



This exam paper must not be removed from the venue

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First Name _____

School of Information Technology and Electrical Engineering EXAMINATION

Semester One Final Examinations, 2017

INFS7900 Information Systems

This paper is for St Lucia Campus students.

Examination Duration: 120 minutes

Reading Time: 10 minutes

Exam Conditions:

This is a Central Examination

This is a Closed Book Examination - no materials permitted

During reading time - write only on the rough paper provided This examination paper will be released to the Library

Materials Permitted In The Exam Venue:

(No electronic aids are permitted e.g. laptops, phones)

Calculators - No calculators permitted

Materials To Be Supplied To Students:

Instructions To Students:

Additional exam materials (eg. answer booklets, rough paper) will be provided upon request.

Write the answers in the space provided in the examination paper.

For Examiner Use Only

Question Mark

Total _____

QUESTION 1. (8 marks) **ER Modelling**

Question 1-1. (6 Marks) Given the following specification, construct an ER diagram. You can assume that the specification below is complete and contains all of the information that is needed to construct the diagram. Do not include any additional concepts of your own.

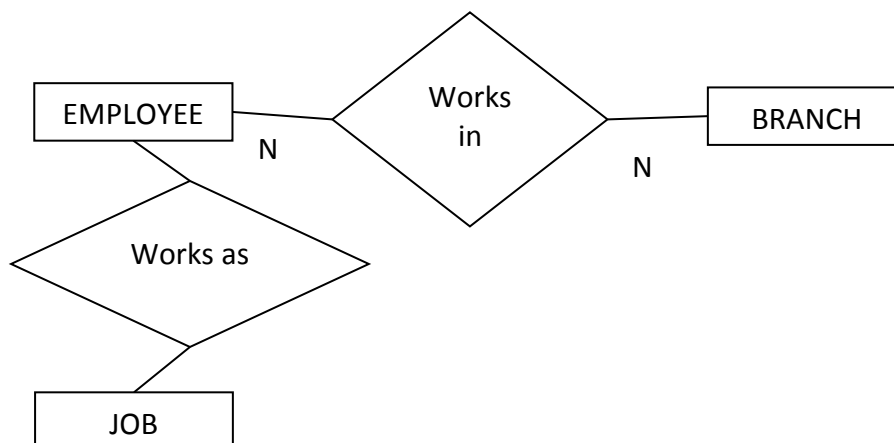
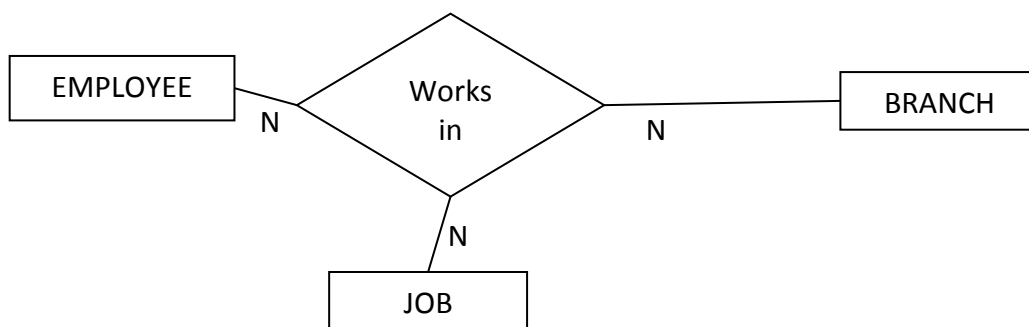
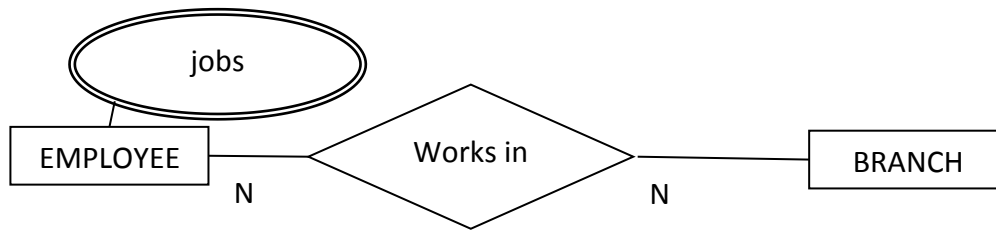
Specification: *Automata Inc. produces specialty vehicles by contract. The company operates several departments, each one of which builds a particular vehicle, such as a limousine, a truck, a van, or an RV. The name of the department is the same as the name of the vehicle it builds. Company budget and location of each department is also stored. When a new vehicle is built, the department places an order with the Purchasing Department to request specific components. Automata's Purchasing Department is interested in creating a database to keep track of orders and to accelerate the process of delivering materials.*

