University of Windsor

Mine

60-315 Winter 2018
Midterm 1 (Solution)
Examiner: Dr. C. I. Ezeife Given: Thursday, Feb. 8, 2018

Student Name:_____

Student Number:_____

INSTRUCTIONS (Please Read Carefully)
Examination Period is 1 hours 20 minutes
Answer all questions. Write your answers in the spaces provided in the question paper. This is closed book and closed notes test.

Total Marks =50. Total number of sections = 2
Please read questions carefully! Misinterpreting a question intentionally or unintentionally results in getting a "ZERO" for that question. Good Luck!!!

CONFIDENTIALITY AGREEMENT & STATEMENT OF HONESTY
I confirm that I will keep the content of this examination confidential.
I confirm that I have not received any unauthorized assistance in preparing for or writing this examination. I confirm knowing that a mark of 0 may be assigned for copied work.

_____ _____
Student Signature Student Name (please print)

_____ _____
Student I.D. Number Date

For marking purposes only (This part not to be filled by students)

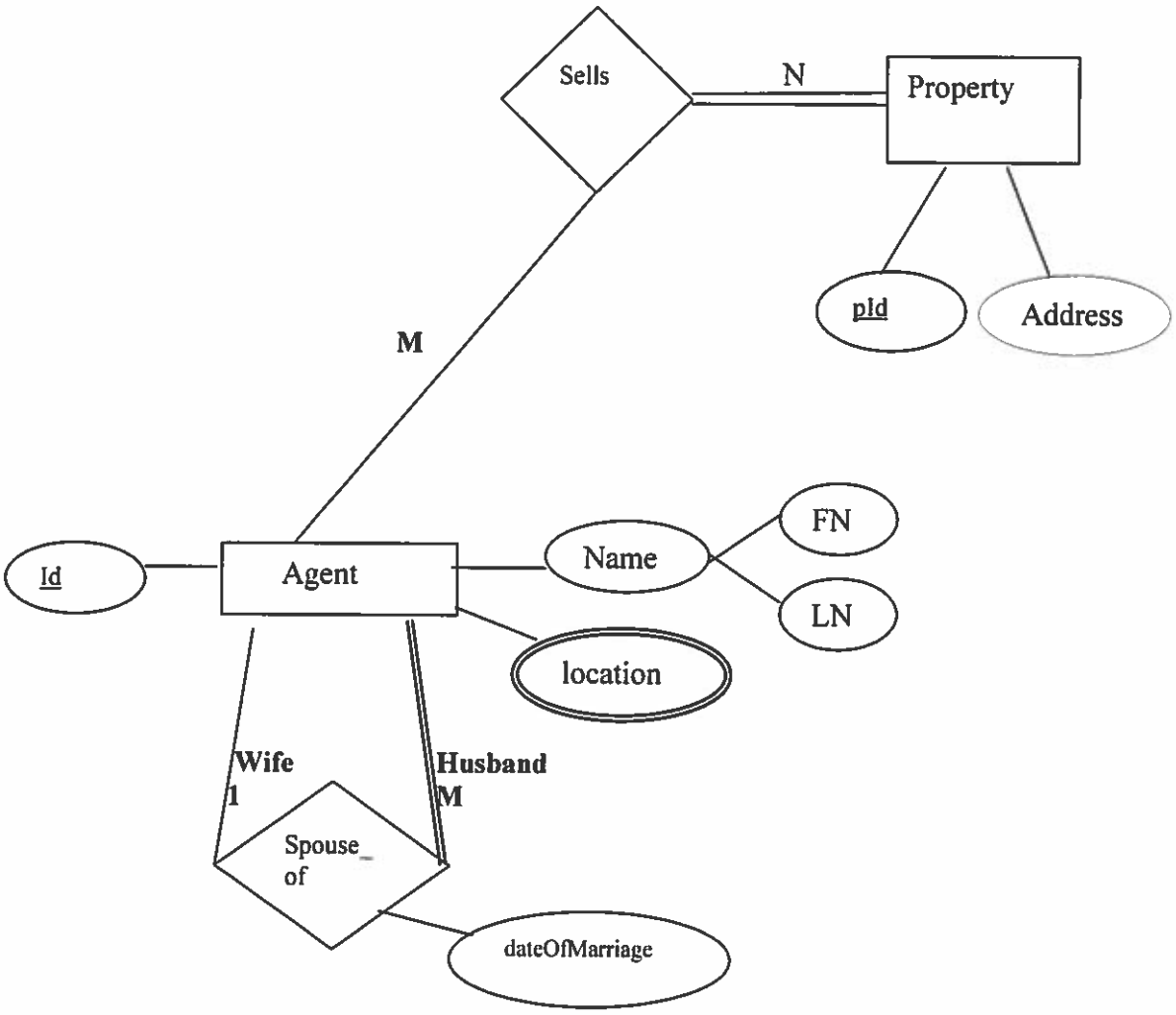
Question	Mark
Section A (15 marks for 10 multiple choice questions)	/15
Section B	
Que 1 (10 marks)	/10
Que 2 (10 marks)	/10
Que 3 (15 marks)	/15
Total	/50

Section A

15 marks for 10 Multiple Choice Questions. Each question in this section is worth 1.5 marks.

