UNIVERSITY OF GHANA

B.A/BSc. FIRST SEMESTER UNIVERSITY EXAMINATIONS: 2017/2018

COMPUTER SCIENCE
CSIT 207: DATABASE FUNDAMENTALS
(3 CREDITS)

EXAMINER: C. KITCHER

TIME ALLOWED: TWO AND A HALF (2½) HOURS

Instruction
Answer Question One (1) and any other three (3) Questions

QUESTION 1 **[Short Answer questions]** **[25 marks]**

Write answers to this question clearly in your answer booklet.

a) A relational database consists of a collection of _____

b) A _____ in a table represents a relationship among a set of values.

c) The term _____ is used to refer to a row.

d) For each attribute of a relation, there is a set of permitted values, called the _____ of that attribute.

e) Database _____ is the logical design of the database, and the database _____ is a snapshot of the data in the database at a given instant in time.

f) Course(course_id, sec_id, semester)Here the course_id, sec_id and semester are _____ and Course is a _____

g) The tuples of the relations can be of _____ order.

h) A table is in _____ normal form when it is in _____ and there are no transitive dependencies.

i) Which type of key is a set of one or more attributes taken collectively to uniquely identify a record? _____

j) An attribute in a relation is a foreign key if the _____ key from one relation is used as an attribute in that relation.

k) A _____ integrity constraint requires that the values appearing in specified attributes of any tuple in the referencing relation also appear in specified attributes of at least one tuple in the referenced relation.

l) Student(ID, name, dept_name, tot_cred) In this schema which attribute forms the primary key? _____

m) The result of which operation contains all pairs of tuples from two relations, regardless of whether their attribute values match. _____

n) The most commonly used operation in relational algebra for projecting a set of tuple from a relation is _____

o) _____ provides a set of operations that take one or more relations as input and return a relation as an output.

p) An attribute A of datatype varchar(20) has the value "Avo" . The attribute B of datatype char(20) has value "Reed". Here attribute A has _____ spaces and attribute B has ____ __ spaces.

q) To remove a relation from an SQL database, we use the _____ command.

r) A table can have only one _____ key
s) According to the levels of abstraction, the schema at intermediate level is called ____
t) A _____ occurs when two keys hash to the same address.
u) In an E-R diagram a dashed line between entities indicate _____

v) Two common data models used at logical database design are _____ _____

QUESTION 2 **[25 marks]**

a) What is your understanding of a data model?
Explain clearly two (2) common data models currently used in industry. **[12 marks]**

a) An engineering consultancy firm supplies temporary specialized staff to bigger companies in the country to work on their project for certain amount of time. The table below lists the time spent by each of the company's employees at other companies to carry out projects. The National Insurance Number (NIN) is unique for every member of staff.

NIN	Contract No	Hours	Employee Name	Company ID	Company Location
616681B	SC1025	72	P. White	SC115	
674315A	SC1025	48	R. Press	SC115	
323113B	SC1026	24	P. Smith	SC23	

616681B	SC1026	24	P. White	SC23	

I. Find the Primary Key (PK) for this relation and explain your choice. **[2 marks]**

II. Find the fully functional dependencies on the PK, the partial dependencies on the PK a nd the transitive dependencies. **[5 marks]**

III. Normalise the table to 3NF – Show all intermediate steps.

And show the primary and foreign keys in all the relations. **[6 marks]**

QUESTION 3 **[25 marks]**

Consider the following database with primary keys underlined:
Project(P-No, P-Name, P-Incharge)
Employee(E-No, E-Name, E-Dob)
Assigned_To(P-No, E-No)

a) Write the relational algebra expression for the following :

I. List details of employees and the projects they work on. **[2 marks]**

II. List names only of employees who were born (E-Dob) in July. **[2 marks]**

a) Write the SQL statement to do the following:

