

2920/206  
DATABASE MANAGEMENT SYSTEMS  
November 2016  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL  
DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY  
MODULE II

DATABASE MANAGEMENT SYSTEMS

3 hours

**INSTRUCTIONS TO CANDIDATES**

*Answer any FIVE of the following EIGHT questions in this paper in the answer booklet provided.  
All questions carry equal marks.  
Candidates to answer the questions in English*

**This paper consists of 7 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**

1. (a) Define the following terms.
- (i) Database Schema.
- (ii) Database Management System. (4 marks)
- (b) Table 1 shows a student's results slip. Use it to answer the question that follows.

Student No: 1022567 Student Name: Alex James Course code: F105 Course Title: ICT					
Subject Code	Subject Title	Number of Hours	Grade	Result code	Results
Bus 119	Business operations	20	10	PA01	Pass
COM110	Introduction to computers	20	8	PA02	Pass
COM112	Application Development	20	2	RE01	Refer Exam
COM114	HCI	10	7	RE01	Refer Exam

Table 1.

Normalize to 3NF

(9 marks)

- (c) The following SQL statement has errors.

```
SELECT Name, location,
FROM EMPLOYEE,
Where location=Nairobi;
```

Identify the *errors* and *correct* the statements.

(3 marks)

- (d) Differentiate between fully *functional* and *transitive* dependency as used in databases.

(4 marks)

2. (a) Explain the function of the following in a *database management systems*:

(i) Data Manipulations Language;

(ii) Data Definition Language.

(4 marks)

- (b) With the aid of an example in each case distinguish between *binary* and *shared* locks in concurrent processing.

(4 marks)

- (c) Table 2 shows the design details of a table named *Asset*. Use it to answer the questions that follow.

Field	Description
Asset_ID	This number identifies the Asset. It is the Primary Key
Asset_Name	Identifies the name of the Asset. The field should not allow null values. Should hold not more than 20 characters.
Asset_Description	Gives a brief description of the function of the Asset. Should hold not more than 60 characters.
Year_of_Purchase	When the Asset was procured. The field should not allow null values

Table 2.

Write an SQL statement that would:

- (i) Create the table; (4 marks)  
 (ii) Add the following column to the table *Asset*; (2 marks)

Field	Description
<i>Asset_Category</i>	<i>This field holds the category the asset belongs to. Should not be null and hold not more than 55 characters.</i>

- (iii) Add the following values to the table. (4 marks)

Asset_Id	Asset_Name	Asset Description	Year_of_Purchase	Asset Category
10	Mouse	A mouse is a device used as an accessory in a computer	2016	Computer accessory

- (d) A database administrator has defined the data type of a field as *Decimal (6,2)*. With the aid of an example interpret this data type. (2 marks)
3. (a) Define the term *weak entity* as used in databases. (2 marks)  
 (b) Explain **two** circumstances under which a hospital would use a database management system. (4 marks)  
 (c) Study the scenario below.

*A computer company undertakes a number of projects. Either, an external client or an internal department handles a project. An external client or internal department may have several projects at one go. A consultant manages each project.*

Draw an *entity relationship diagram* to represent the scenario showing the *relationship cardinality*. (6 marks)

(d) Table 3 shows details of Students. Use it to answer the questions that follow.

Student Id	StudentName	D.O.B	Gender	Course id	Marks
N001	Jane F	23.06.98	Female	004	70 1-2
N002	Andrew M	22.05.96	Male	003	75
N003	Catherine F	18.09.98	Female	004	90 2
N004	Agnes F	16.06.99	Female	002	92 3
N005	Noel M	26.04.98	Male	004	65
N006	Martin M	14.07.98	Male	001	63

Table 3.

Write an algebraic expression that would:

- (i) Display all records of female students who attained more than 70 marks; (2 marks)
- (ii) Display all the *course\_Id* of the students; (2 marks)
- (iii) Rename the relation *Students* to '*Student Marks*' and the attribute *Student\_Id* to *S\_id*. (4 marks)

4. (a) Outline **two** functions of a system analyst during database development. (2 marks)
- (b) Explain **two** advantages of a *distributed database systems*. (4 marks)
- (i) Explain **two** benefits of *normalization* in databases. (4 marks)
  - (ii) Table 4 shows an extract of Employees details at Faraja Company. Use it to answer the questions that follow:

Employee Number	Employee Name	Department Number	Department Name	Department Manager
K9870678	Jane Abraham	101	Marketing	Alex Stephen
K8767599	Stephy Jacobs	102	Production	Grace Johns
K2345908	Frank Edward	103	Accounts	Evans
K2358907	Josephine Ted	106	Marketing	Alex Stephen
K2567890	Stephen Max	109	Accounts	Evans

Table 4.

Explain a scenario in the table that may lead to occurrence of each of the following anomalies.