For Questions 1 – 10, circle the correct answer.

Figure A.1: ER diagram Agent-Sells-Property Database



Use the ER diagram of Figure A.1 to answer the next few questions

1. **Which statement best describes the cardinality constraint of the relationship *Sells* shown in Figure A.1 above?**

a. Each agent can sell only one property but each property can be sold by many agents.
b. Each agent can sell many properties and each property can be sold by many agents.
c. Each agent can sell many properties but each property can be sold by only one agent.
d. All of the above.
e. None of the above.

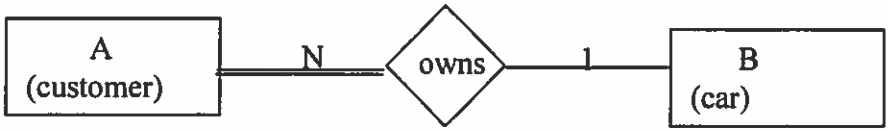
2. Which statement best describes the participation constraint of the relationship Spouse_of shown in Figure A.1 above?

a. Every husband agent can have a wife agent through spouse_of recursive relationship.
b. Every wife agent can have a husband agent through spouse_of recursive relationship.
c. Only some husband agents can have wife agents through spouse_of recursive relationship.
d. All of the above.
e. None of the above.

3. Which statement best describes the entities and relationships in Figure A.1 above?

a. An agent is a weak entity.
b. Every property has to be sold by some agents to be in the database.
c. Location of agent is a composite attribute.
d. All of the above.
e. None of the above.

Figure A.2 :



4. From the database on ER diagram of Figure A.2, it can be inferred that:

a. No customer owns a car.
b. Only some customers own a car.
c. Every customer owns a car.
d. Most customers own a car.
e. None of the above

5. A database management system (dbms) is:

a. Text editors and compilers
b. Data definition, data manipulation language and data model

c. **Word processor and power point**
d. **a set of software for building databases and its applications**
e. **none of the above**

6. The 3 levels of data architecture for representing data by the dbms are called:
   a. **First, second and third levels**
   b. **Foot, middle and top levels**
   c. **External, conceptual and physical (or internal) levels**
   d. **All of the above**
   e. **none of the above**

7. **Each column of a database table schema has a specific range of values known as the**
   a. **numbers**
   b. **characters**
   c. **attribute domains**
   d. **fields**
   e. **none of the above**

8. **Some of the main advantages of using a database management system as opposed to the traditional file system of running programs with data in a file are:**
   a. **Using programming languages such as JAVA to create database applications**
   b. **Provision of data independence**
   c. **Replication of data and programs**
   d. **Use of the internet**
   e. **none of the above**

9. **Example of a database management systems (dbms) is:**
   a. **NOSQL dbms**
   b. **Relational dbms**
   c. **Object oriented dbms**
   d. **all of the above**
   e. **none of the above**

10. **In a database, the 3-level data architecture allows us to define the simple database "to track cars owned by customers" using the dbms data model at the conceptual level. An external level query view of this database is:**

    a. **Print all courses taken by students**
    b. **Print all books borrowed by students**
    c. **Print all cars owned by a customer**
    d. **All of the above**
    e. **None of the above**

Section B (35 marks):
This section has 3 questions :

1. **(10 marks)** Consider the following set of requirements for a UNIVERSITY database that is used to keep track of students' transcripts. This is similar but not identical to the database shown in the Figure 1.2 in the book used in class:

(Note : 3 marks for correct entity with attributes and 4 marks for correct relationship with attributes identifications, 3 marks constraint on edge labels). Penalize incorrect use of symbols and others accordingly.

Marking scheme

(a) The university keeps track of each student's name, student number, social security number, current address and phone, permanent address and phone, birthdate, sex, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and zip of the student's permanent address, and to the student's last name. Both social security number and student number have unique values for each student.

(b) Each department is described by a name, department code, office number, office phone, and college. Both name and code have unique values for each department.

(c) Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of course number is unique for each course.

(d) Each section has an instructor, semester, year, course, and section number. The section number distinguishes different sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.

(e) A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3, 4 for F, D, C, B, A, respectively).

