THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

This exam paper must not be removed from the venue

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Family Name _____

First Name _____

School of Information Technology and Electrical Engineering

EXAMINATION

Semester Two Final Examinations, 2017

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 - 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.

Answer all questions

For Examiner Use Only

Question	Mark

Total _____

PART I – FUNDAMENTALS (10 Marks)

Question 1. The schema and instances for a relational database are given below.

An online Puzzle-Solving system has been developed that contains a database of challenging puzzles. Both students and teachers can register in this system and obtain a login and working space. Once a solver opens a puzzle, it appears in their space in a so-called "unsolved" list. Solvers can have unlimited attempts to solve the puzzle and submit their solution. When and if the right solution is submitted, the Puzzle is transferred to the "solved" list for that solver. Dates of both first opening the puzzle and of solving the puzzle are recorded in this system.

There are three levels of Puzzle "Difficulty", namely Simple, Advanced and Hard. The "Solutions" attribute in the PUZZLE relation cannot be retrieved by any solver, and are only used by the system to check solutions submitted by solvers. STUDENT and TEACHER are sub-classes of SOLVER. "Type" attribute in the SOLVER relation has two values, "Student" and "Teacher". "Year" in the STUDENT relation represents the year of study for the student e.g. first year, second year, honors, etc. "PName" is a unique Puzzle Name. A NULL value for the "DateSolved" attribute indicates that the given puzzle has not yet been solved by the given solver.

PUZZLE [PName, Difficulty, Solution]

SOLVERS [RegNo, Password, Name, RegistrationDate, Type]

STUDENT [RegNo, Year]

SOLVED [RegNo, PName, DateOpen, DateSolved]

TEACHER [RegNo, Position]

The sample instances below are indicative of the domain (data type) for the various attributes.

PUZZLE

PName	Difficulty	Solution
Bits	Simple	101
Astro	Advanced	Teapot
Travel	Hard	9 days

SOLVERS

RegNo	Password	Name	RegistrationDate	Type
112	XXVT	Steve	1/9/2007	STUDENT
227	9987	Lisa	1/9/2008	TEACHER

SOLVED

RegNo	PName	DateOpen	DateSolved
112	Bits	1/10/2007	5/10/2007
227	Bits	1/4/2009	3/4/2009
112	Astro	1/2/2008	16/5/2008

Tick the correct answer (2 Marks)

a) Inserting a tuple <Fron, Simple, rX2> into PUZZLE will result in the following

- ☐ Key constraint violation
- ☐ Domain constraint violation
- ☐ All of the above
- ☐ None of the above

b) Deleting the tuple with RegNo=112 in SOLVERS will result in the following

- ☐ Entity integrity constraint violation
- ☐ Referential integrity constraint violation
- ☐ All of the above
- ☐ None of the above

c) Updating the Password of tuple with RegNo=227 in SOLVERS from 9987 to XXVT will result in the following

- ☐ Key constraint violation
- ☐ Referential integrity constraint violation
- ☐ All of the above
- ☐ None of the above

d) Deleting the tuple with RegNo=227 in SOLVED will result in the following

- ☐ Entity integrity constraint violation
- ☐ Referential integrity constraint violation
- ☐ All of the above
- ☐ None of the above

Question 2.
Briefly explain the following in database systems (4 Marks)

a) Data independence

b) Views

c) Triggers

d) System Catalogue (or Data Dictionary)

Question 3. Use the schema below to give an example for the following concepts (4 Marks)

SUPPLIER [sno, sname, address]

PART [pno, pname, desc]

SUPPLY [sno, pno, qty]

a) Super Key

b) Minimal Key

c) Foreign Key

d) Non-prime Attribute

PART II – DATABASE DESIGN (20 Marks)

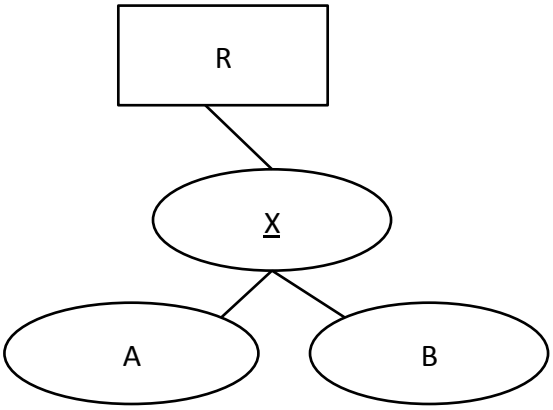
Question 4.

a) Identify three possible errors that a DFD can have. Explain your answer by drawing (part of) a DFD (3 Marks)

b) What is the difference between a context level DFD and a level 0 DFD. Explain with the help of an example (2 Marks)

