



KENYATTA UNIVERSITY

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 304: ADVANCED DATABASE

2ND SEMESTER 2021/2022

TIME: 2 HOURS

INSTRUCTIONS:

- (i) Attempt question ONE and any other TWO questions
- (ii) Use clear diagrams where necessary

Question 1 (30marks) Compulsory

- a) i) Define the term *deadlock*. [2 marks]
ii) List and briefly explain the **three** general techniques for handling deadlock. [6marks]
- b) Differentiate between the following terms: [4 marks]
 - i.) Wait-die protocol and wound-wait protocol.
 - ii.) Shared lock and exclusive lock.
- (ii) List and explain the **ACID** properties of a transaction. [4 marks]
- c) Compare and contrast the homogenous and heterogeneous distributed database system. [4 marks]
- d) Given the lattice of the month against store sales, deduce information that can assist the management to choose stores that they need to invest more resources, the stores that need to be closed down and month that they need to lay off part time staff [5 marks]

	1	2	3	4	5	6	7	8
Apr								
May								
Jun								
Jul								
Aug								
Sep								
Oct								
Nov								
Dec								
Jan								
Feb								
Mar								

- e) Explain two scenarios which can lead to inference attack

[5 marks]

Question 2 (20marks)

- Describe the types of problem that occur in a multi-user environment when concurrent access to the database is allowed. [6 marks]
- List and explain the **two** main concurrency control techniques that allow transactions to execute safely in parallel. [4 marks]
- using a diagram explain the Reference Architecture for DDBMS [6 marks]
- list four components that can be distributed in a database [4 marks]

Question 3(20marks)

- using a diagram discuss three components of a back-end database system [6 marks]
- Differentiate between the following: – [4 marks]
 - Pessimistic and Optimistic concurrency control techniques.*
 - 2 tier and 3 tier databasesystem.
- Identify any four types of cost in running database in the organization. [4marks]
- Lists and diagram the different states of a transaction [6 marks]

Question 4(20marks)

- Once deadlock has been detected the DBMS needs to abort one or more of the transactions to recover from the deadlock. List and explain the **three main** issues that need to be considered in such a situation. [6 marks]
- Discuss the two-phase locking protocol as concurrency control mechanism. [4 marks]
- List and explain the **two** main reasons for allowing concurrent execution. [4 marks]

d) Illustrate any four different TP Monitor Architectures [4 marks]

e) What is starvation [2 marks]

Question 5(20marks)

a) Define the term **Distributed Database**, what are the assumption for a DS' [4 marks]

b) List and explain any **five** advantages of a distributed database management system.[5marks]

c) Draw a workflow for a Loan Processing in a bank [6 marks]

d) Given the concurrent transaction below come up with at least one serializable conflict equivalent [5 marks]

T_1	T_2
read(A) write(A)	read(A) write(A)
read(B) write(B)	read(B) write(B)



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2020/2021

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCO 304: ADVANCED DATABASE SYSTEMS

DATE: Tuesday, 15th June 2021

TIME: 4.30 p.m. - 6.30 p.m.

INSTRUCTIONS:

Answer Question ONE and any other TWO Questions

Question 1

(a) Describe the four (4) ACID properties of a transaction in a database. [4 Marks]

(b) Draw a state diagram, and describe the typical states that a transaction goes through during execution. [4 Marks]

(c) Consider the following schema:

Message(mId, subject, body), Customer(email, name, householdSize, address), SentTo(mId, email, sendDate)

(i) Write an SQL query that returns all attributes of customers that have household size greater than one.

(ii) Write an SQL query that counts the total number of messages.

(iii) Write an SQL query that returns all email addresses and names of customers who have been sent the message with subject "KU CBD Campus" [6 Marks]

(d) Explain four advantages of Distributed Database System. [8 Marks]

(e) Triggers are variously used to automate various database systems processes. In this regard.

(i) What is the basic structure of a trigger?

(ii) Differentiate between row-level and statement-level trigger granularities.