Each order is given a unique order number. The date on which the order was placed is also stored. When received by the Purchasing Department, the order can contain several different items (one per line). Each line of the order also specifies the quantity being ordered for that item. An inventory is maintained to keep track of item quantities on hand. When an order comes in, it is checked to determine whether the requested item(s) is (are) in inventory. If an item is not in inventory, it must be ordered from a supplier. Each item may have several suppliers. Every item is identified by a unique item code in the inventory. In addition the description and unit price of each item is also maintained. All suppliers that Automata Inc deals with are given a supplier id in the database. Name of supplier companies, address and contact phone number is also stored.

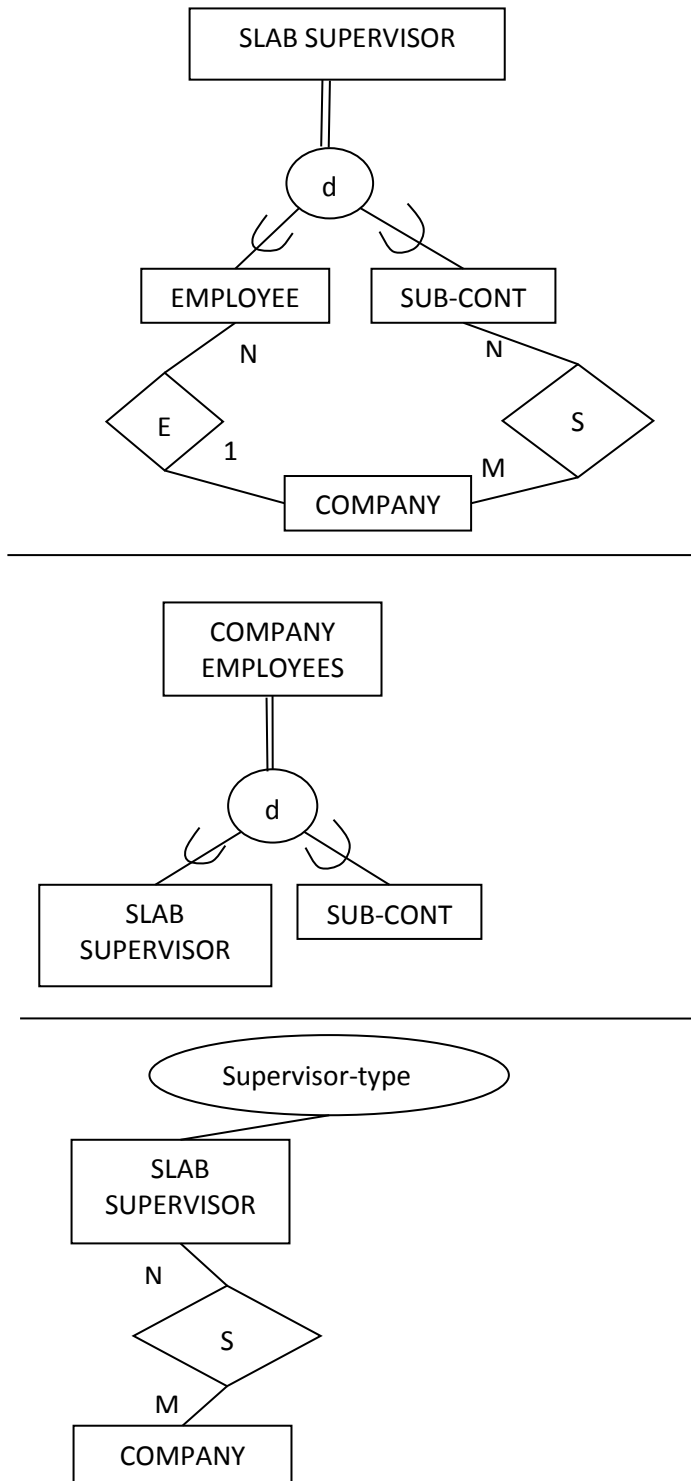
Please draw your ER diagram below.

Question 1-2. (2 Marks) Circle the ER diagram that would best represent the following specification. Detailed attributes have been omitted for simplicity.

- (i) **Specification:** An employee works in several branches. The employee may be given a different job for every branch he/she works in. The employee may even be given many different jobs for the same branch.



- (ii) **Specification:** The building industry has several registered slab supervisors. Some of these supervisors work exclusively as employees of individual companies, whereas others work as sub-contractors for multiple companies.

