60-315 Fall 2018 (Solution)
Midterm 1
Examiner: Dr. C. I. Ezeife
Given: Thursday, Oct. 4, 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)

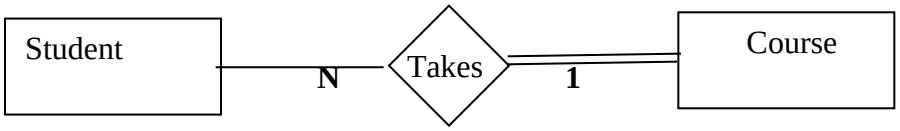
Question	Mark
Section A (15 marks for 10 multiple choice questions)	/15
Section B	
Que 1 (10 marks)	/10
Que 2 (10 marks)	/10
Que 3 (15 marks)	/15
Total	/50

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 :



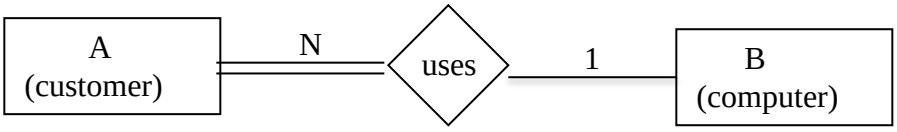
1. **Which statement best describes the relationship shown in Figure A.1.**

    a. **Each student record can take only one course and each course can be taken by only one student.**
    b. **Each student record can take multiple courses and each course can be taken by only one student.**
    c. **Each student record can take one course and each course can be taken by multiple students.**
    d. **Each student record can take multiple courses and each course can be taken by multiple students.**
    e. **None of the above**

2. **In Figure A.1, if an instance of the entity type student has 4 student records and an instance of entity type Course has 3 course records, which statement is correct about the participation relationship in this figure?**

    a. **Every of the 4 student records must take some course(s).**
    b. **Every of the 3 course records must be taken by some student(s).**
    c. **All students must take some course(s) and all courses must be taken by some student(s).**
    d. **All of the above.**
    e. **None of the above.**

Figure A.2 :



3. **If entity A in Figure A.2 represents customer and entity B represents computer, which of the following statements is correct?**

a. **Each customer can use only one computer, but each computer can be used by many customers.**
b. **Each customer can use only one computer and each computer can only be used by one customer.**
c. **Each customer can use many computers and each computer can be used by many customers.**
d. **Each customer can use many computers, but each computer can be used by only one customer.**
e. **None of the above**

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

a. **No customer uses a computer.**
b. **Only some customers use a computer.**
c. **Every customer uses a computer.**
d. **Most customers use a computer.**
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. **Which of the following can be an example of a composite attribute in ER modeling of a database?**
a. **address**
b. **last name**
c. **first name**
d. **country**
e. **none of the above**

7. **A valid database maintains integrity constraints. Example database integrity constraints is/are:**

a. **Logical data independence constraint**
b. **Physical data independence constraint**
c. **Entity constraint**
d. **Data program separation constraint**
e. **none of the above**

8. **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**

9. **In a database, the 3-level data architecture allows us to define the simple database "to track computers used 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 computers used by a customer**
c. **Print all books borrowed by students**
d. **All of the above**
e. **None of the above**

10. **If each computer in the database is allowed to have more than one Monitor in its screen attribute, the type of this computer attribute in ER modeling design is:**

a. **weak attribute**
b. **multivalued attribute.**
c. **nonexclusive attribute.**
d. **derived attribute**
e. **None of the above**

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

1. **(10 marks)** Given the ER diagram of a UNIVERSITY database of Figure B.1, answer the following questions with this diagram.

