ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SEMESTER II EXAMINATION, 2016/2017 ACADEMIC SESSION

COURSE TITLE: DATABASE DESIGN AND MANAGEMENT

COURSE CODE: ECT320

EXAMINATION DATE: 27th JULY 2017

COURSE LECTURER: DR B. S. AFOLABI

HOD's SIGNATURE

TIME ALLOWED: 2½ HRS

INSTRUCTIONS:

1. **ATTEMPT ALL QUESTIONS IN SECTION A AND ANY THREE QUESTIONS IN SECTION B**
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW CALCULATORS AND ANY OTHER WRITING MATERIALS DURING THE EXAMINATION.
4. STATE CLEARLY THE COMBINED STOPPING CONDITIONS USED IN YOUR SOLUTIONS

Section A (Attempt all questions in this Section)

1. If you were collecting and storing information about your music collection, an album would be considered a(n) _____. a) Relation b) Entity c) Instance d) Attribute
2. What term is used to refer to a specific record in your music database; for instance; information stored about a specific album? a) Relation b) Instance c) Table c) Column
3. Which one of the following is used to define the structure of the relation, deleting relations and relating schemas? a) DML(Data Manipulation Langauge) b) DDL(Data Definition Langauge) c) Query d) Relational Schema
4. Which one of the following provides the ability to query information from the database and to insert tuples into, delete tuples from, and modify tuples in the database? a) DML(Data Manipulation Langauge) b) DDL(Data Definition Langauge) c) Query d) Relational Schema
5. Create table employee (name varchar ,id integer) What type of statement is this ? a) DML b) DDL c) View d) Integrity constraint
6. Select * from employee
   What type of statement is this? a) DML b) DDL c) View d) Integrity constraint
7. The basic data type char(n) is a _____ length character string and varchar(n) is _____ length character. a) Fixed, equal b) Equal, variable c) Fixed, variable d) Variable, equal
8. An attribute A of datatype varchar(20) has the value "Avi" . The attribute B of datatype char(20) has value "Reed" .Here attribute A has ____ spaces and attribute B has ____ spaces. a) 3, 20 b) 20, 4 c) 20 , 20 d) 3, 4
9. To remove a relation from an SQL database, we use the _____ command. a) Delete b) Purge c) Remove d) Drop table
10. Insert into instructor values (10211, 'Smith', 'Biology', 66000);
    What type of statement is this? a) Query b) DML c) Relational d) DDL
11. Updates that violate _____ are disallowed. a) Integrity constraints b) Transaction control c) Authorization d) DDL constraints
12. Select _____ dept_name
    from instructor;
    Here which of the following displays the unique values of the column ? a) All b) From c) Distinct d) Name
13. The _____ clause allows us to select only those rows in the result relation of the ____ clause that satisfy a specified predicate. a) Where, from b) From, select c) Select, from d) From, where
14. The _____ clause is used to list the attributes desired in the result of a query. a) Where b) Select c) From d) Distinct
15. Select name, course_id
    from instructor, teaches
    where instructor_ID= teaches_ID;
    This Query can be replaced by which one of the following ? a) Select name,course_id from teaches,instructor where instructor_id=course_id;
    b) Select name, course_id from instructor natural join teaches; c) Select name ,course_id from instructor;
    d) Select course_id from instructor join teaches;
16. Select * from employee where salary>10000 and dept_id=101;
    Which of the following fields are displayed as output? a) Salary, dept_id b) Employee c) Salary d) All the field of employee relation
17. Which of the following statements contains an error? A) Select * from emp where empid = 10003; B) Select empid from emp where empid = 10006;
    C) Select empid from emp; D) Select empid where empid = 1009 and lastname = 'GELLER';
18. Insert into employee _____ (1002,Joey,2000);
    In the given query which of the keyword has to be inserted ? a) Table b) Values c) Relation d) Field

19. Select name ____ instructor name, course id
from instructor, teaches
where instructor.ID= teaches.ID;
Which keyword must be used here to rename the field name ? a) From b) Rename c) As d) Join
20. Select emp_name
from department
where dept_name like ' _____ Computer Science';
Which one of the following has to be added into the blank to select the dept_name which has Computer Science as its ending string? a) % b) _ c) || d) $
21. '_ _ _' matches any string of _____ three characters. '_ _ _ %' matches any string of at _____ three characters. a) Atleast, Exactly b) Exactly, Atleast c) Atleast, All d) All , Exactly
22. In SQL the spaces at the end of the string are removed by _____ function.a) Upper b) String c) Trim d) Lower
23. _____ operator is used for appending two strings. a) & b) % c) || d) _
24. Select name
from instructor
where dept name = 'Physics'
order by name;
By default, the order by clause lists items in _____ order.
a) Descending b) Any c) Same d) Ascending
25. Select *
from instructor
order by salary ____, name ___;
To display the salary from greater to smaller and name in ascending order which of the following options should be used ? a) Ascending, Descending b) Asc, Desc c) Desc, Asc d) Descending, Ascending
26. Delete from r; r – relation
This command performs which of the following action? a) Remove relation b) Clear relation entries c) Delete fields d) Delete rows
27. The____condition allows a general predicate over the relations being joined. a) On b) Using c) Set d) Where
28. Which of the join operations do not preserve non matched tuples. a) Left outer join b) Right outer join c) Inner join d) Natural join
29. The operation which is not considered a basic operation of relational algebra is a) Join b) Selection c) Union d) Cross product
30. What type of join is needed when you wish to include rows that do not have matching values? a) Equi-join b) Natural join c) Outer join d) All of the mentioned

