University of Windsor

60-315 FALL 2018
Midterm 2 (solution)
Examiner: Dr. C. I. Ezeife **Given: Thursday, Nov. 1, 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 JOB.

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

Section A

10 marks for 10 Multiple Choice Questions. Each question in this section is worth 1 mark.

For Questions 1 – 10, circle the correct answer.

Detailed marking scheme for Section A: I mark for each correct multiple choice.

Consider a relation *R(A,B,C,D,E)* with the following functional dependencies:
AB -> {C, D, E}
C -> E

1. **The relation *R(A,B,C,D,E) above is in 3NF:***

   a. **TRUE**
   b. **FALSE**
   c. **MAY BE**
   d. **ALL OF THE ABOVE**
   e. **NONE OF THE ABOVE**

Given a relation *R1(A,C,B)* with the following functional dependencies:
AC -> B
B -> C

2. **Relation *R1(A,C,B)* is in 3NF:**

   a. **TRUE**
   b. **FALSE**
   c. **MAY BE**
   d. **ALL OF THE ABOVE**
   e. **NONE OF THE ABOVE**

3. **Relation *R1(A,C,B)* is not in BCNF because:**

   a. **There is transitive dependency between the primary key and a non-key**
   b. **There is a non-key attribute that determines part of the primary key**
   c. **There are only three fields**
   d. **There is multi valued dependency**
   e. **none of the above**

Given the following relation table state for JOB, where Jobid is the primary key and Dnum refers to Dnum in another relation DEPARTMENT, use it to answer the next few applicable questions.

JOB

Jname	Jobid	location	Dnum
FixX	1	London	4
FixY	2	Windsor	4
FixZ	3	Toronto	4
IT	10	Ottawa	5
Manage	20	Chatham	1
HumanResource	30	Ottawa	5

4. Which of the following statements is correct about the table JOB?

   a. It does not contain update anomaly

   b. It does not contain insert anomaly

   c. It does not contain delete anomaly

   d. All of the above
   e. None of the above

5. Which of the following create table command is given most correctly for creating the table JOB?

   a. CREATE TABLE JOB(Jname VARCHAR2(15),
      Jobid CHAR(1), location VARCHAR2(15), Dnum NUMBER(3));

   b. CREATE TABLE JOB(Jname VARCHAR2(15),
      Jobid DATE, location VARCHAR2(15), Dnum NUMBER(3),
      PRIMARY KEY (Jobid), FOREIGN KEY (Dnum) REFERENCES
      DEPARTMENT(Dnum));

   c. CREATE TABLE JOB(Jname VARCHAR2(15),
      Jobid NUMBER NOT NULL, location VARCHAR2(15),
      Dnum NUMBER(3), PRIMARY KEY (Jobid), FOREIGN KEY (Dnum)
      REFERENCES DEPARTMENT(Dnum));

   d. All of the above
   e. None of the above

6. **The effect of the following SQL instruction on the JOB table, when the only known Dnum instances in the DEPARTMENT table are 1, 4 and 5 is _____ .**

INSERT INTO JOB VALUES('Finance', 4, 'Windsor', 7);

a. **Insert an additional tuple in the JOB table with values specified.**
b. **Update the second tuple of the JOB table to have the values specified.**
c. **Raise an exception to indicate that there is a referential integrity violation.**
d. **Raise an exception to indicate that there is a primary key constraint violation.**
e. **None of the above**

7. Looking at the table JOB, is it normalized and in at least 3NF?

a. **YES**
b. **NO (note that also location determines Dnum)**
c. **MAY BE**
d. **DON'T KNOW**
e. **None of the above**

8. A basic SQL retrieval query to get all JOBs located in Toronto is:

a. **Select * where location = 'Toronto';**
b. **Select * from JOB J where J.location = 'Toronto';**
c. **Select * from JOB where location = Toronto**
d. **All of the above**
e. **None of the above**

9. To retrieve the number of JOBs handled by each Dnum in the table JOB, we can use the query:

a. **Select min(*) from JOB group by Dnum;**
b. **Select Dnum, count(*) from JOB group by Dnum;**
c. **Select Dnum, sum(*) from JOB group by Dnum;**
d. **Select max(*) from JOB group by Dnum;**
e. **None of the above**

10. The result of the following query on the table JOB is _____ showing just the tuples.
Select * from JOB where Jobid=1 or Jobid=2;

a. **IT 10 Ottawa 5**
HumanResource 30 Ottawa 5
b. **IT 10 Ottawa 5**
c. **HumanResource 30 Ottawa 5**
d. **All of the above**
e. **None of the above**

Section B (40 marks):
This section has 3 questions:

1. **(10 marks)** Given the following relation schema T, with attribute D as the primary key, answer the questions below.

T Relation

A	B	C	D
a1	b1	c1	d1
a1	b1	c2	d2
a2	b1	c1	d3
a2	b1	c3	d4

(i) What functional dependencies FD can you see exist in this relation above?
(ii) What update, (iii) delete and (iv) insertion anomalies may or not be present in this T relation above. Explain with examples using this database and functional dependencies.