Question 5.
a) Tick the option below that represents the best mapping for the given ER. (3 Marks)

i)



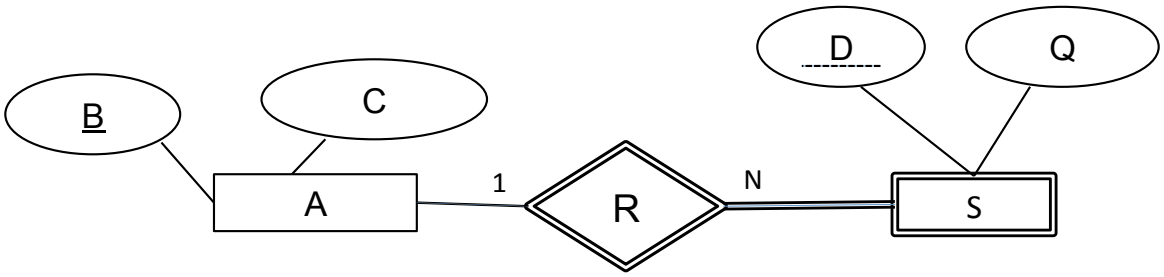
☐ R [X]

☐ R [A, B]

☐ X [A, B]

☐ R [A, B]

ii)



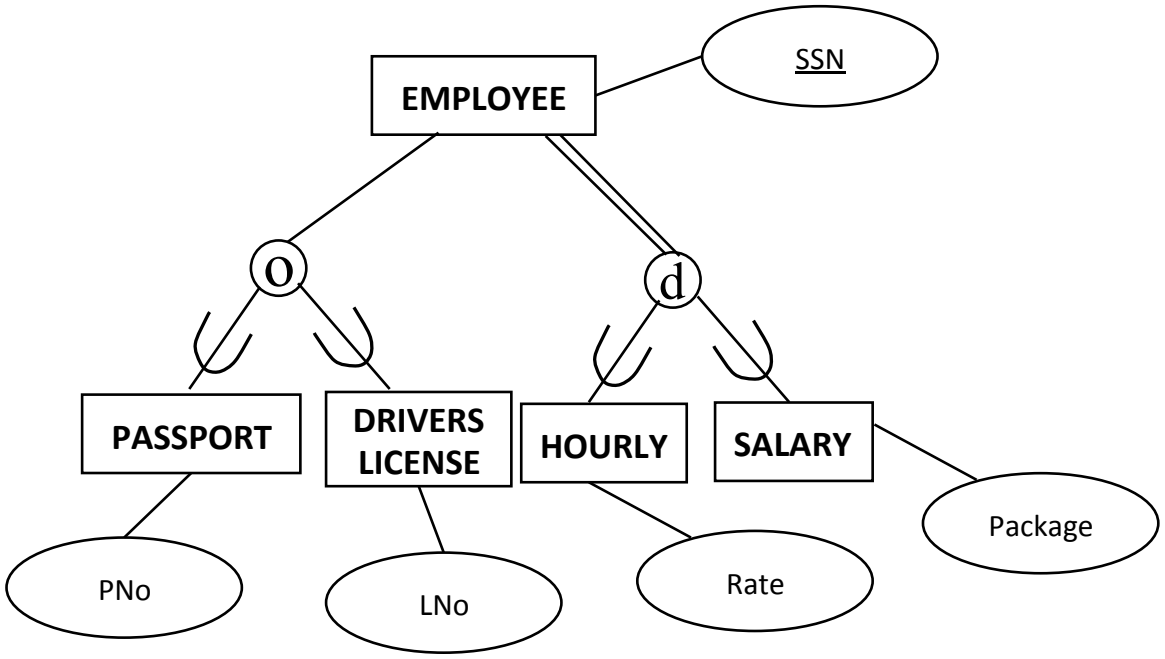
☐ A [B, C] S [D, Q]

☐ A [B, C] S [D, Q, B]

☐ A [B, D, C] S [D, Q]

☐ A [B, C] S [B, D, Q]

iii)



- ☐ HOURLY (SSN, Rate)
  SALARY (SSN, Package)
  EMPLOYEE (SSN, T1, PNo, T2, LNo)

- ☐ EMPLOYEE (SSN, Rate, Package, T1, PNo, T2, LNo)

- ☐ EMPLOYEETYPE (SSN, Rate, Package)
  EMPLOYEEID (SSN, PNo, LNo)

