THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

This exam paper must not be removed from the venue

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Student Number |__|__|__|__|__|__|__|__|

Family Name _____

First Name _____

School of Information Technology and Electrical Engineering

EXAMINATION

Semester Two Final Examinations, 2016

INFS1200 Introduction to 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 - specified 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.

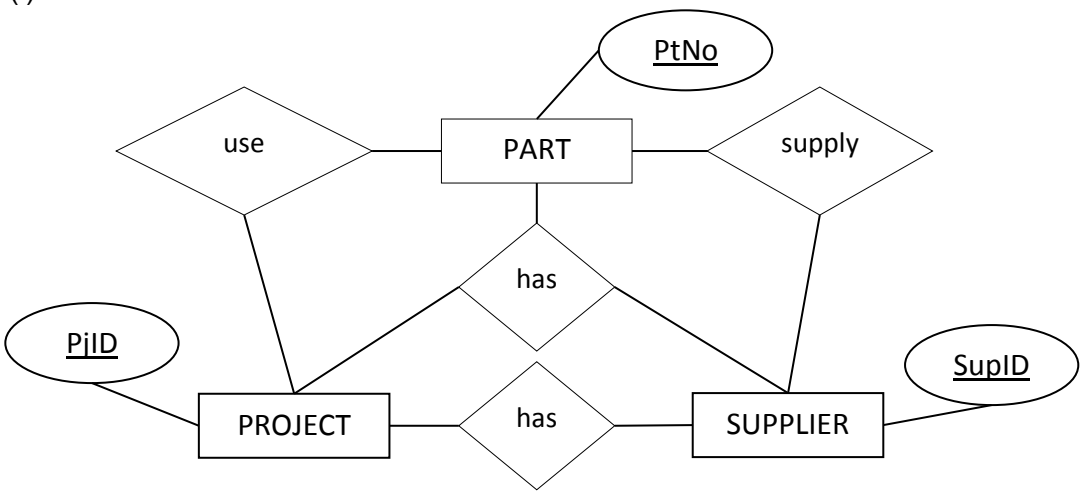
Specification: A company database needs to store information about employees (identified by *ssn*, with *salary* and *phone* as attributes); departments (identified by *dno*, with *dname* and *budget* as attributes); and children of employees (with name and *age* as attributes). Employees work in departments; each department is managed by an employee; a child must be identified uniquely by name when the parent (who is an employee; assume that only one parent works for the company) is known.

Please draw your ER diagram below.

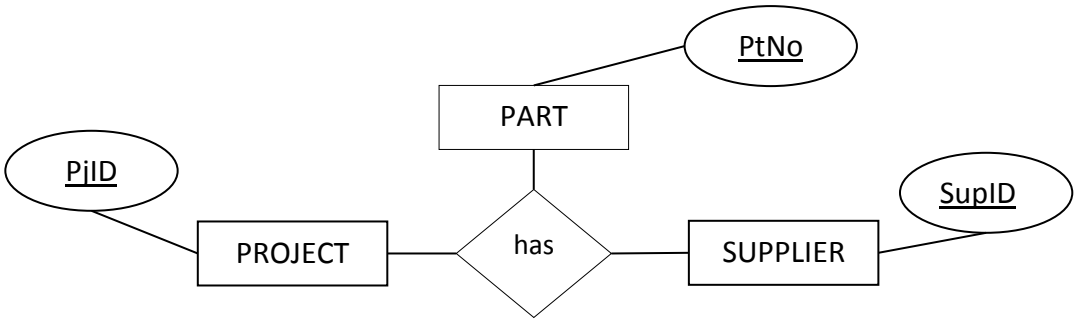
Question 1-2. (2 Marks) Circle the ER diagram that would best represent the following specification. Detailed attributes have been omitted for simplicity.

Specification: A project uses parts that are supplied by suppliers. A project may use many parts and may have many suppliers. A project may even have a different supplier for each part it is using.