(iii) List at least three of the issues to consider in trigger handling. [8 Marks]

Question 2

(a) Describe three methods/techniques to solve deadlock problems in relational database systems. [10 Marks]

INVOLVEMENT IN ANY EXAMINATION IRREGULARITY SHALL LEAD TO DISCONTINUATION

Page 1 of 2

- (b) Consider a database with objects X and Y and assume that there are two transactions T_1 and T_2 . Transaction T_1 reads objects X and Y and then writes object X . Transaction T_2 reads objects X and Y and then writes objects X and Y .
- Give an example schedule with actions of transactions T_1 and T_2 on objects X and Y that results in a write-read conflict.
 - Give an example schedule with actions of transactions T_1 and T_2 on objects X and Y that results in a read-write conflict.
 - Give an example schedule with actions of transactions T_1 and T_2 on objects X and Y that results in a write-write conflict.
 - For each of the three schedules, show that Strict 2PL disallows the schedule.
- [10 Marks]

Question 3

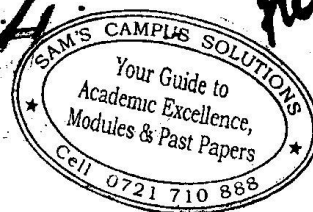
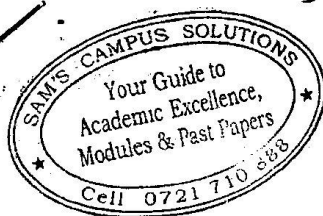
- Using the necessary illustrations, describe the three problems arising from concurrent database transaction execution.
- [10 Marks]
- By use of example SQL statements, explain the capabilities of the superuser or system account maintained by the DBA.
- [10 Marks]

Question 4

- Describe the two main purposes of Database Recovery in any organization.
- [6 Marks]
- Explain three types of failure that may occur on a database.
- [6 Marks]
- Define the following terms as they relate to database recovery.
- [8 Marks]
- Deferred database modification
 - Immediate database modification

Question 5

- Differentiate between discretionary and mandatory access controls.
- [2 Marks]
- Describe three threats that database systems may encounter.
- [6 Marks]
- Describe four kinds of countermeasures that can be implemented to protect databases against the types of threats identified in (a) above.
- [12 Marks]



-KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2017/2018

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

(COMPUTER SCIENCE)

SCO 304: ADVANCED DATABASE SYSTEMS

DATE: THURSDAY 22ND FEBRUARY 2018

TIME: 2.00 P.M. - 4.00 P.M.

INSTRUCTIONS:

ANSWER QUESTION 1 AND ANY OTHER TWO

Question 1 (compulsory)

- (a) Define the term Big Data. Discuss main characteristics defining the same. (4 marks)
- (b) Explain any three physical database design activities. (6 marks)
- (c) Describe any two ways on how DBMS handles problems generated by concurrent access to the database. (6 marks)
- (d) Write an SQL DDL command to create customer table described below.

Field name	Data type	Size	Required
custid	number	10	Primary Key
fname	text	20	Required
Credit status	number	4	-
Date_reg	date		-

- (e) State main components of data mining system. (4 marks)
- (f) Explain any three challenges of implementing distributed database system. (6 marks)

Question 2

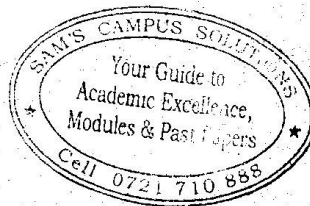
Consider the following table definitions: and answer the questions that follow

```
CREATE TABLE Lecturer (  
    Name VARCHAR(30),  
    Position VARCHAR(20),  
    Address VARCHAR(100),  
    Age INT,  
    PRIMARY KEY (Name) );  
  
CREATE TABLE Module (  
    Code CHAR(5),  
    Name VARCHAR(80),  
    Credits INT,  
    Type CHAR(1),  
    PRIMARY KEY (Code) );  
  
CREATE TABLE Allocation (  
    Name VARCHAR(30),  
    Code CHAR(5),  
    PRIMARY KEY (Name, Code),  
    FOREIGN KEY (Name) REFERENCES Lecturer,  
    FOREIGN KEY (Code) REFERENCES Module );  
    Code CHAR(5);  
    Day CHAR(8),  
    Time TIME,  
    Duration INT,  
    Room CHAR(6),  
    PRIMARY KEY (Code, Day, Time),  
    FOREIGN KEY (Code) REFERENCES Module );
```