Section B (Attempt any THREE questions from this Section)

Question 1

Micro loans are small loans, which is beginning to gain popularity especially among borrowers in developing countries. The idea is to bring venture lenders together using information technology. Typically, the loans will be used to finance startup or development of the borrower's company, so that there is a realistic chance for repayment. The money in a loan can, unlike traditional loans, come from many lenders. In this problem, you must create an E-R model that describes the information necessary to manage micro loans. The following information form the basis for creating the model:

- Each borrower and lender must be registered with information about name and address.
- A loan starts with a loan request, which contains information about when the loan should at latest be granted, The total amount being discussed (US-dollars), and how long the payback period is. Also, a

description is included of how the money will be used. The rent on the payment is calculated in the loan amount, which is to say, the full amount is not paid.

- Lenders can commit to an optional portion of the total amount of a loan request.
- When the commitments for the loan request covers the requested amount, the request is converted to a loan. If not enough commitments can be reached, the loan request is cancelled. A borrower can have more than one request, and more than one loan at a time, but can at most make one request per day.
- The loan is paid through an "intermediary", typically a local department of a charity, who has a name and an address.
- The borrower chooses when he or she will make a payment. Every payment must be registered in the database with an amount and a date (at most one payment per loan per day). The lenders share the repayment based on how large a part of the loan they are responsible for.
- If the loan is not repaid before the agreed upon deadline, a new date is agreed. The database must not delete the old deadline, but save the history (the deadline can be overridden multiple times).
- Each lender can for each burrower save a "trust", which is a number between 0 and 100 that determines the lender's evaluation of the risk of lending money to that person. The number must only be saved for the borrowers, for whom there has been made such an evaluation.

a) Make an E-R model for the data described above. If you make any assumptions about data that doesn't show from the problem, they must be described. Use the E-R notation from KBL. Put an emphasis on having the model express as many properties about the data as possible, for instance participation constraints.

b) Make a relational data model for micro loans:
   - Describe at least two of the relations using SQL DDL (make reasonable assumptions about data types), and
   - state the relation schemas for the other relations.

   (The emphasis is if there is a correlation between the relational model and the E-R diagram from (a), along with primary key and foreign key constraints being stated for all relation. It is not necessary to state CHECK constraints and the like).

Question 2

The following relation schema can be used to register information on the repayments on micro loans (see the text in the Question 1 for the explanation on micro loans).

Repayment(borrower_id,name,address,loanamount,requestdate,repayment_date,request_amount)

A borrower is identified with a unique borrower_id, and has only one address. Borrowers can have multiple simultaneous loans, but they always have different request dates. The borrower can make multiple repayments on the same day, but not more than one repayment per loan per day.

a) State a key (candidate key) for *Repayment*
b) Make the normalization to BCNF. State for every step in the normalization, which functional dependency that causes it.
c) Write an SQL request that returns all the tuples with information on repayments from the borrower with id equal to 42, and where the lent amount exceeds 1000 USD.
d) Write an SQL request that for each address finds the total repaid amount for the address.
e) Write an SQL request that finds all names which has a unique address, which to say is where there does not exist a tuple with a different name and same address.
f) Write an SQL command, which deletes all information on ended loans, which is to say loans where the total repaid amount equals the lend amount.

Question 3

The academic world is an interesting example of international cooperation and exchange. This problem is concerned with modeling of a database that contains information on researchers, academic institutions, and

collaborations among researchers. A researcher can either be employed as a professor or a lab assistant. There are three kinds of professors: Lecturer, Associate Professors, and Professors. The following should be stored:

- For each researcher, his/her name, year of birth, and current position (if any).
- For each institution, its name, country, and inauguration year.
- For each institution, the names of its schools (e.g. School of Law, School of Business, School of Computer Science,. . .). A school belongs to exactly one institution.
- An employment history, including information on all employments (start and end date, position, and what school).
- Information about co-authorships, i.e., which researchers have co-authored a research paper. The titles of common research papers should also be stored.
- For each researcher, information on his/her highest degree (BSc, MSc or PhD), including who was the main supervisor, and at what school.
- For each professor, information on what research projects (title, start date, and end date) he/she is involved in, and the total amount of grant money for which he/she was the main applicant.

a) Draw an E/R diagram for the data set described above. Make sure to indicate all cardinality constraints specified above. The E/R diagram should not contain redundant entity sets, relationships, or attributes. Also, use relationships whenever appropriate. If you need to make any assumptions, include them in your answer.

b) Convert your E/R diagram from question a) into relations, and write SQL statements to create the relations. You may make any reasonable choice of data types. Remember to include any constraints that follow from the description of the data set or your E/R diagram, including primary key and foreign key constraints.