Design an ER schema for this application, and draw an ER diagram for that schema.
Specify key attributes of each entity type and structural constraints on each relationship type.Some assumptions to consider are:
Assumption applicable to the following ER-diagram are :

1. A department can have 0 to n minor students.
2. A department can have 0 to n major students.
3. A student can major in exactly 1 department.
4. A student can minor in exactly 1 department.
5. A department can have 0 to n courses
6. A course can have exactly 1 department
7. A section belongs to exactly 1 course
8. A course has 0 to n sections
9. A section has 0 to n grades and 0 to n ~~grades~~ students
10. A grade can belong to 0 to n sections and 0 to n students.
11. A student can have 0 to n grades and 0 to n sections.

Feel free to use either the simple or the alternative notation for constraints.
Hint (just to assist. This was taught in class and in the notes): the alternative notation involves associating a pair of integer number (min, max) with each participation of entity E1 (eg. student),

in a relationship type R (eg major-dept) with entity E2 (dept). The numbers mean that for each entity e in E1 (eg student), e must participate in at least min and at most max relationship instances in R (eg. major_in) that are associated with entitites E2 (dept) at any point in time.

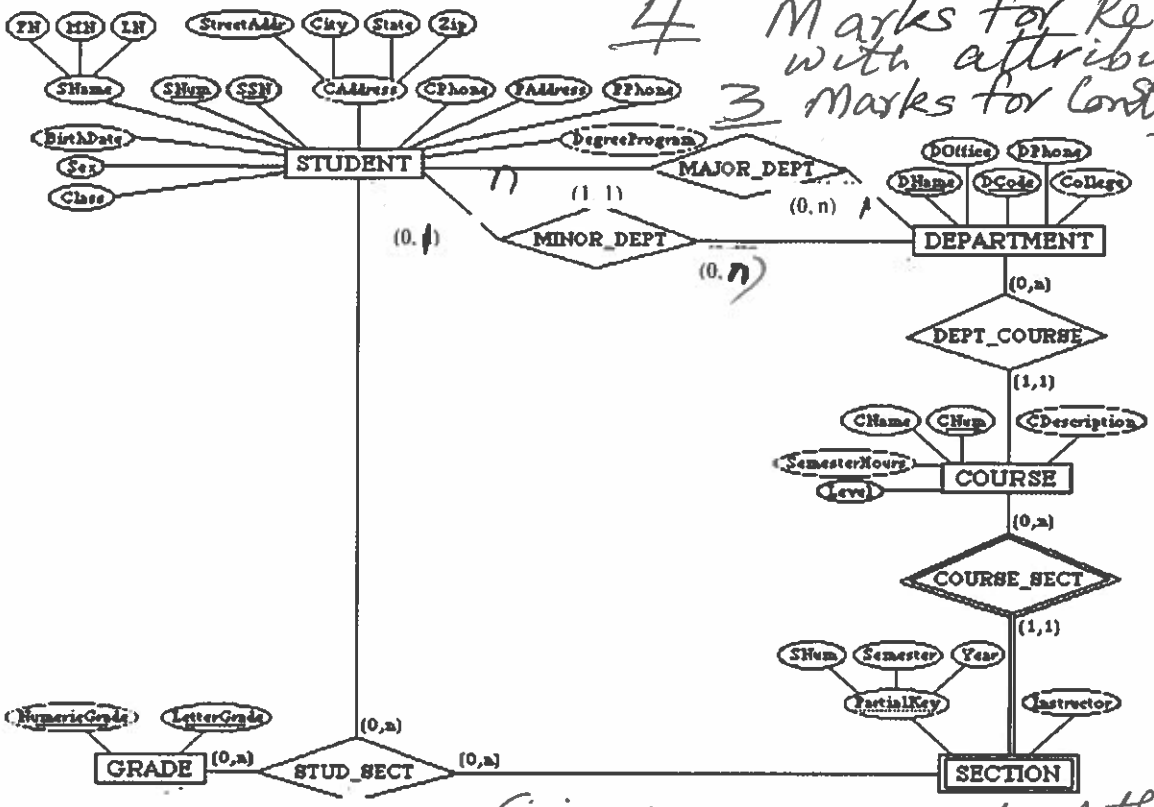
Solution:
Draw your ER diagram here with all entities, relationships, and their attributes and the constraints on the edges.

Solution:
The left edge label of STUDENT and MAJOR_DEPT is n or (1, 1) in alternative notation, and the right edge label of MAJOR_DEPT and DEPARTMENT is 1 or (0, n) in alternative notation. This means that through the MAJOR_DEPT relationship, it is n:1 relationship between students entity and department entity (that is each department can have many major students but each student entity can have only one major department).
Note that the constraint STUDENT __(1,1)__MAJOR_DEPT___(0, n)___DEPT is stating that each record of STUDENT can have a minimum of 1 and a maximum of 1 major DEPT while each record of DEPT can have a minimum of 0 and a maximum of n STUDENTS.

