1. (a) Outline **two** uses of a *data model* in a database. (2 marks)

(b) Distinguish between *data redundancy* and *data inconsistency* as used in databases. (4 marks)

(c) Describe **three** components of a *three tiered architechure* in a client server database system. (6 marks)



(d) An organisation uses a time card system to track hours worked by employees to be used when computing payments. A time card should have hours worked, date submitted, a unique id and status. Each time card is associated with exactly one employee and each employee has a unique id, name, address and payment type. An employee submits a time card every pay period. Each employee is associated with exactly one manager and each manager has a unique id and a name. Each manager is in charge of multiple employees and each manager approves time cards for multiple employees.
Draw an ER diagram to represent the information. (8 marks)

2. (a) Distinguish between a *sophisticated user* and *an end user* as used in databases. (4 marks)



(b) Describe **three** classifications of Database Management Systems. (6 marks)

(c) Distinguish between *non-lossy decomposition* and *lossy decomposition* as used in normalization.

(4 marks)

(d) Figure 1 shows a type of database organisation model. Use it to answer the question that follows.


Figure 1

Explain **three** benefits of using this type of database model. (6 marks)

3. (a) Andrew a manager, would like to purchase a Database Management System for his company. Outline **four** factors he should consider during the selection. (4 marks)

(b) The following are SQL statements. Use them to answer the question that follows.

```
Create Table  (Staffno varchar(5),lname(varchar(15),salary
decimal ((7,2);
INSERT TO  STAFF ('ST678','Lenny' "15700");
SELECT staffno,lastname,salary
From staff
Where salary >10000;
```

Identify and correct the errors found in the statements.. (4 marks)



(c) Mary developed a system with the following modules; *sales, invoicing* and *payroll* all maintaining their own data files. Explain **three** disadvantages she would experience from this approach. (6 marks)

(d) Describe **three** database security measures that can be applied on data within a network. (6 marks)

4. (a) Describe a *normal form* as used in normalization (2 marks)

(b) (i) Outline **four** factors to consider when to setting a Database Management System. (4 marks)



(ii) Describe the following during database designs.

I. Logical; (2 marks)

II. Physical. (2 marks)

(c) Explain **three** objectives a *Query builder* in a database system. (6 marks)

(d) Eric would like to de-normalise a table. Explain **two** problems that he may encounter from this approach. (4 marks)

5. (a) Distinguish between *COUNT DISTINCT* and *COUNT ** as used in structured query language. (4 marks)



(b) Explain **three** advantages of the contemporary *database architecture*. (6 marks)

(c) Figure 2 shows a customer's order form. Use it to answer the question that follows.

(10 marks)

| Customer No<br>Customer Name<br>Customer Address | | Order No _____<br>Order date _____ | | |
|---|---|---|---|---|
| Product No | Product Description | Quantity | Price | Value |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Total | | | | |

Figure 2

Perform each of the following normal forms:

(i) 1st



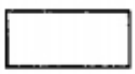
(ii) 2nd

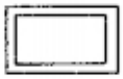
(iii) 3rd

6. (a) Explain **two** benefits an organisation would gain from using a *multidimensional database*. (4 marks)



(b) Outline the function of each of the following symbols used in an Entity Relationship Diagram.

(i)  (1 mark)

(ii)  (1 mark)

(c) State **three** differences between a *join operator* and a *union operator* as used in relational algebra. (6 marks)

(d) The following tables show relationships between the student score and grades. Use them to answer the questions that follow.

| Names | Score | Grade |
|---|---|---|
| ALI | 10 | B |
| ALI | 20 | A |
| BEATRICE | 10 | B |

**Table R**



| Names | Score | Grade |
|---|---|---|
| ALI | 20 | A |
| ALI | 30 | A |

**Table K**

State the output when each of the following operations are applied between the tables.

(i) $R \cup K$ (2 marks)

(ii) $\Pi_{names, grade}(R)$ (2 marks)

(iii) R-K (2 marks)

(iv) $R \cap K$ (2 marks)

7. (a) The following tables shows lectures information and the courses assigned to each of them respectively. Use them to answer the questions that follow.

| LECTURES ID | NAME | DEPATMENT | SALARY |
|---|---|---|---|
| T01010 | BENERD | COMPUTER | 30,000 |
| T01011 | RICHARD | BUSINESS | 40,000 |
| T01012 | LIONE | MECHANICAL | 35,000 |
| T02011 | MAURICE | MECHANICAL | 45,000 |

**Lectures table**

| LECTURES ID | COURSE ID |
|---|---|
| T01010 | CS-001 |
| T01012 | BU-001 |
| T01014 | MC-001 |

**Course table**

(i) State the output when the following operations are applied on the tables.

I. Lecturers $\bowtie$ Course (2 marks)



II. Lectures $\bowtie$ Course (2 marks)

III. Lecturers ⋈ Course. (3 marks)

IV. department avg(salary) as avgsal (3 marks)



(b) Table 1 shows a relation named *product* in a database. Use it to answer the question that follows.

| Sales ID | SalesMan | Age | Product Name | DailySales |
|---|---|---|---|---|
| S/001 | Andrew | 25 | Soap | 50,000 |
| S/010 | Mary | 45 | Oil | 20,000 |
| S/015 | Philip | 35 | Soap | 25,000 |
| S/002 | Billy | 27 | Oil | 40,000 |
| S/005 | Sarah | 36 | Soap | 80,000 |

**Table 1**

Write SQL statements to:

(i) count the number of records with the product name "oil"; (2 marks)

(ii) display the fields, salesman, age, dailysales for those salesman whose age is more than 30 and daily sales is in the range of 20,000 and 40,000; (2 marks)

(iii) add a column named department that would store data of at most five characters; (2 marks)

(iv) sort the records in ascending order by Salesman and dailysales; (2 marks)

(v) create a view from *products* table with the fields salesman and age. (2 marks)



8. (a) Outline the function of each of the following SQL statements.

(i) FROM; (1 mark)

(ii) HAVING; (1 mark)

(iii) ORDER BY; (1 mark)

(iv) WITH. (1 mark)

(b) Distinguish between *relational algebra* and *structured query language* as used in databases. (4 marks)



(c) The following are tables named *customer* and *order* respectively. Use them to answer the questions that follow.

| CUSTOMER ID | NAME | ADDRESS | AGE | SALARY |
|---|---|---|---|---|
| C/001 | ALI | 788 NRB | 45 | 40,000 |
| C/002 | ANNE | 2000 KSM | 75 | 30,000 |
| C/003 | MATHEW | 3412 NRB | 25 | 33,000 |
| C/004 | DEBORAH | 4222 NR | 33 | 22,000 |
| C/005 | ANTONY | 7243 MA | 22 | 10,000 |

**Customer**

| ORDER ID | DATE | CUSTOMER ID | AMOUNT |
|---|---|---|---|
| 0/0001 | 24/12/2012 | C/003 | 20,000 |
| 0/0002 | 23/05/2014 | C/003 | 30,000 |
| 0/0003 | 20/07/2014 | C/002 | 40,000 |
| 0/0004 | 20/02/2014 | C/004 | 5,000 |

**Order**

(i) State the output when the following SQL statements are applied on the tables.
(12 marks)

I.
```
SELECT ID,NAME,AMOUNT,DATE
FROM CUSTOMERS
INNER JOIN ORDERS
ON CUSTOMERS ID=ORDERS.CUSTOMERS
ID
```



II.
```
SELECT CUSTOMER ID,NAME,AMOUNT
FROM CUSTOMERS
FULL JOIN ORDERS
ON CUSTOMERS ID=ORDERS.CUSTOMERS
ID
```