I. List details of projects where the P-Incharge contains four characters ending with the letter 'k'. **[2 marks]**

II. Display the number of projects for each P-Incharge, where the number of projects is more than one. **[3 marks]**

III. List the Name of employees who are currently not assigned to any project. **[3 marks]**

IV. Define the table Assigned_To. Identify the primary key and any foreign keys. **[4 marks]**

V. Create a view NoOfProjects(Emp_No, Projects), where Emp_No is the E-No of the em ployee and Projects is the number of projects assigned to the employee. **[3 marks]**

a) Assume the following data in tables Employee and Assigned_To

EMPLOYEE: (2345, Boakye, 23/6/62), (2456, John, 4/4/77), (2678, Elsie, 16/3/82)

ASSIGNED_TO: (CD203A, 2345), (IA2015, 2778)

Evaluate these relational algebra expressions, showing any intermediate stages:

I. Employee =X= Assigned_To **[4 marks]**
II. ($\prod_{E\text{-}No}$(Employee)) ($\prod_{E\text{-}No}$(Assigned_To)) **[2 marks]**

QUESTION 4 **[25 marks]**

a) What is a recursive relationship? Give three examples, showing the 3 types of connectivity in a recursive relationship. **[8 marks]**

a) Use a diagram to explain data independence and the three levels of data abstraction in a data model **[8 marks]**

a) Provide a comparison of Access methods between three (3) different file organization structures that may be used for physical database design **[9 marks]**

QUESTION 5 **[25 marks]**

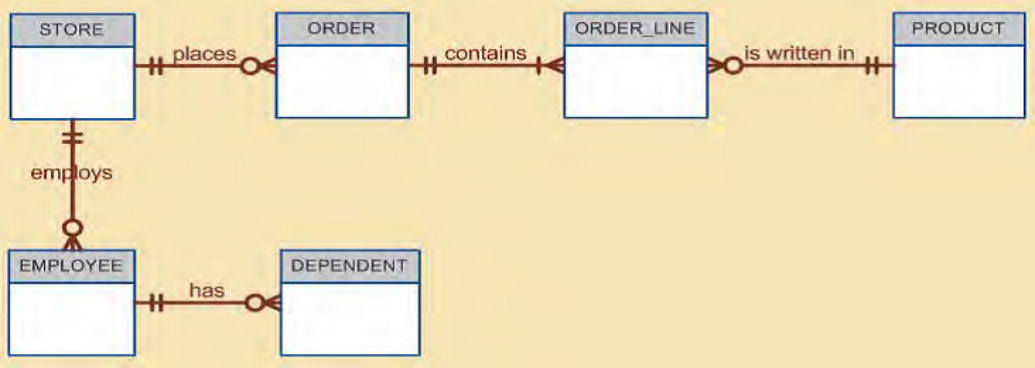
a) Give four (4) advantages and one (1) disadvantage of a database management system (DBMS). **[5 marks]**

a) UPS prides itself on having up-to-date information on the processing and current location of each shipped item. To do this, UPS relies on a company-wide information system. **[20 marks]**

- Shipped items are the heart of the UPS product tracking information system.
- Shipped items can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date.
- Shipped items are received into the UPS system at a single retail center.
- Retail centers are characterized by their type, unique ID, and address.
- Shipped items make their way to their destination via one or more standard UPS transportation events (i.e., flights, truck deliveries).
- These transportation events are characterized by a unique schedule Number, a type (e.g, flight,truck), and a delivery Route.

Create an Entity Relationship diagram. using Crow's Foot notation, that captures this information about the UPS system. Be certain to indicate identifiers and cardinality constraints.

QUESTION 6 **[25 marks]**



a) Using the Ordering management system above: **[13 marks]**

I. Write the 6 cardinalities that are appropriate for the 3 relationships “places”, “contains” and “is written in”.

II. Write three business rules reflected in this ERD.

III. Identify one composite or bridge entity and one weak entity in the ERD.

IV. What would be the composition of the primary keys for the bridge and weak entities i n (iii)?

V. What is a foreign key? Give 2 examples from this model

a) i. Name three (3) security threats to databases. **[12 marks]**

ii. What is discretionary access control (DAC) in a database system?

iii. Explain briefly two mechanisms of implementing DAC.