Question 4

We consider the following relation:

Articles(ID,title,journal,issue,year,startpage,endpage,TR-ID)

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:

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

The following is an instance of the relation:

ID	Title	Journal	Issue	Year	Startpage	Endpage	TR-ID
42	Cuckoo Hashing	JAlg	51	2004	121	133	87
33	Deterministic Dictionaries	JAlg	41	2001	69	85	62
33	Deterministic Dictionaries	JAlg	41	2001	69	85	56
39	Dictionaries in less space	SICOMP	31	2001	111	133	47
57	P vs NP resolved	JACM	51	2008	1	3	99
77	What Gödel missed	SICOMP	51	2008	1	5	98
78	What Gödel missed	Nature	2222	2008	22	22	98

a) Based on the above, indicate for each of the following sets of attributes whether it is a key for Articles or not. Use the answer sheet of the exam for your answer.

1. {ID}; 2. {ID,TR-ID}; 3. {ID,title,TR-ID} 4. {title}; 5. {title,year}; 6. {startpage,journal,issue}

collaborations among researchers. A researcher can either be employed as a professor or a lab assistant. There are three kinds of professors: Lecturer, Associate Professors, and Professors. The following should be stored:

- For each researcher, his/her name, year of birth, and current position (if any).
- For each institution, its name, country, and inauguration year.
- For each institution, the names of its schools (e.g. School of Law, School of Business, School of Computer Science,. . .). A school belongs to exactly one institution.
- An employment history, including information on all employments (start and end date, position, and what school).
- Information about co-authorships, i.e., which researchers have co-authored a research paper. The titles of common research papers should also be stored.
- For each researcher, information on his/her highest degree (BSc, MSc or PhD), including who was the main supervisor, and at what school.
- For each professor, information on what research projects (title, start date, and end date) he/she is involved in, and the total amount of grant money for which he/she was the main applicant.

a) Draw an E/R diagram for the data set described above. Make sure to indicate all cardinality constraints specified above. The E/R diagram should not contain redundant entity sets, relationships, or attributes. Also, use relationships whenever appropriate. If you need to make any assumptions, include them in your answer.

b) Convert your E/R diagram from question a) into relations, and write SQL statements to create the relations. You may make any reasonable choice of data types. Remember to include any constraints that follow from the description of the data set or your E/R diagram, including primary key and foreign key constraints.

Question 4

We consider the following relation:

Articles(ID,title,journal,issue,year,startpage,endpage,TR-ID)

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:

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

The following is an instance of the relation:

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77	What Gödel missed	SICOMP	51	2008	1	5	98
78	What Gödel missed	Nature	2222	2008	22	22	98

a) Based on the above, indicate for each of the following sets of attributes whether it is a key for Articles or not. Use the answer sheet of the exam for your answer.

1. {ID}; 2. {ID,TR-ID}; 3. {ID,title,TR-ID} 4. {title}; 5. {title,year}; 6. {startpage,journal,issue}

If you wish, you may additionally write a brief explanation for each answer, which will be taken into account, but is not necessary to get full points.

b) Based on the above, indicate for each of the following potential functional dependencies, whether it is indeed an FD or not. Use the answer sheet of the exam for your answer.

1. ID → title; 2. startpage → endpage; 3. journal issue → year
4. title → ID; 5. ID → startpage endpage journal issue; 6. TR-ID → ID

If you wish, you may additionally write a brief explanation for each answer, which will be taken into account, but is not necessary to get full marks.

c) Based on a) and b), perform normalization into BCNF, and state the resulting relations.

d) Indicate for each of the following expressions whether it is a valid SQL statement or not. A valid statement, as described in GUW, should be accepted by a standard SQL interpreter, whereas an invalid statement should result in an error message. Use the answer sheet of the exam for your answer.

1. SELECT * FROM Articles WHERE endpage-startpage>10;
2. SELECT * FROM Articles WHERE endpage-startpage<0;
3. SELECT SUM(title) FROM Articles;
4. SELECT AVG(year) FROM Articles WHERE title LIKE 'C%;
5. SELECT COUNT(*) FROM Articles GROUP BY year;
6. SELECT year,COUNT(*) FROM Articles WHERE COUNT(*)>10 GROUP BY year;