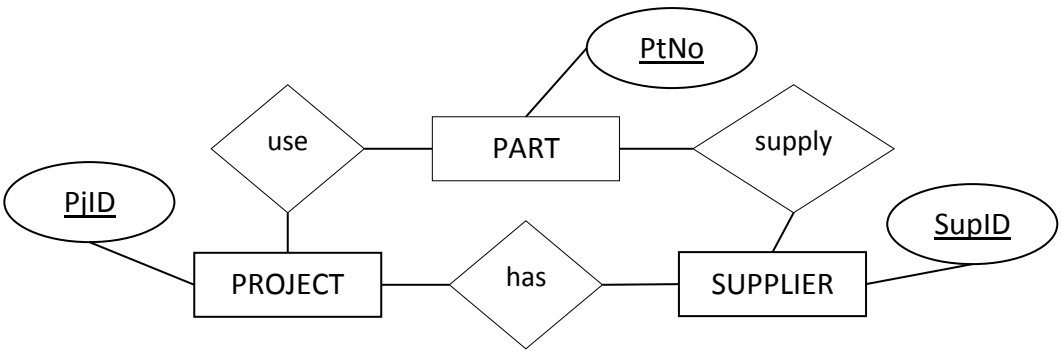
(i)



(ii)



(iii)

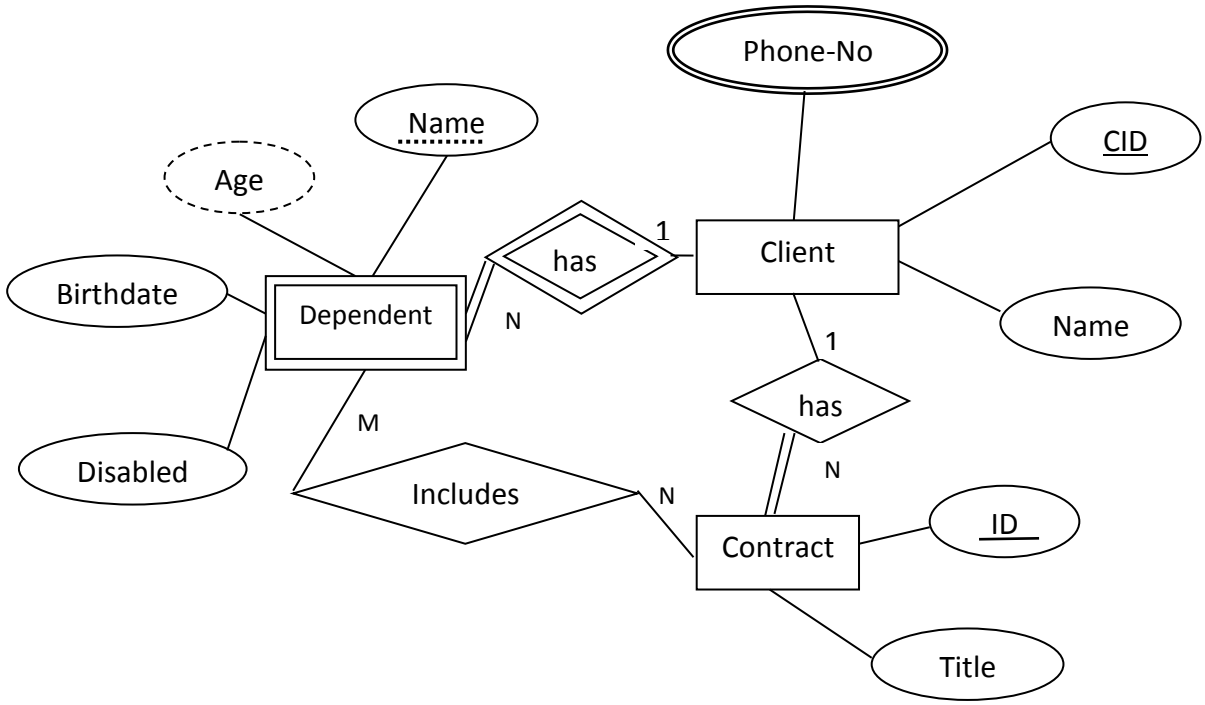


QUESTION 2. (8 Marks) **ER to Relational Mapping**

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.