Write SQL statement to do the following

- (a) (i) Provide an alphabetically ordered list of all Professors (represented by the attribute Position) younger than 50. (3 marks)
- (ii) Provide an alphabetically ordered list of all the lecturers and the modules they teach. (4 marks)
- (b) Draw an ER diagram based on above query statements. (6 marks)
- (c) Describe the two operations by means of which concurrent transactions are supported within a DBMS. (6 marks)

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22nd Feb 2012



Question 3

- (a) Discuss any four factors to consider while selecting a DBMS. (8 marks)
- (b) Study the following immunization system, with a view to developing a database, develop an entity relationship (E/R) diagram. (12 marks)

A system is required to record details of infant immunization in a health region. Every infant in the region is required to have a course of general vaccinations against diseases such as whooping cough and diphtheria. Patients are identified by a unique NHS number and details such as the name, date of birth and NHS number of the parent or guardian of the infant are also recorded. Each vaccination is for a single vaccination type such as mumps, rubella, etc., and is given to a single patient. However, every infant is given a number of booster injections of certain vaccination types at periodic intervals. The date of each vaccination is recorded. Vaccination is given by General Practitioner (GPs). A general practice usually has many GPs. Each GP works for only one general practice and usually has many patients. Each GP works for only one general practice and usually has many patients on his or her list. Each infant is on the list of only one doctor. Practices are identified by practice names and GPs are identified by unique GP numbers. The name of each doctor and the number of vaccination patients on each doctor's list also needs to be recorded. Besides general update operations, the following processes must be supported by the system: The production of appointment letters; A work-list by General Practice for a given week; an audit list indicating the number of vaccinations by type conducted during the previous six-month period.

Question 4

- (a) Discuss two of the problems associated with distributed database systems. (4 marks)
- (b) Define the two main approaches to data security. (4 marks)
- (c) List and explain any four of Date's rules for distributed data base systems. (8 marks)
- (d) Briefly discuss any two data summarization technique. (4 marks)

Question 5

- (a) Briefly explain any two query optimization technique. (6 marks)
- (b) Explain how system recovery is implemented by means of transactions logs and check point. (4 marks)
- (c) Explain how a deadlock state can be detected and how the system can break such a state. (6 marks)
- (d) Explain how modern DMBS handle unstructured data. (4 marks)



STUDENT CENTRE K M

KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2017/2018

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE
(COMPUTER SCIENCE)

SCO 304: ADVANCED DATABASE SYSTEMS

DATE: THURSDAY 22ND FEBRUARY 2018

TIME: 2.00 P.M. - 4.00 P.M.

INSTRUCTIONS:

ANSWER QUESTION 1 AND ANY OTHER TWO

Question 1 (compulsory)

- (a) Define the term Big Data. Discuss main characteristics defining the same. (4 marks)
- (b) Explain any three physical database design activities. (6 marks)
- (c) Describe any two ways on how DBMS handles problems generated by concurrent access to the database. (6 marks)
- (d) Write an SQL DDL command to create customer table described below.

Field name	Data type	Size	Required
custid	number	10	Primary Key
fname	text	20	Required
Credit status	number	4	-
Date_reg	date		-

CREATE TABLE cust (custid NUMBER(10) PRIMARY KEY, fname VARCHAR(20) NOT NULL, credit_status NUMBER(4), date_reg DATE);

- (e) State main components of data mining system. (4 marks)
- (f) Explain any three challenges of implementing distributed database system. (6 marks)

CREATE TABLE cust (custid NUMBER(10) PRIMARY KEY, fname VARCHAR(20) NOT NULL, credit_status NUMBER(4), date_reg DATE);

CREATE TABLE cust (custid NUMBER(10) PRIMARY KEY, fname VARCHAR(20) NOT NULL, credit_status NUMBER(4), date_reg DATE);

