W1-2-60-1-6

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

University Examinations 2021/2022

EXAMINATION FOR THE DEGREE OF BACHELOR OF BUSINESS COMPUTING

ICS 2206: DATABASE SYSTEMS

DATE: DECEMBER, 2021 **TIME: 2 HOURS**

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY QUESTION

a) Using examples explain the differences of the following:
   i. 1ST NORMAL FORM:
   ii. 2ND NORMAL FORM
   iii. 3RD NORMAL FORM

6 Marks

b) Given the following relational database schema:

Employee (Ename, ESSN, Address, Salary, Dno)
Department (Dname, Dno, D loc)
Project (Pname, Pno, P loc, Dno)
Works on (ESSN, Pno, Hours)
Child (ESSN, Dep name, Birthday, Sex)

Specify an expression in SQL for each of the following queries:
   i. Find the sum of the salaries, the maximum salary, the minimum salary, and the average salary of all employees who work for the "R&D" department.
   ii. For each project on which more than five employees work, retrieve the project number, the project name, and the number of employees who work on the project.
   iii. Find the names of all employees who earn less than $30,000, have at least four children, and work more than 40 hours per week.
   iv. Retrieve the names of all employees who have at least three boys and two girls.

8 Marks

c) Given the following relational database schema:
Player(Pname, Age, Years, PNO)
Play for(Pname, Tname, Position, Salary)
Team(Tname, City, Asset, Owner, Manager)
Create the Player table with the following constraints: (i) Pname is the primary key, (ii) Age cannot be null, (iii) the default value of Years is 1, and (iv) PNO must be in between '00' and '99'.

3 Marks

d) Study the following table: StudentID is the primary key.

StudentID	StudentName	Address	HouseName	HouseColor	Subject	SubjectCost	Grade
19594332X	Mary Watson	10 Charles Street	Bob	Red	English	$50	B
					Maths	$50	A
					Info Tech	$100	B-

Normalize the table to
   i. 1NF
   ii. 2NF
   iii. 3NF

6 Marks

(Show the resulting tables after each normalization)

e) What are FULL OUTER JOIN, LEFT OUTER JOIN and RIGHT OUTER JOIN? Give an example of the three kinds of outer joins on two tables both of which contain dangles.

3 marks

f) Differentiate between Entity integrity and Referential integrity 4 marks

QUESTION TWO

a) Explain the following classifications of DBMS
   a. Single User database systems
   b. Multi-user database
   c. Centralized Database system
   d. Distributed database system **4 marks**

b) Study the case study below and answer the questions that follow

A relational database is to be designed for a medium sized Company dealing with industrial applications of computers. The Company delivers various products to its customers ranging from a single application program through to complete installation of hardware with customized software. The Company employs various experts, consultants and supporting staff. All personnel are employed on long-term basis, i.e. there are no short-term or temporary staff. Although the Company is somehow structured for administrative purposes (that is, it is divided into departments headed by department managers) all projects are carried out in an inter-disciplinary way. For each project a project team is selected, grouping employees from different departments, and a Project Manager (also an employee of the Company) is appointed who is entirely and exclusively responsible for the control of the project, quite independently of the Company's hierarchy. The following is a brief statement of some facts and policies adopted by the Company.

i. Identify the entities as described in the case study **4 Marks**
ii. Obtain E-R diagram for the case study above **8 Marks**
iii. Explain the constraints that may be added while designing a database for the case study above **4 Marks**

QUESTION THREE

a) Explain the following three levels of a DBMS schemas:
   i) Internal level
   ii) Conceptual level
   iii) External level **[6 Marks]**

b) Study the table below and answer the questions that follow:

Grade

ID	Code	Mark
S103	DBS	72
S103	IAI	58
S104	PR1	68
S104	IAI	65
S106	PR2	43
S107	PR1	76
S107	PR2	60
S107	IAI	35

Write an SQL query

i. to find a list of the **ID NUMBERS** and **MARKS** in IAI of students who have passed (scored 40 or higher) IAI
ii. to show all columns where the mark is greater than 60
iii. Increase the mark of the first record from 72 to 82
iv. to show the ID column only without duplicates **[12 Marks]**

c) Explain the difference between HAVING and WHERE keywords as used in SQL **2 Marks**

QUESTION FOUR

a) Explain two properties of a foreign key. **[4 Marks]**
b) Define the following terms.
   i. database
   ii. database management system
   iii. relation
   iv. instance
   v. cardinality ratio **[5 Marks]**
c) Study the following tables: Children, Playgroups and Activities.

Children

Name	Age	Address

Playgroups

PlaygroupID	Name

Activities

PlaygroupID	Date	Description

Write SQL queries to do the following:

i. Find a list of names of all children. **[4 Marks]**

ii. Find a list of names of all children aged 4. **[3 Marks]**

iii. Return a list of names and addresses of all children in playgroup with playgroupID=1. **[4 Marks]**