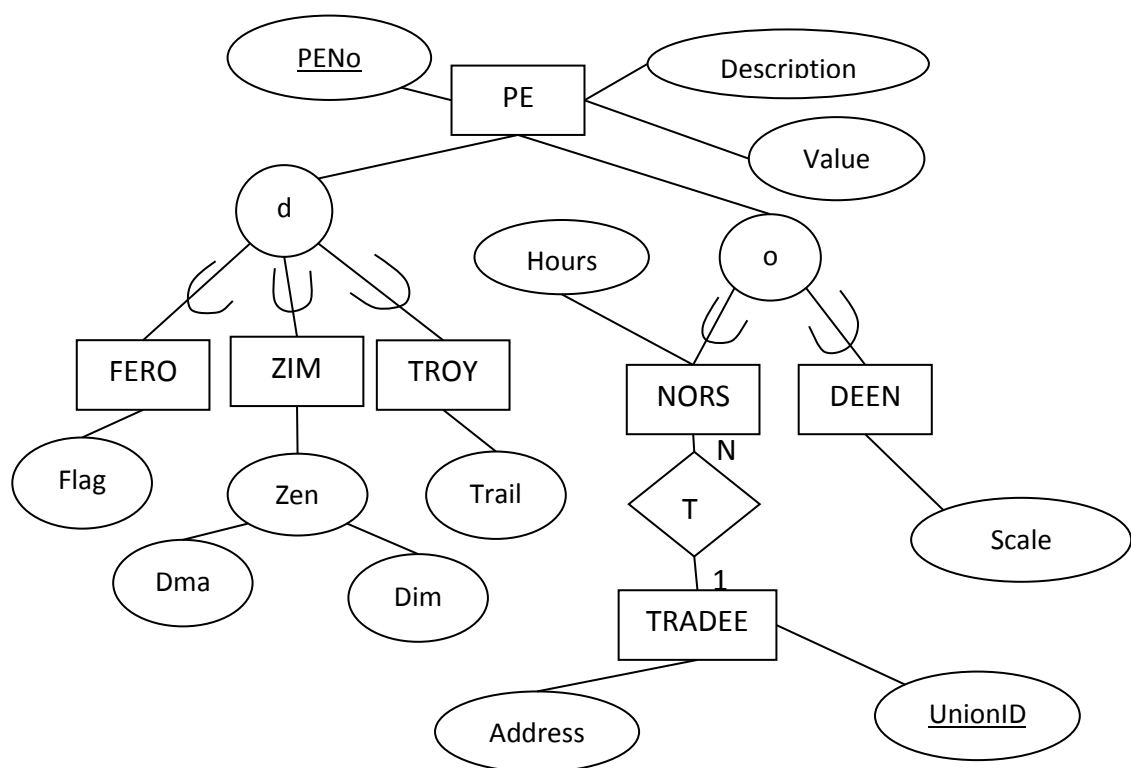


QUESTION 2. (8 Marks) **ER to Relational Mapping**

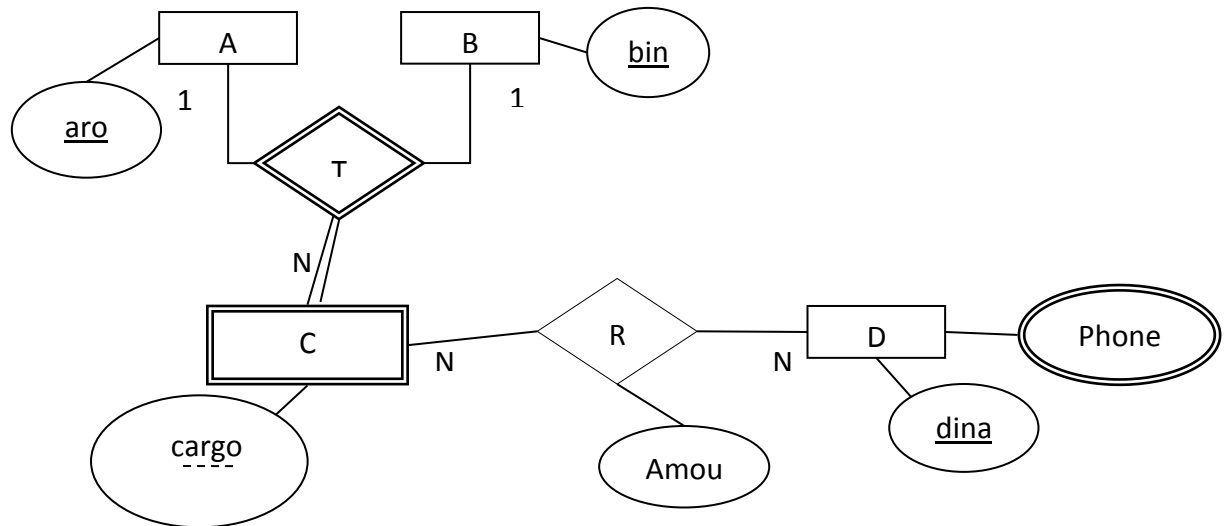
Map the following ER diagram into a relational database schema and specify all primary keys and foreign keys. Use the following notations in your schema:

- Attribute(s) that form the primary key should be underlined (do not underline other candidate keys).
- Display referential integrity constraints by drawing a directed arc from each foreign key to the relation it references. The arrowhead should point to the primary key of the referenced relation.