Complexity, Security, Replication

Question 2

Consider the following table definitions: and answer the questions that follow

```
CREATE TABLE Lecturer (
    Name VARCHAR(30),
    Position VARCHAR(20),
    Address VARCHAR(100),
    Age INT,
    PRIMARY KEY (Name) );

CREATE TABLE Module (
    Code CHAR(5),
    Name VARCHAR(80),
    Credits INT,
    Type CHAR(1),
    PRIMARY KEY (Code) );

CREATE TABLE Allocation (
    Name VARCHAR(30),
    Code CHAR(5),
    PRIMARY KEY (Name, Code),
    FOREIGN KEY (Name) REFERENCES Lecturer,
    FOREIGN KEY (Code) REFERENCES Module );

CREATE TABLE Section (
    Code CHAR(5),
    Day CHAR(8),
    Time TIME,
    Duration INT,
    Room CHAR(6),
    PRIMARY KEY (Code, Day, Time),
    FOREIGN KEY (Code) REFERENCES Module );
```

SECRET
 From techin
 kiter posit = 1 (partially)
 AND here < 50;
 @ 2062 BT POSITION.

Write SQL statement to do the following

- (a) (i) Provide an alphabetically ordered list of all Professors (represented by the attribute Position) younger than 50. (3 marks)
- (ii) Provide an alphabetically ordered list of all the lecturers and the modules they teach. *SELECT lecturer, m.module* (4 marks)
- (b) Draw an ER diagram based on above query statements. *from lecturer, module* (6 marks)
- (c) Describe the two operations by means of which concurrent transactions are supported within a DBMS. locking (6 marks)

lock
transfer

QOR
Tm

21-4-20

Question 3

- (a) Discuss any four factors to consider while selecting a DBMS. (8 marks)
- (b) Study the following immunization system, with a view to developing a database, develop an entity relationship (E/R) diagram. (12 marks)

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Question 4

- (a) Discuss two of the problems associated with distributed database systems. (4 marks)
- (b) Define the two main approaches to data security. (4 marks)
- (c) List and explain any four of Date's rules for distributed data base systems. (8 marks)
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Question 5

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- (b) Explain how system recovery is implemented by means of transactions logs and check point. (4 marks)
- (c) Explain how a deadlock state can be detected and how the system can break such a state. (6 marks)
- (d) Explain how modern DMBS handle unstructured data. (4 marks)



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KENYATTA UNIVERSITY

UNIVERSITY EXAMINATION 2016/2017

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF

SCIENCE (COMPUTER SCIENCE)

SCO 304: ADVANCED DATABASE SYSTEMS

DATE: Wednesday 7th December 2016

TIME: 2.00p.m -4.00p.m

INSTRUCTIONS

Answer question one and any other two

Question 1 (Compulsory)

- a) Define the term transaction and outline and outline three properties of it. *4 mechanism used to apply modifications to the final db*
ACID
- Isolation
- Atomicity
- Consistency
- Durability or permanency
[4marks] 30
- b) Explain the purpose of data independent on the basis of three levels of ANSI/SPARC architecture of a database system. *to separate each user from db for the answer*
Access view
intention system is not
[4marks] 20
- c) Describe one of the possible problems generated by concurrent access to the same data and illustrate how the problem can be resolved by using the locking mechanism. *Deadlock*
- Left update
- Dirty read
- Repeatable read
[6marks]
- d) Explain the pillars of Big Data. *- Volume*
Value
Velocity
Veracity
[6marks]
- e) Discuss any three factors to consider while selecting object oriented DBMS. *data cen*
integrity
obj cen
[4marks]
- f) Explain, based on a diagrammatic representation, two possible architectures for database systems. *- Client-server*
- Distributed
- Client-server
- Server
- Distributed
[6marks]

Question 2

- a) Discuss any four functions of a DBMS. *Database Management System*
Recovery
Query optimization
Database access
[8marks]

Study the following scenario and answer question below

RESEARCH DATABASE

The university has created a number of structural division to enable it to manage research. Research units constitute collections of staff working in a common research area such as Information Systems, Software Engineering, etc. Research centers are aggregations of