Also, the left edge label of STUDENT and MINOR_DEPT is n and the right edge label of MINOR_DEPT and DEPARTMENT is 1.
1.

Just more explanation

3 Marks for Entities with attributes.
4 Marks for Relationships with attributes.
3 Marks for Constraints on the edges.



Give 0.5 for each of the entities for up to 25 and 0.5 for all of the attrs

ER Schema diagram for exercise 3.16:

Figure B.1: ER diagram for a UNIVERSITY database

Loose 0.5 for incorrect symbol, 0.5 for incorrect attrs. Follow the same scheme for Relationship to 0.5 for each correct up to 2.5 and -1.5 for incorrect placement of relationship or its attrs.

2. **(10 marks)** Given the following four relations for a bank database application:

BANK(Code, Name, Addr)
ACCOUNT(Acct_no, Balance, Type)
CUSTOMER(Ssn, CName, Addr, Phone)
HAS_ACCT(Acct_no, Ssn, Code)

Here, Balance refers to balance in the account; Type refers to the type of account (eg. savings); Code refers to the bank code. All the other attributes are self explanatory.

a. Specify all the foreign keys for this schema. State each foreign key using the following format "foreign key is the attribute ---------- of relation ---------- that references relation ---------- ". **(5 marks)**

0.5 for each correct pair of constraint tables. Ignore the total participation Constraints

b. State two English queries involving more than one table that can be posed on this database indicating the tables to visit to answer the queries each time. **(5 marks)**

Question	Foreign Key
2a (5 marks)	(Note: if you find more foreign keys, insert more lines) i. foreign key is the attribute -----Acct_no----- of relation -- HAS_ACCT --- that references relation --- ACCOUNT - ii. foreign key is the attribute --- Ssn --- of relation -- HAS_ACCT --- that references relation -- CUSTOMER --- iii. foreign key is the attribute --- Code --- of relation --- HAS_ACCT --- that references relation --- BANK ---

1.5 marks for each correct & 0.5 bonus for getting at least 2 correct,

Question	Query in English only	Tables needed to answer query
2b (5 marks)	i. Get the total balance maintained by each customer name and in what bank name ~~Select Customer.Cname, sum(Account.Balance)~~ ~~From Customer, Bank, Account, Has_Account~~ ~~Where Customer.Ssn = Has_Account.SSn and~~ ~~Has_Account.Code = Bank.Code and~~ ~~Has_Account.Acct_no = Account.Acct_no~~ ~~Group by Custmer.Cname;~~ (ii) Print all account types with account number maintained by customer "Smith". ~~Select Account.Type, Acct.Acct_no~~ ~~From Customer, Account, Has_Account~~ ~~Where Customer.Ssn = Has_Account.SSn and~~ ~~Has_Account.Acct_no = Account.Acct_no~~ ~~And Customer.Cname LIKE '%Smith';~~	i. Customer, Bank, Account, Has_Account ii. Customer, Account, Has_Account

1.5 for each query

1 mark for each correct listing of tables

1.5

1 mark

3. (15 marks)

a. Design a simple normalized RETAIL store records database with 3 to 4 tables to track customer purchases of store products and answer the following questions about your database. **(5 marks)**

b. Discuss how your database is in third normal form using functional dependencies (FDs). **(5 marks)**

c. Create an instance (a state) of your database. **(5 marks)**

Question	Answers
a. (5 marks)	CUSTOMER(<u>cid</u>, cname, cphone, number_of_goods) PRODUCTS(<u>pid</u>, pname, price) BUYS(<u>cid</u>, <u>pid</u>, cost)
b. (5 marks)	A database is in third normal form if all the tables in the database schema are in 3NF. A database table is in 3NF if every non-key attribute is functionally determined by only the primary key. This means that there is no transitivity in the functional dependency between an attribute of the table and the primary key. Looking at the 3 tables in the database schema above, BUYS has primary key as: (cid, pid, buy_date) with FDs as: (cid, pid) → cost. CUSTOMER has primary key as: (cid) with FDs as: (cid) → (cname, cphone, number_of_goods). PRODUCTS has primary key as: (pid) with FDs as: (pid) → (pname, price)
c. (5 marks)	CUSTOMER --- cid cname cphone number_of_goods 1 Mary 5199999991 3 2 Peter 5199999992 1 PRODUCTS --- pid pname price 31 Sugar 2.30 42 Rice 8.00 45 Bread 1.89 50 Brocolli 2.10 BUYS --- cid pid cost 1 31 2.30 1 42 8.00 1 50 2.10 2 42 8.00

1.5 mark for each of three Correct tables with attributes + 0.5 if Correct. 4 Correct tables also allowed.

2 marks Correct discussion verbal

3 marks discussion using FDs for 3 tables (1 mark for each FD)

1.5 marks for each table Correctly populated.

0.5 marks for getting it Correct.