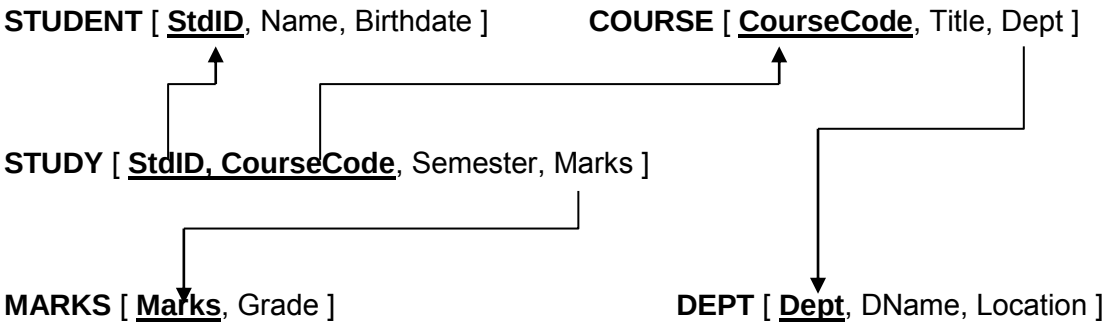


QUESTION 3. (6 Marks) **Relational Model**

Question 3-1. (3 Marks)

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

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

COURSE

CourseCode	Title	Dept
INFS1200	Intro to Inf Sys	CSEE
INFS7900	Intro to Inf Sys	InfEnv

STUDY

StdID	CourseCode	Semester	Marks
303428	INFS1200	1	68
303099	INFS7900	2	85
803427	INFS1200	2	74

DEPT

Dept	DName	Location
CSEE	Computer Science and Electrical Engineering	St Lucia
InfEnv	Information Environments	Ipswich
Econ	Economics	St Lucia

MARKS

Marks	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 <39908765, Sarah, 19/01/1971> into relation "STUDENT".

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) Insert the tuple <"ECO7800", "Macro Economics", "Econ"> 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 <5, "1"> 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 <303428, null, 89, 7> 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 3-2. (3 Marks)

Given the following relational database schema:

REEF [reef-name, latitude, longitude, 2006-bleached-area, Mean-temperature]

REEFTEMP [reef-name, date-of-reading, temperature-reading]

CORAL [coral-code, coral-name, thermal-threshold]

CORALSAMPLING [sample-no, coral-code, reef-name, date-of-sampling, bleach-percent]

Identify the following. You may use the relation name as a prefix if required e.g. *REEF.reef-name.*