Que 1 (2.5 marks for each of i to iv)

(i) FDs (2.5 marks)	FD1: D -> {A, B, C} FD2: A -> B; FD3: C -> B; Since for for FD2, every tuple with A value a1, its B value is b1 and every tuple with A value a2, its B value is b1. Also, for FD3, for every tuple with C value of c1, it has a B value of b1. This indicates that the primary key does not fully functionally determine all attributes and thus, this table is not in 2NF or 3NF and may contain anomalies. Detailed Marking scheme: duck -0.5 for each of the missing FDs and -2.5 if none is correct.
(ii) Update anomalies (2.5 marks)	Since A -> B, if there is need to change the A value (e.g. a1 now has b1 value for B attribute and we want to change it's A value to a3, as must change all other tuples with A value a1 to a3 and have all their B values remain b1), thus several tuples having the A value a1 in the table will have to be updated or there is a violation of the functional dependency (A -> B) in the database that must exist. This is update anomaly. Detailed Marking scheme: duck -1 for only a decent explanation and -2.5 for poor explanation of either redundant multiple updates or violation of FD should the value of one of the FD variables be entered incorrectly.

(iii) Delete anomalies (2.5 marks)	In the table above, if we delete the 2 tuples with A values of a2, we no longer know what B values are associated with an A value of a2. This is delete anomaly. Detailed Marking scheme: duck -1 for only a decent explanation and -2.5 for poor explanation of losing the association between FD variables should the only tuple having it be deleted.
(iv) Insertion anomalies (2.5 marks)	If a new tuple is inserted whose A and B values are not yet known, we might not be able to insert this tuple until we can assign them an A and B values that maintains the FD (A -> B). This is insert anomaly. Detailed Marking scheme: duck -1 for only a decent explanation and -2.5 for poor explanation of inability to insert a tuple if the values of the FD variables are unknown.

2. **(15 marks)** Given the following six relations for a student record database application in a University:

Student(sid, sname, major, gpa)
Course(cid, ctitle, credit)
Faculty(fid, fname, salary)
Room(Rid, location, capacity)
Enrolled(sid, cid, grade)
Teach(fid, cid, Rid, time)

Here, the primary key for each relation is underlined. The attributes sid stands for student id, cid is course id, fid is faculty id, Rid is room id. All other attributes are self explanatory.
A small database state of this database is:

STUDENT

sid	sname	major	gpa
1111	John Smith	CS	85.34
2222	Mary Pert	Math	80.25

COURSE

cid	ctitle	credit
60-212	Java	3
60-315	Database	3

FACULTY

fid	Fname	salary
23567	Rusty Odo	80000
55555	Katy Mill	Null

ROOM

Rid	location	capacity
ER1118	ERIE HALL	150
TC204	TOLDO	100

ENROLLED

sid	cid	grade
1111	60-212	78.50
1111	60-315	81.45
2222	60-212	90.10

TEACH

fid	cid	Rid	time
23567	60-212	ER1118	T,R: 10:00
55555	60-315	TC204	M,W: 11:30

a. Write the SQL DDL instructions to create at least three tables (including at least a relationship table with foreign key constraints) of the above database in the Oracle DBMS on our cs server specifying all constraints such as Key, entity and foreign key constraints. **(5 marks)**

b. Write the SQL instructions to insert all the data (all tuples) in the database state above for at least 3 tables you created. **(5 marks)**

c. Write the SQL query for the following query posed on this database, also write the results of the queries and the tables involved in answering the query.

Print all Professors with the courses (Fname, cid, ctitle) they teach student 'John Smith'.

Detailed Marking scheme: There must be either Enrolled or Teach relation or duck -2. It is 1.5 for each of the 3 tables created well. Duck -0.5 for any incorrect constraint or attribute. **(5 marks)**

Que 2a (5 marks): Creating Tables

```
CREATE TABLE STUDENT
(SID   VARCHAR2(10) NOT NULL,
Sname VARCHAR2(15),
Major VARCHAR2(15),
gpa NUMBER(6, 2),
PRIMARY KEY(Sid));

CREATE TABLE COURSE(CID VARCHAR2(10) NOT NULL,
Ctitle VARCHAR2(15),
Credit NUMBER(1),
PRIMARY KEY(FID));

CREATE TABLE FACULTY(FID VARCHAR2(10) NOT NULL,
Fname  VARCHAR2(15),
Salary NUMBER(8,2),
PRIMARY KEY(CID));

CREATE TABLE ROOM(RID VARCHAR2(10) NOT NULL,
location VARCHAR2(15),
Capacity NUMBER(4),
PRIMARY KEY(RID));

CREATE TABLE  ENROLLED
```

```
        (SID   VARCHAR2(10) NOT NULL,
        CID VARCHAR2(10) NOT NULL,
        GRADE  NUMBER(4,2),
        PRIMARY KEY(Sid, Cid),
        FOREIGN KEY (Sid) REFERENCES STUDENT(Sid),
        FOREIGN KEY (Cid) REFERENCES COURSE(Cid));

        CREATE TABLE  TEACH
        (FID   VARCHAR2(10) NOT NULL,
        CID  VARCHAR2(10) NOT NULL,
        RID VARCHAR2(10) NOT NULL,
        TIME VARCHAR2(8),
        PRIMARY KEY(Fid, Cid, Rid),
        FOREIGN KEY (Fid) REFERENCES FACULTY(Fid),
        FOREIGN KEY (Cid) REFERENCES COURSE(Cid),
        FOREIGN KEY (rid) REFERENCES ROOM(Rid));

COMMIT;
```

For Que 2b, Detailed Marking scheme: It is 1.5 for each of the 3 tables with all its data inserted well. Duck -0.5 for any line of data with error and -1 for any line of data missing. Do not deduct marks for missing COMMIT instructions.