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Research unit

research centre

research units that roughly corresponds to the units of assessment created by the research assessment exercise (RAE). Both research units and research centers are headed by one member of academic staff. The following forms of research output are used to assess the performance of research units and research centers: publications (journal papers, conference papers, professional articles, books, chapters in books), research grants (submitted and successful) and research students (registered, complete). Members of academic staff at the university author publications and submit or hold research grants. A member of staff can author more than one publication and submit/hold more than one research grant. A publication can be authored by more than one member of staff and a research grant can have more than one applicant. Research students are enrolled by an academic department or school and are supervised by one or more members of academic staff. Members of staff may supervise more than one research student. In terms of research grants, the system need to record: the title of the grant, the application(s)/holder(s), funding body, the total value of the grant submitted, the total value of the grant awarded, date grant submitted, date grant awarded. In terms of research students, the system need to record: enrolment number name of student, academic department, date enrolled, date registered, type of research degree (Mphil, MPhil/PhD, and PhD) (Supervisor(s), date transferred, results of transfer, date examined, and results of examination). A minimal set of staff details need to be recorded in the system: payroll number, name, title, department/school.

b) Develop relational database model for the university.

[12marks]

Question 3

a) Discuss any two database recovery tools used by DBA

Deferred update
crash update

[4marks]

b) Discuss any four physical database design activities. Give examples in each case.

File

File organization
Base Relations
Indexing

[8marks]

Study the following case and answer questions that follow.

Cinema Land is a land company which owns a number of cinemas in Kenya. They require corporate database to record details of cinemas, venues and taking. Each cinema complex is given a unique code. Other attributes of a cinema include the cinema's name, its seating capacity, the number of employees, its location and its manager. Cinemas show a number of films over a season. The company currently needs to know which films are showing in which cinemas. Also, they need to know what films have been shown at what cinemas. A venue is a showing of a given film at a given cinema. Each venue has a start date and end date. The company wishes to record the entire takings for each venue and the total number of pupil attending each venue.

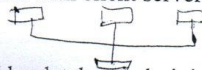
- c) Design an object oriented database for the cinema land. [8marks]

Question 4

- a) Discuss any two problems associated with client server database architecture.

- Failure of server

- delete file



[4marks]

- b) Discuss any three challenges faced by database administrator in securing distributed transactions.

audit

[4marks]

- c) List and explain any four Date's rules for distributed database systems.

[8marks]

- d) Explain any two query optimization techniques.

→ Select in self

Use sub query function

→ Avoid DISTANCE on select queries

local site use →

Custom select →

Custom

How make in

[4marks]

local autonomy
Operating System
Hardware
Network
Continuous op

Question 5

- a) Briefly explain any three security concern if the bank database was to be distributed.

[6marks]

- b) Explain two factors which have influenced development of object oriented database systems.

[4marks]

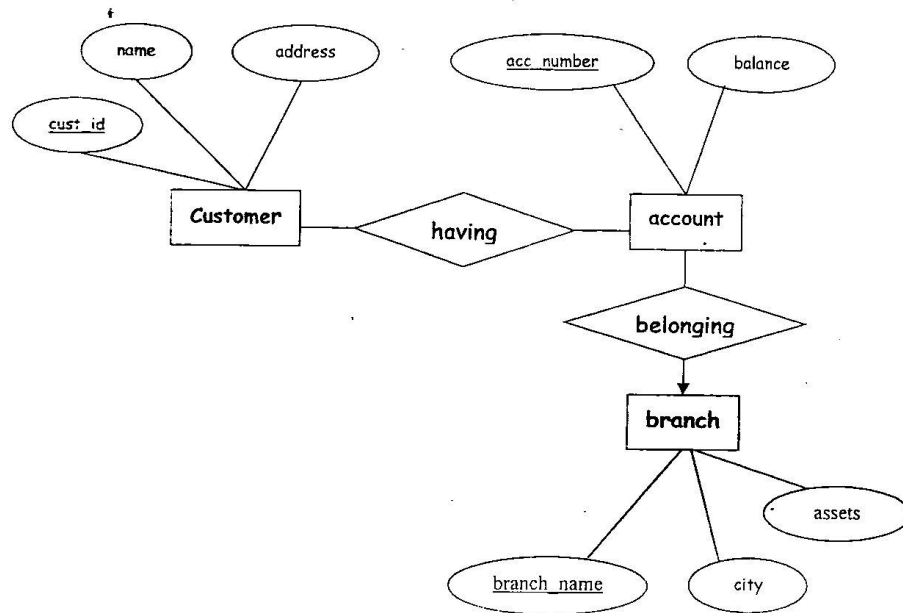
Abstract

Graphical

Inheritance

Increased potential for
Failure of one site m
causes that data to
- Increase complexity
to ensure coordination
- processing over

Consider an E-R diagram of a banking database system as follows



(c) Transform the above ER model into a physical model.