(i) A foreign key: _____

(ii) A composite primary key: _____

(iii) A non-key attribute: _____

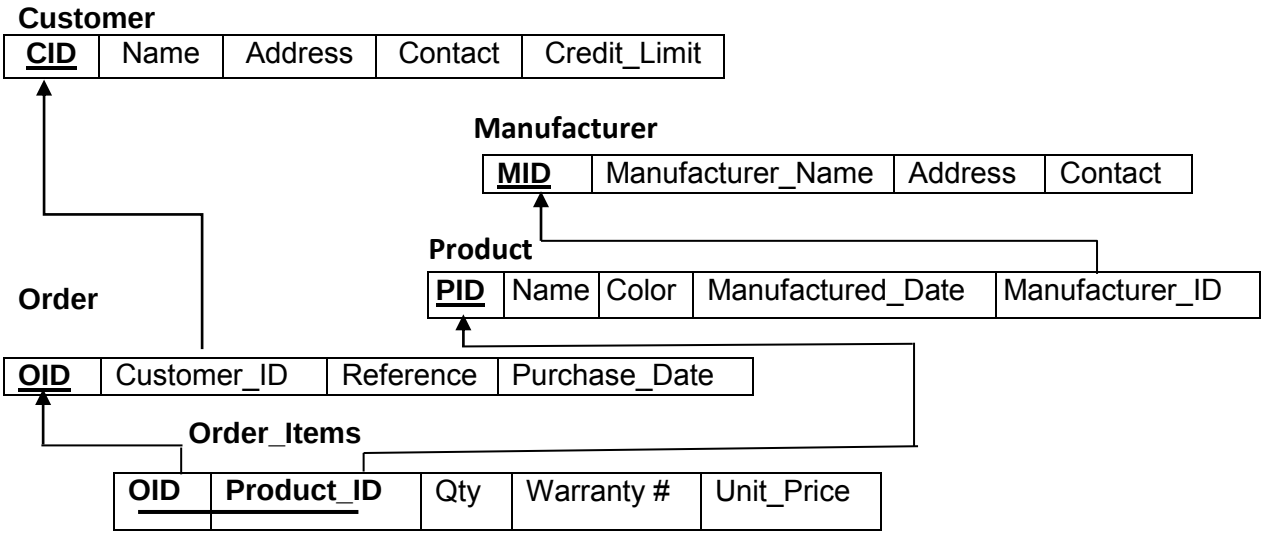
(iv) A candidate key: _____

(v) A super key: _____

(vi) A minimal key: _____

QUESTION 4. (8 Marks) **SQL Programming**

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



Question 4-1. (2 Marks)

Write an SQL statement to find details of products that were bought by customers in year 2015 (i.e., *year(Order.Purchase_Date)=2015*).

Question 4-2. (2 Marks)

Write an SQL statement to find the names and addresses of customers who bought products in the same year that the products were manufactured (i.e., *year(Order.Purchase_Date) = year(Product.Manufactured_Date)*).

Question 4-3. (2 Marks)

Write an SQL statement to find the names and credit limits of customers who bought red colour HD-DVD Player (i.e., *Product.Name = 'HD-DVD Player' and Product.Color = 'Red'*) that have unit price less than $600 (i.e., *Order_Item .Unit_Price < 600*).

Question 4-4. (2 Marks)

Write an SQL statement to find out the details of customers who purchased products manufactured by Hitachi in different orders (i.e., at least two orders).

QUESTION 5. (6 Marks) **FD & Normalization**

Question 5-1. (3 Marks)

Consider the following relation R and functional dependencies.

Relation: R = (X, Y, Z, S)

FDs: FD = { $XY \rightarrow S$, $Y \rightarrow Z$}

(i) Find all candidate keys for relation R.
(ii) What is the highest normal form of relation R?
(iii) Decompose R (if required) into 3NF 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 = (X, Y, Z, W)

FDs: FD = {W→X, YZ→W, XY→ZW}

(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. (14 Marks) **Fundamentals**

Question 6-1. (7 Marks)

Briefly answer the following questions.

(i) What are the foreign keys in a relational model? How are they used in SQL queries?

(ii) What is a functional dependency (FD)? What is it used for? How is it enforced? Is it specified within an ER Diagram?

(iii) What is an FD closure? What is it used for?

(iv) What does it mean if a relation is in 3NF?

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

(vi) In SQL programming, what is a correlated SQL sub-query?

(vii) In SQL programming, can every nested SQL query be rewritten as a join query? (A join query is a query with joins of multiple relations.)

Question 6-2. (7 Marks)

Define the following terms and briefly describe their functions in the relational database technology.

(i) Tuple

(ii) Super key

(iii) Candidate key

(iv) Referential integrity

(v) Relation

(vi) Database state

(vii) Attribute

END OF EXAMINATION