MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR
SECOND YEAR SECOND SEMESTER

SCHOOL OF SCIENCE
BACHELOR OF SCIENCE
(COMPUTER SCIENCE)

COURSE CODE: COM 2104

COURSE TITLE: DATABASE SYSTEMS

DATE: 3RD MAY, 2018 **TIME: 11:00 – 13:00**

INSTRUCTIONS TO CANDIDATES

(i) Answer Question **ONE** and any other **TWO** questions

*This paper consists of **4** printed pages. Please turn over.*

SECTION A (30Marks): Answer ***all*** questions from this section

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QUESTION 1

(a) Define what you understand by the following terms **(3 marks)**

(i) Overlap constraint

(ii) Non-attribute key

(iii) Weak entity set

(b) Give the difference between the following **(3 Marks)**

(i) Entity and Entity set

(ii) Relationship and relationship set

(iii) candidate key and the primary key

(c) Explain the statement that relational algebra operators can be composed **(3 Marks)**

(d) Give five advantages of using a DBMS **(5 Marks)**

(e) Consider the following schema: **(5 Marks)**

Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

Catalog(sid: integer, pid: integer, cost: real)

The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in SQL:

(i) Find the pnames of parts for which there is some supplier

(ii) Find the snames of suppliers who supply every part

(iii) Find the snames of suppliers who supply every red part

(iv) Find the pnames of parts supplied by Acme Widget Suppliers and no one else

(v) Find the sids of suppliers who charge more for some part than the average cost of that part (averaged over all the suppliers who supply that part)

(f) Given two relations R1 andR2, where R1 contains N1 tuples, R2 contains N2 tuples, and N2 > N1 > 0, give the minimum and maximum possible sizes (in tuples) for the resulting relation produced by each of the following relational algebra expressions. In each case, state any assumptions about the schemas for R1 andR2 needed to make the expression meaningful **(4 Marks)**

(i) $R1 \cup R2$

(ii) $R1 \cap R2$

(iii) $R1 - R2$

(iv) $R1 \times R2$

(g) Explain the purpose of testing the database system **(3 Marks)**
(h) Explain the purpose and scope of database security **(4 Marks)**

SECTION B (40Marks): Answer any ***TWO*** questions from this section

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QUESTION 2

(a) What is relational completeness **(2 Marks)**
(b) What is the role of the DBA with respect to security? **(2 Marks)**
(c) Describe how strong and weak entities differ and provide an example of each **(4 Marks)**
(d) Discuss the important role played by users in the process of database design **(4 Marks)**
(e) Consider the following relations:

Student(snum: integer, sname: string, major: string, level: string, age: integer)
Class(name: string, meets at: time, room: string, fid: integer)
Enrolled(snum: integer, cname: string)
Faculty(fid: integer, fname: string, deptid: integer)

The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Write the SQL statements required to create these relations, including appropriate versions of all primary and foreign key integrity constraints **(4 Marks)**
(f) Explain the purpose and scope of database security **(4 Marks)**

QUESTION 3

(a) Discuss the main types of threat that could affect a database system, and for each, describe the possible outcomes for an organization. **(8 Marks)**
(b) A university database contains information about professors (identified by social security number, or SSN) and courses (identified by courseid). Professors teach courses; each of the following situations concerns the Teaches relationship set.
For each situation, draw an ER diagram that describes it (assuming no further constraints hold). **(12 Marks)**

(i) Professors can teach the same course in several semesters, and each offering must be recorded.
(ii) Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded. (Assume this condition applies in all subsequent questions.)
(iii) Every professor must teach some course.
(iv) Every professor teaches exactly one course (no more, no less).

(v) Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor.

(vi) Now suppose that certain courses can be taught by a team of professors jointly, but it is possible that no one professor in a team can teach the course. Model this situation, introducing additional entity sets and relationship sets if necessary.

QUESTION 4

(a) Define the following **(3 Marks)**

(i) The relation cardinality

(ii) The relation degree

(iii) Weak entity set

(b) What is an unsafe query and explain why it is important to disallow such queries **(3 Marks)**

(c) Consider the SQL query whose answer is show below **(4 Marks)**

sid	*name*	*login*	*age*	*gpa*
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0

Table showing Students with age < 18 on Instance S

(i) Modify this query so that only the login column is included in the answer

(ii) If the clause WHERE S.gpa >= 2 is added to the original query, what is the set of tuples in the answer

(d) Consider the following schema:

Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

Catalog(sid: integer, pid: integer, cost: real)

The key fields are underlined, and the domain of each field is listed after the field name. Therefore sid is the key for Suppliers, pid is the key for Parts, and sid and pid together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in relational algebra and SQL. **(10 Marks)**

(i) Find the sids of suppliers who supply some red part and some green part

(ii) Find the sids of suppliers who supply every part

(iii) Find the sids of suppliers who supply every red part

(iv) Find the sids of suppliers who supply every red or green part

(v) Find the sids of suppliers who supply every red part or supply every green part

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