Do not show the schema in progress after each step. Only give the final relational database schema.

2-1 (6 Marks)

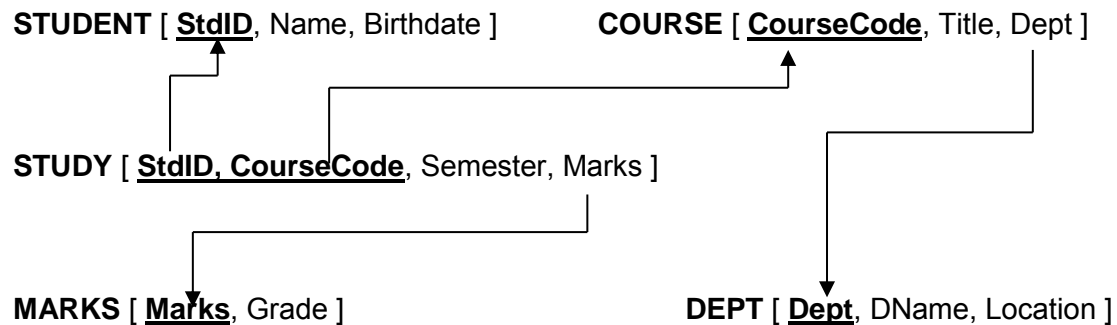
Provide your answer here:

2-2 (2 Marks)**Provide your answer here:**

QUESTION 3. (6 Marks) **Relational Model**

The schema and instances for a relational database are given below. The primary keys are underlined, and referential integrity constraints are represented by directed arcs from each foreign key to the primary key of the relation it references.

The domain of attribute “BirthDate” consists of valid dates in the format “DD/MM/YYYY”. (DD for Day, MM for Month and YYYY for year e.g. 27/01/1975). The domain of attribute “Grade” consists of integers between 1 and 7.



STUDENT

<u>StdID</u>	Name	Birthdate
303428	John	3/02/1975
303099	Susan	14/09/1964
803427	Cholena	26/11/1980

COURSE

<u>CourseCode</u>	Title	Dept
INFS1200	Intro to Inf Sys	CSEE
INFS7900	Intro to Inf Sys	INEN

STUDY

<u>StdID</u>	<u>CourseCode</u>	Semester	Marks
303428	INFS1200	1	68
303099	INFS7900	2	85
803427	INFS1200	2	74

DEPT

<u>Dept</u>	DName	Location
CSEE	Computer Science and Electrical Engineering	St Lucia
INEN	Information Environments	Ipswich
ECON	Economics	St Lucia

MARKS

<u>Marks</u>	Grade
81	6
68	4
85	7
74	5

Assume that the following operations are done on the *initial* instances as shown above. Operations from one part of the question do not affect those appearing in other parts of the question.

(i) Insert the tuple <"DATA7001", "Intro to Data Science", "ITEE"> into relation "COURSE".

Does this operation violate an integrity constraint? Write either "yes" or "no": _____

If yes, state the type of constraint violated: _____

and briefly describe how the constraint was violated: _____

(ii) Delete the tuple <"INFS1200", "Intro to Inf Sys", "CSEE"> into relation "COURSE".

Does this operation violate an integrity constraint? Write either "yes" or "no": _____

If yes, state the type of constraint violated: _____

and briefly describe how the constraint was violated: _____

(iii) Insert the tuple <65, "5"> into relation "MARKS".

Does this operation violate an integrity constraint? Write either "yes" or "no": _____

If yes, state the type of constraint violated : _____

and briefly describe how the constraint was violated: _____

(iv) Insert the tuple <803433, INFS7900, 1, 85> into relation "STUDY".

Does this operation violate an integrity constraint? Write either "yes" or "no": _____

If yes, state the type of constraint violated: _____

and briefly describe how the constraint was violated: _____

(v) Delete the tuple <"INFS1200", "Intro to Inf Sys", "CSEE"> from "COURSE".

