2010	16-Jan-2010
PROD_LABEL	Rotary sander	0.25-in. drill bit	Band saw	Rotary sander	Power drill
VEND_CODE	211	211	309	211	157
VEND_NAME	NeverFail, Inc.	NeverFail, Inc.	BeGood, Inc.	NeverFail, Inc.	ToughGo, Inc.
QUANT SOLD	1	8	1	2	1
PROD PRICE	\$49.95	\$3.45	\$39.99	\$49.95	\$87.75

prod label n prod price 1 vend code
prod num -> prod label n prod price
vend code -> prod num

(15)

3. EMPLOYEE (EMPLOYEEID, LASTNAME, FIRSTNAME, PHONE, HIREDATE, JOBID, SALARY, MANAGERID, DEPARTMENTID)
 JOB (JOBID, JOBTITLE, MINSALARY, MAXSALARY)
 DEPARTMENT (DEPARTMENTID, DEPARTMENTNAME, MANAGERID, LOCATIONID)
 LOCATION (LOCATIONID, STREETADDRESS, POSTALCODE, CITY, STATEPROVINCE, COUNTRYID)
 COUNTRY (COUNTRYID, COUNTRYNAME, REGIONID)

For the schema above, write SQL to implement the following queries:

- List last names and first names of those employees whose salary is greater than 10000.
- List the last name and job title of the employees who do not have a manager.
- For all employees assigned to work in departments, list the employee ID, last name, phone and the name of the country they work in.
- List all possible pairs of employees (employee ids only) who have the same manager (the first employee id in each pair should be the lower employee id).

(3+3+4+4)

4. For the same schema in Question 3, write the following SQL:

- List the number of employees who are employed in the SALES and ADMINISTRATION departments respectively.
- List all the details of the employee/s who have the highest salary.
- Add a tuple into the EMPLOYEE table that has the following attributes: EMPLOYEEID=9999, LASTNAME='Blue', FIRSTNAME='Barry' with both SALARY and DEPARTMENTID the same as that of the employee with the last name of 'Green'.

(4+4+6)

5. For the same schema in Question 3, write down the *Relational Algebraic* expression for the following:

- Show the FIRSTNAME and LASTNAME of the employees who earn more than 1000 as salary.
- List the FIRSTNAME and JOBTITLE of employee 'John'.
- List the average salary of each department.
- Delete all employees from EMPLOYEE table who earn less than 1000 as salary.

(3+3+4+4)

6. a. Which considerations should be applied while choosing the primary key of a relation?
 b. What are the advantages and disadvantages of storing derived attributes in tables?
 c. Create three users U1, U2, and U3 and assign them SELECT and DELETE privileges respectively on T1 and T2 tables. Do this by assigning the users a role of "Admin". Then transfer these privileges to another role named "SuperAdmin".

(3+4+7)

7. a. With the help of diagram, explain how data is read from magnetic hard disk.
 b. Discuss elevator algorithm in brief.
 c. What is RAID? Which two RAID levels are most popular and why?

(6+3+5)

(16)

Ahsanullah University of Science & Technology

Department of Computer Science and Engineering

3rd Year 1st Semester Final Examination, Spring 2013

Course No: CSE 303

Course Title: Database

Full Marks: 70

Time: 3 Hours

Date: 07/09/2013

Directions: There are Seven (7) Questions. Answer any Five (5).
 [Marks allotted are indicated in the right margin.]

- a) What are the advantages of a database over a file system? [7]
 b) Describe different levels of data abstraction. [3]
 c) What are the different functions of a database administrator? [4]

- a) What do you mean by primary key, candidate key and alternate key? [3] Explain with examples.
 b) Explain different types of mapping cardinalities with appropriate examples. [4]

- Consider the following scenario:
 Each musician who records at the studio has a social security number (ssn) and a name, and no two musicians have the same ssn. Musicians form bands. A band is described by a unique name and has at least one musician as a member. Bands record albums, which have a title and a year of production. Each album is recorded by exactly one band, and no two albums have the same title and the same production year. Each album is produced by exactly one musician (don't worry about whether that musician is a member of the recording band). Albums are made up of songs, described by their titles. You may assume that, if the studio no longer wants to store information about an album, then it also does not store the songs belonging to that album. Naturally, each song belongs to exactly one album, and all songs on the same album have different titles.

Draw the database ER diagram and translate the ER diagram into an equivalent relational schema.

- a) Consider the following schema:
 Student (sid, sname, city, department)
 Professor (pid, pname, department)
 Course (cid, title, credits, area)
 Enrolment (sid, cid, pid, semester, year, grade)
 Write expressions of relational algebra to answer the following queries:
 - Find all information about courses.
 - Find all CSE or EEE students.
 - Find all CSE students who live in Edinburg.
 - Find names of students who took a course taught by Andrew.

- (17)
- v. Find titles of all courses taken by the student named Nathan.
 - vi. Find courses that were not offered in Fall semester, 2009.
 - vii. Find names of professors who taught in 2009 or 2010.

4. a) Consider again the schema in question#3(a) and write expressions in [14] SQL for the queries (i-vii) given in question#3(a).

✓ 5. a) Define functional dependency and transitive dependency. [4]

b) Write short notes on the following normal forms with necessary examples: [4]

i. 2NF ii. 3NF

c) Bring the following relation to 1NF, 2NF, 3NF and then to BCNF. [6]

Also, explain based on the definitions and the relevant functional dependencies that why this relation is/is not in a certain normal form and explain how you can decompose this relation to bring it to a higher normal form.

ClientInterview

clientNo	interviewDate	interviewTime	staffNo	roomNo
C76	13-08-13	10.30 am	SG5	G101
C56	13-08-13	12.10 pm	SG5	G101
C74	13-08-13	12.10 pm	SG7	G102
C56	01-09-13	11.00 am	SG5	G103

✓ 6. a) Explain data integrity with appropriate examples. [3]

b) What happens to primary and foreign key values of corresponding records in database tables when the following integrity constraints are imposed while creating the tables and then deletion of a primary key value is carried out?

- i. ON DELETE CASCADE
- ii. ON DELETE NO ACTION

c) Explain the ACID features that must be supported by a database transaction. [5]

d) What is the function of translator in query processing? [2]

✓ 7. a) What is distributed database (DDB)? Discuss on different types of distributed database. [5]

b) Describe different applications of data mining. [6]

c) What is a data warehouse? [3]