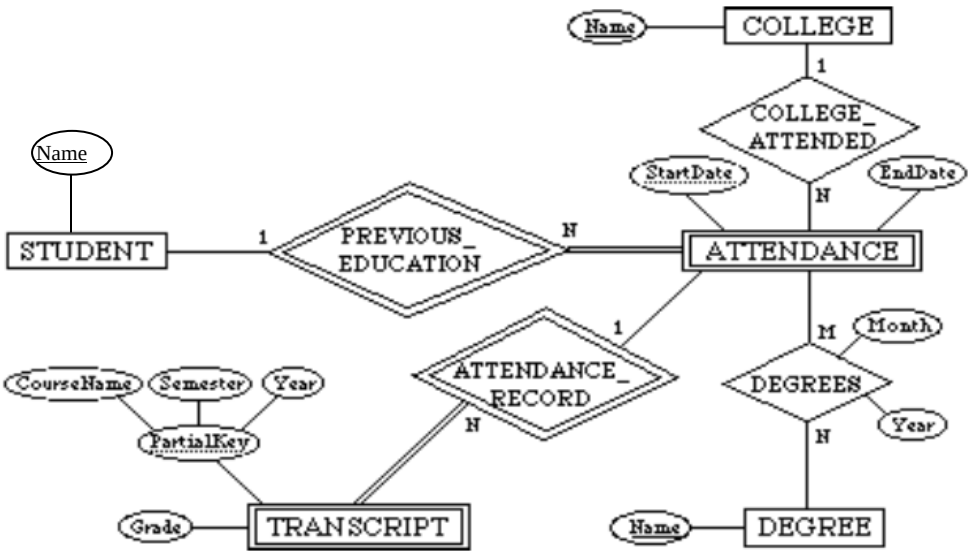


Figure B.1: ER diagram for a UNIVERSITY database

Write the relational database schema for UNIVERSITY including all the entities with attributes, relationships with attributes and at least two referential integrity (foreign key) constraints that apply to this database.

UNIVERSITY Database Component	UNIVERSITY SCHEMA for the Database Component
Entities with attributes (4 marks)	COLLEGE (CName) STUDENT(SName) ATTENDANCE(StartDate, EndDate) TRANSCRIPT(CourseName, Semester, Year, Grade) DEGREE(DName) **Detailed scheme: 5 tables expected. Duck (-0.5) for each table missing. There are 5 entities tables. Take -0.5 for each incorrect attribute set. Deduct up until -3 total.
Relationships with attributes (4 marks)	COLLEGE_ATTENDED(CName, StartDate) DEGREES(DName , StartDate , Month, Year) ATTENDANCE_RECORD(CourseName, Semester, Year, StartDate) PREVIOUS_EDUCATION(SName, StartDate)

	**Detailed scheme: 4 tables expected. Duck (-0.5) for each table missing. There are 4 relationship tables. Take -0.5 for each incorrect attribute set. Deduct up until -3 total.
Two referential Integrity Constraints (2 marks)	The referential integrity constraints occur through foreign key attributes in a child relation (usually a relationship relation) that references primary key attributes in a parent relation. Two examples are: 1. The foreign key attribute value for CName in the COLLEGE_ATTENDED relationship relation must reference an existing CName value in the COLLEGE entity relation. Also the foreign key attribute StartDate value in the same COLLEGE_ATTENDED relationship relation must reference an existing StartDate in the ATTENDANCE entity relation. 2. The foreign key attribute value for SName in the PREVIOUS_EDUCATION relationship relation must reference an existing SName value in the STUDENT entity relation. Also the foreign key attribute SSn value in the StartDate in the same PREVIOUS_EDUCATION relation must reference an existing StartDate in the ATTENDANCE entity relation **Detailed scheme: Duck (-1) for each of the 2 constraints not clearly defined.

2. **(10 marks)** Given the following six relations for an order-processing database application in a company:

CUSTOMER (Cust#, Cname, City)
ORDER (Order#, Odate, Cust#, Ord_Amt)
ORDER_ITEM (Order#, Item#, Qty)
ITEM (Item#, Unit_price)
SHIPMENT (Order#, Warehouse#, Ship_date)
WAREHOUSE (Warehouse#, City)

Here, Ord_Amt refers to total dollar amount of an order; Odate is the date the order was placed; Ship_date is the date an order (or part of an order) is shipped from the warehouse. Assume that an order can be shipped from several warehouses.

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**)

b. State two 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)	i. the attribute Cust# of relation ORDER that references relation CUSTOMER, ii. the attribute Order# of relation ORDER_ITEM that references relation ORDER, iii. the attribute Item# of relation ORDER_ITEM that references relation ITEM, iv. the attribute Order# of relation SHIPMENT that references relation ORDER, and v. the attribute Warehouse# of relation SHIPMENT that references relation WAREHOUSE. **Detailed scheme: Duck (-1) for each of the 5 main foreign keys missing.

Question	Query	Tables needed to answer query
2b (5 marks)	i. Print the quantity and price of items ordered by a customer. ii. Print the city, order date and shipment date of an order. **Detailed scheme: Duck (-1.5) for each of the English queries not given. -1 for not identifying the table involved in answering the queries.	i. CUSTOMER, ORDER ORDER_ITEM ITEM ii. ORDER SHIPMENT WAREHOUSE

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) **Detailed scheme: Duck (-1.5) for each of 3 main tables not identified correctly with its attributes and primary key (PK) (-0.5 from the -1.5 if only the PK is not identified).

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) **Detailed scheme: We did not get the opportunity to fully discuss this in class but I expect that students put up some discussion or any answer that shows they were in the last class and had reviewed this chapter in any form to be given full 5 marks. Thus, once there is an answer, give full marks. No answer gets -5.
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 **Detailed scheme: It is -1 for each table not filled. -1 for violating the PK and FK constraints.