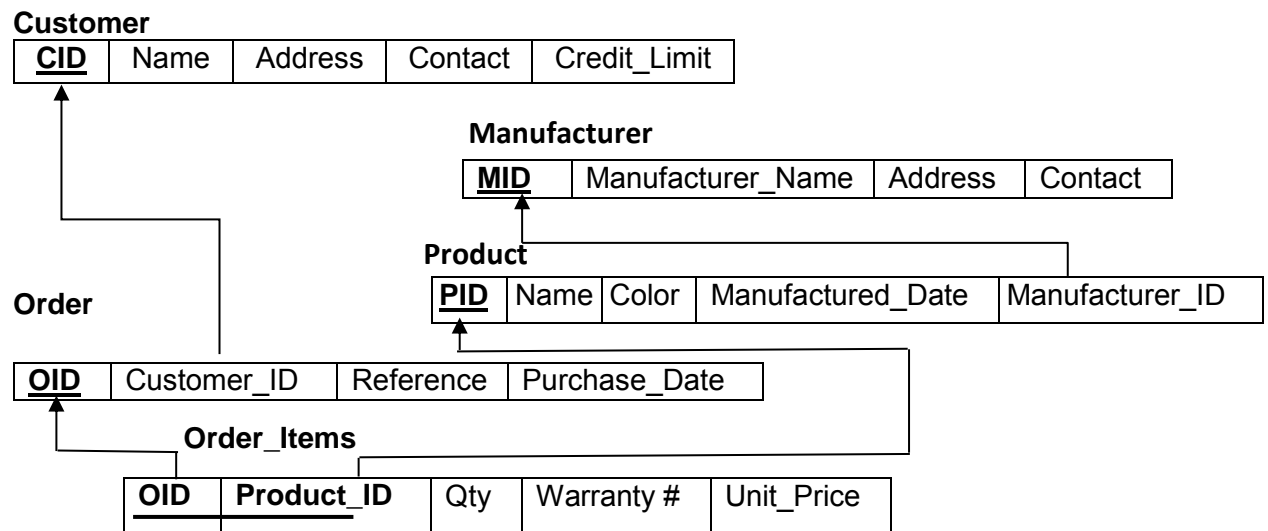
Does this operation violate an integrity constraint? Write either "yes" or "no": _____

If yes, state the type(s) of constraint(s) violated: _____

and briefly describe how the constraint was violated: _____

QUESTION 4. (16 Marks) **SQL Programming**

You are given the following relational database schema for recording customer purchasing of product items.

**Question 4-1.** (4 Marks)

Write an SQL statement to find the details of Manufacturers who produced products that are purchased by customers whose credit limit is less than 50,000 (i.e., Credit_Limit < 50,000).

Question 4-2. (4 Marks)

Write an SQL statement to calculate and display the average price of the orders in 2016 (i.e., *year(Order.Purchase_Date) = 2016*).

Question 4-3. (4 Marks)

Write an SQL statement to find the details of customers who have purchased the products manufactured by the same manufacturers.

Question 4-4. (4 Marks)

Write an SQL statement to find out the details of orders that have recorded the highest Unit_Price.

QUESTION 5. (6 Marks) **FD & Normalization****Question 5-1.** (3 Marks)

Consider the following relation R and functional dependencies.

Relation: R [Component, Weight, Angle, Rotation]

FDs:

F1: Component \rightarrow Angle, Rotation, Weight

F2: {Angle, Rotation} \rightarrow Component, Weight

F3: Weight \rightarrow Angle

- (i) Find all candidate keys for relation R.
- (ii) What is the highest normal form of relation R?
- (iii) Decompose R (if required) into BCNF relations. For each decomposition you make, identify the normal form of the original and resulting relations and specify the keys. Give a brief explanation of each normalization step.

Question 5-2. (3 Marks)

Consider the following relation R and functional dependencies.

Relation: $R = (A, B, C, W)$

FDs: $FD = \{W \rightarrow A, BC \rightarrow W, AB \rightarrow CW\}$

- (i) Find all candidate keys for relation R.
- (ii) What is the highest normal form of relation R?
- (iii) Decompose R (if required) into BCNF relations. For each decomposition you make, identify the normal form of the original and resulting relations and specify the keys. Give a brief explanation of each normalization step.

Question 6. (6 Marks) Fundamentals

Briefly describe the following concepts and answer the questions.

- [illegible]

(iv) What is an Attribute Closure? What is it used for?

(v) What does it mean if a relation is in 2NF?

(vi) In designing a relational database, what is the normalization process used for?

(vii) In SQL programming, what is an aggregation query?

(viii) What is DBMS used for?

END OF EXAMINATION