- I. update anomaly; (2 marks)
  - II. insertion anomaly; (2 marks)
  - III. deletion anomaly. (2 marks)
- (d) Distinguish between the output of SQL Statement A and B (4 marks)

**A.**  
 (i) SELECT Distinct (Grade)  
 FROM employees;

**B.**  
 (ii) SELECT Grade  
 FROM employees;

5. (a) Outline **four** components of a database management system. (4 marks)
- (b) Explain **two** circumstances that would make an organisation to implement a *client server database* architecture. (4 marks)
- (c) Using the following tables, differentiate between the output generated from the operations  $A \cup B$  and  $A \cap B$  operations. (6 marks)

**Table A**

Personal No
K133
K137
K143
K145
K146

**Table B**

Personal No
k135
k137
k145
k143
K147

- (d) (i) A database administrator wants to apply the union, intersection and difference operation to a relation, explain **two** conditions he must check that the relations fulfil before applying the operations. (4 marks)
- (ii) State the meaning of ACID in Database Management Systems. (2 marks)
6. (a) Define the roles each of the following personnel in databases:
- (i) Specialised end user;
- (ii) Database designers. (4 marks)
- (b) State **two** differences between the *file based approach* and the *database approach*. (4 marks)
- (c) Table 5 is a table named *Results* in a database. Use it to answer the questions that follow:

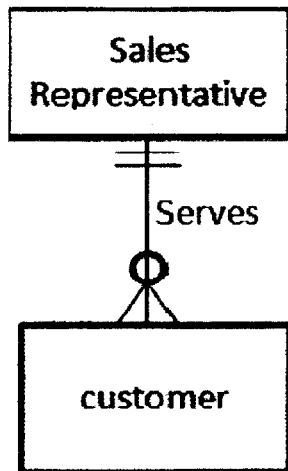
FirstName	SirName	IDNo	DOB	Marks
Alice	Smith	123980	23-06-1984	95
Alex	Maps	879060	14-04-1989	60
Banice	Young	879067	12-03-1990	75
John	Wallace	312689	18-06-1994	55

Table 5: Results

Write an SQL statement that would perform each of the following:

- (i) display all records from the fields *FirstName, SirName and IDNO*; (2 marks)
- (ii) display the *DOB value* for *John Wallace*; (3 marks)
- (iii) display all records whose marks range from *50 to 90*; (3 marks)
- (iv) sort all the records from *highest to lowest* based on marks; (2 marks)
- (v) display all records whose *firstname* start with letter *A*. (2 marks)

- 7 (a) Outline **two** differences between *homogeneous* and *heterogeneous* distributed database systems. (4 marks)
- (b) Explain **two** criteria that may be used to choose *physical design* in database. (4 marks)
- (c) Interpret the following *entity relationship diagram* as used in database design. (4 marks)



- (d) Use the following tables *C* and *D* to answer the questions that follow.

Sid	Sname
001	English
002	Kiswahili
003	Science

**C**

Pno	Name	Sid	Hours
K0088769	Cate	002	10
K0099221	Jonathan	001	20
K0008702	Andrew	002	30

**D**

- (i) Write an algebraic expression that would join the tables *C* and *D*. (2 marks)
- (ii) Write the output generated from the expression in (i) above. (3 marks)
- (iii) Write the output of the following expression: (3 marks)

$$C \bowtie_{d.hours \geq 15} D$$

- 8 (a) Outline **four** types of *database threats* a database administrator is likely to encounter. (4 marks)
- (b) Describe each of the following phases of the database life cycle:
- (i) requirements phase; (2 marks)
- (ii) conceptual phase; (2 marks)
- (iii) physical design phase. (2 marks)

(c) A database has a table named *Employees*. Use the table to answer the questions below.

**Employees**

EmpNo.	Employee Name	Salary	DeptNo.
K0001	Jane	10000	03
K0002	Esther	15000	02 X
K0003	Alex	30000	02 X
K0004	John	25000	04
K0005	Elvis	30000	01
K0006	Hope	75000	02 X

Write an SQL statement that would:

- (i) count all the employees in *DeptNo* 02; (2 marks)
- (ii) calculate the average salary of all employees; (2 marks)
- (iii) calculate the total salary for all employees; (2 marks)
- (iv) display all records for employees whose salary is less or equal to the average salary of all employees. (4 marks)

30 833

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Handwritten calculation for the average salary:

$$\begin{array}{r}
 30233. \\
 6 \overline{) 181400} \\
 \underline{120} \phantom{0} \\
 56 \phantom{0} \\
 \underline{48} \phantom{0} \\
 20 \phantom{0} \\
 \underline{18} \phantom{0} \\
 20
 \end{array}$$

Handwritten calculation for the total salary:

$$\begin{array}{r}
 331666 \\
 6 \overline{) 205000} \\
 \underline{18} \phantom{000} \\
 25 \phantom{00} \\
 \underline{24} \phantom{00} \\
 10 \phantom{00} \\
 \underline{6} \phantom{00} \\
 40 \phantom{0} \\
 \underline{36} \phantom{0} \\
 4
 \end{array}$$