(10 marks)



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2015/2016

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE
(COMPUTER SCIENCE)

SCO 304: ADVANCED DATABASE SYSTEMS

DATE: FRIDAY 11TH DECEMBER 2015

TIME: 8.00 A.M. - 10.00 A.M.

SECTION A: COMPULSORY QUESTION 30 MARKS

QUESTION ONE

- a) Citing appropriate examples discuss the following concepts as used in databases:
- i. Transaction ✓
 - ii. Deadlock ✓
 - iii. Consistent database state ✓
- (6 Marks)
- b) Differentiate between the following concepts:
- i. Database replication and database fragmentation
 - ii. Database and data warehouse
 - iii. Rollback and roll forward
- (6 Marks)
- c) A typical Banking institution has several branches and several customers, at a given point in time multiple transactions are taking place. Using illustrations from the given scenario discuss the problems that can arise should the concurrent transactions not be managed. For each problem propose a solution. (9 Marks)
- d) Discuss the four transparency features of a distributed database management system. (6 Marks)
- e) Briefly discuss any two challenge of big data. (3 Marks)

SECTION B: ANSWER ANY TWO QUESTIONS (20 MARKS EACH).

QUESTION TWO

- a) Discuss the four properties of transactions (8 Marks)
- b) SQL is a DDL and a DML discuss the distinctions between the two and state any two SQL commands that fall in each category. (4 Marks)
- c) Consider the relational schemas below. Draw an entity relationship diagram (ERD) for the logical design. Clearly show the relationships and the cardinalities. Show clearly also the Primary Key (PK) and/or Foreign Key (FK) applied in each relation.
- SUPPLIER(SupplierNo, SupplierName, SupplierArea, SupplierStreet, SupplierCity)
- PART(PartNo, PartName, UnitPrice, SupplierNo)
- LINE_ITEM(OrderNo, PartNo, Part_Quantity)
- ORDER(OrderNo, Order_Date)
- (8 Marks)

QUESTION THREE

- a) Discuss any two problems that are avoided when the relations are normalized up to at least the Third Normal Form (3NF). (3 Marks)
- b) Meru University of Science and Technology intends to develop an online examination processing system. The system will enable the students to remotely access their results. Among other requirements security is considered to be a very crucial component of the system. Using the above scenario answer the following questions
- Citing examples discuss the three objectives in designing a secure system. (6 Marks)
 - Discuss the role that a security policy document will play in the above scenario. (3 Marks)
 - Discuss any four major security threats that might face the system and for each threat state a countermeasure. (8 Marks)

QUESTION FOUR

- a) Discuss the concept of a distributed DBMS in respect to how data is stored and updated (6 Marks)
- b) A leading mobile phone service provider has been in existence for the last fifteen years over that period they have used a database to store all customer transactions. Advise on any four kinds of patterns that can be mined from the data. (8 Marks)
- c) Discuss the use of locks in concurrency control; elaborate on how locks work, the types of locks and any TWO problems that can be caused by locks. (6 Marks)

QUESTION FIVE

- a) Consider the following table structures:

Product(P_code, P_description, P_indate, P_price, P_quantity, V_code)

Vendor(V_code, V_name, V_contact, V_address)

P_code and V_code are the primary keys to the product and vendor tables respectively and V_code is the foreign key in the product table. Write SQL queries that will:

- Create the product table.
- Create a view that contains the names of the products to be ordered (use a reorder level of 50).
- Output the name of the product with the highest price.
- Output the average price of products supplied by a vendor whose code is 0034.
- Outputs the names of all products alongside the names of the vendors who supply them.
- Modify the data type of the attribute V_name to varchar(50).
- Delete the records of a vendor whose vendor code is 0098.
- Update the contacts of a vendor whose vendor code is 0198.
- Add a column called V_AccNo to the vendor table.
- Delete the column called V_AccNo from the vendor table.

(20 Marks)