- ☐ HOURLY (SSN, Rate)
  SALARY (SSN, Package)
  EMPLOYEEPASS (SSN, PNo)
  EMPLOYEEPDL (SSN, LNo)

T1 and T2 represent attributes that contain a binary value (Y/N) of whether a tuple belongs to a subclass or not

b) Reverse Engineer the following Schema to make an ER. (3 Marks)

Profile(UserName, Age, country, spoken-languages, hobbies)

Message-board(Owner-username, message-id, content, sender-username, date)

Friend-list(Owner-username, Friend-username, Rating)

Community(Community-name, description)

Community-msg-board(Community-name, msg-id, username, date, content)

Community-user(Community-name, UserName)

Foreign keys:

Friend-list.Owner-username references Profile.UserName

Friend-list.Friend-username references Profile.UserName

Community-msg-board.msg-id references Message-board.message-id

Community-msg-board.Community-name references Community. Community-name

Community-user.Community-name references Community. Community-name

Community-user.UserName references Profile.UserName

Question 6. Construct an ER for the following UoD. (4 Marks)

Movies are identified by a unique movieID and store the movie's title, synopsis, main language and release date. Each cast or crew member is also given an ID and information such as their name, date of birth and biography is recorded. Awards have an awardID as well as information about the award's name and the organisation in charge of giving out the award. For the purposes of this example it is assumed that awards are always awarded to both a cast or crew member and the movie (e.g. the director of the best picture will receive the award). The year that any award is awarded is also recorded. Additionally, no cast/movie combination can receive the same award twice.

Question 7.

a) Give an example of a relation in 2NF but not 3NF. (1 Mark)

b) Determine all (minimal) keys for the following relation. (1 Mark)

i) R [A B C]

F = {AB → C, C → B}

ii) R [A B C D]

F = {C → D, BC → A}

c) Given the following:

RETAILTHERAPY [ProductID, ProductName, Manufacturer, RetailerName, URL, Price]

FD1: ProductID → {ProductName, Manufacturer}
FD2: RetailerName → URL
FD3: {ProductID, RetailerName} → Price

i) Determine the candidate key(s) for the given relation (0.5 Mark)

ii) Determine the highest normal form of the given relation (0.5 Mark)

iii) Decompose the given relation to achieve BCNF. You only have to show the final BCNF relations here (2 Marks)

PART III – SQL (10 Marks)

Question 8. Given the schema R1 (a, x) and R2 (b, a).
Tick the correct answer (2 Marks)

a) SELECT a FROM R1 WHERE a NOT IN (SELECT a FROM R2) is equivalent to

☐ SELECT R1.a FROM R1, R2 WHERE R1.a <> R2.a

☐ SELECT R1.a FROM R1 WHERE R1.a <> ALL (SELECT R2.a FROM R2)

☐ SELECT R1.a FROM R1 WHERE EXISTS (SELECT R2.a FROM R2 WHERE R1.a = R2.a)

☐ None of the above

b) 'What is the highest value of x' can be written in SQL as

☐ SELECT max (x) FROM R1

☐ SELECT x FROM R1 WHERE x > ALL (Select x FROM R1)

☐ All of the above

☐ None of the above

c) 'What is the average x for each a' can be written in SQL as

☐ SELECT a, avg (x) FROM R1

☐ SELECT a, avg (x) FROM R1 WHERE a > ALL (Select a FROM R1)

☐ SELECT a, avg (x) FROM R1 GROUP BY a

☐ None of the above

d) 'How many groups of tuples have the same value of a' can be written in SQL as

☐ SELECT b, count (a) FROM R2

☐ SELECT a, count (b) FROM R2

☐ SELECT b, count (*) FROM R2 GROUP BY b

☐ SELECT a, count (*) FROM R2 GROUP BY a

Question 9. The following schema and respective domain information is given:

RECIPE [recipeID, recipeName, preparationTime, difficulty, uploadDate, Style]

RESTAURANT [restaurantName, openingHours]

RESTAURANTRECIPE [restaurantName, recipeID, price]

RECIPE.difficulty can have the following values: Easy, Advanced, Hard

RECIPE.prepratonTime is given in hours

uploadDate is given in the format of dd/mm/yyyy

Same attribute name implies foreign key e.g.
RECIPEINGREDIENTS.recipeID references RECIPE.recipeID

Formulate the following questions in SQL. (2 Marks each)

a) List details of 'Advanced' recipes that have a preparation time of less than 4 hours.

b) Find the recipes that no restaurants offer.

c) What is the average price of recipes that have a difficulty of ‘Easy’.

d) Find the restaurant that offers at least *all* those recipes that restaurant ‘Seafood on George’ offers.

END OF EXAMINATION