Que 2b (5 marks): Inserting Data into the Database Tables

Solution (b) (For just inserting data into table Student, Course, and Enrolled)

```
INSERT INTO STUDENT
VALUES ('1111', 'John Smith', 'CS', 85.34);
COMMIT;

INSERT INTO STUDENT
VALUES ('2222', 'Mary Pert', 'Math', 80.25);
COMMIT;

INSERT INTO COURSE
VALUES ('60-212', 'Java', 3);
COMMIT;

INSERT INTO COURSE
VALUES ('60-315', 'Database', 3);
COMMIT;

INSERT INTO ENROLLED
VALUES ('1111', '60-212', 78.50);
```

```
COMMIT;

INSERT INTO ENROLLED
VALUES ('1111', '60-315', 81.45);
COMMIT;

INSERT INTO ENROLLED
VALUES ('2222', '60-212', 90.10);
COMMIT;
```

For Que 2c, Detailed Marking scheme: Query is worth 3 marks, tables used 1 mark and query result 1 mark. Duck marks accordingly for any parts missing or incorrect. For query, assign 1 mark to correct project list, 1 mark to correct table list and 1 mark to correct select condition.

Question	Query	Tables needed to answer query and Result
2c (5 marks)	Print all Professors with the courses (Fname, cid, ctitle) they teach student 'John Smith' Select Faculty.Fname, Course.cid, Course.ctitle From Enrolled, Student, Course, Teach, Faculty Where Student.sid = Enrolled.sid And Course.cid = Enrolled.cid And Teach.cid = Enrolled.cid And Teach.fid = Faculty.fid And Student.sname = 'John Smith';	ENROLLED, COURSE STUDENT TEACH FACULTY Result: Fname cid ctitles Rusty Odo 60-212 Java Katy Mill 60-315 Database

3. (15 marks)

Given the following Parttime_Emps relation schema, with Ssn as the primary key, lot is employee parking lot number, rating is employee rank, answer the questions below.

Ssn	name	lot	rating	wage	hours
123-22-3666	Attishoo	48	8	10	40
231-31-5368	Smiley	22	8	10	30
131-24-3650	Smethurst	35	5	7	30
434-26-3751	Guldu	35	5	7	32
612-67-4134	Madayan	35	8	10	40

a. Is this table in 3NF? If this table is not in 3NF, normalize it into 3NF showing all the tables in your new decomposed database. Explain using functional dependencies. **(6 marks)**

b. Provide one valid tuple instance that can be inserted into this original database. **(3 marks)**

c. Provide one SQL query for updating a record in the original table. **(3 marks)**

d. Provide one SQL query for deleting this original table schema from your database.

(3 marks)

Question	Answers
a. (6 marks)	FD1: Ssn -> {name, lot, rating, wage, hours} FD2: rating -> wage Since for every tuple with rating value 5, its wage is 7 and every tuple with rating value 8, its wage is 10. This indicates that the primary key does not fully functionally determine all attributes and thus, this table is not in 2NF or 3NF and may contain anomalies. To decompose into 3NF relations, we need to remove the violating FD2 by deleting the attribute wage from the original relation and create a new relation with the FD2 to have the following two normalized relations. Parttime_Emps 1(Ssn, name, lot, rating, hours) Parttime_Emps 2(rating, wage) It can be seen that both FD1 and FD2 are preserved by this decomposition in this database. For Que 3a, Detailed Marking scheme: Lose mark as appropriate. 1 mark for knowing table is not in 3NF. It is 2 marks for discussion with FDs. It is 3 marks for correct decomposition based on violating FDs.
b. (3 marks)	Any tuple that is inserted has to conform to all the FDs in the database which are FD1 and FD2. Thus, a valid tuple that can be inserted into the original Hourly-Emps table is: 131-24-3651 Panterlo 37 5 7 50 For Que 3b, Detailed Marking scheme: It is -3 for any insertion causing an anomaly.
c. (3 marks)	UPDATE Parttime-Emps SET hours = 25 WHERE name = 'Smiley'; For Que 3c, Detailed Marking scheme: It is -1 for missing each of the 3 parts of Tablename, SET attributes and Where condition.
d. (3 marks)	DROP TABLE PARTTIME_EMPS CASCADE; For Que 3d, Detailed Marking scheme: It is -3 marks for incorrect DROP Table command. It can be without CASCADE.