COSC 304 - Fall 2019 - Midterm Exam Two

Duration: 75 minutes

Name:_____

This midterm consists of three parts with questions on 6 pages for a total of 41 marks. You are responsible for completing all questions. Provide your answers neatly and clearly.

Part A: This part consists of 5 multiple-choice questions. Indicate your answer by circling the letter of the best choice(s). (Total of 5 marks)

1) A table that is in 2nd Normal form with no repeating attributes is in

a) BCNF Form b) 2nd Normal Form c) 3rd Normal Form d) 4th Normal Form
e) All of the above

2) Which of the following statements is true about the table T(A,B,C,D, E) if A,B and A, C are candidate keys?

a) A, B, C is a candidate key
b) B determines C and C determines B
c) If there are no partial or transitive dependencies in T, then T is in BCNF
d) T is in 3NF
e) D, E could be a super key

3) The Oracle function `NVL(foo, 'Bob')` will

a) return the index of the first occurrence of string '`Bob`' in column `foo`.
b) return the value of column `foo` if `foo` does not contain the string '`Bob`'.
c) return NULL if the value of column `foo` is equal to '`Bob`'
d) return '`Bob`' if the value of `foo` is NULL.
e) return the value of column `foo` if it is not equal to '`Bob`'.

4) If the functional dependency (X,Y) → Z holds in the normalized (BCNF) table T(W,X,Y,Z), then which of the following statements is/are true. (Circle **all** true statements)

a) Z is a candidate key.
b) Y could be the only candidate key.
c) (X,Y) could be just part of some candidate key.
d) (X,Y) is the only super key.
e) (X,Y) is a candidate key.

5) If columns X, Y, Z uniquely identify all of the rows in table T(U,W,X,Y,Z), but columns X, Y together do not, then we can say that (X,Y,Z) is a,

a) candidate key b) partial key c) primary key d) super key

Part B Normalization (22 marks)

Question 1: (7 marks) The table T(a,b,c,d,e,f) has the following functional dependencies:

1. a, c --> e
2. a, e --> b
3. a, e --> c
4. b, c --> f
5. e, d --> c

i. List two other ***non-trivial*** functional dependencies that can be derived from dependencies 1, 2, 3, 4 and 5 above. If you list more than two, the first two will be marked.

ii. For one of the functional dependencies you specified in **(i)** provide a justification using Armstrong's Axioms (as we did in class).

iii. What are the candidate keys for this relation?

Question 2:

i) (3 marks) Suppose that in a table T(a, b, c, d, e, f), (a, c) and (a, d, e) are the only candidate keys **and table T is normalized to BCNF**. Check the appropriate column for each dependency below:

		TRUE	FALSE	CANNOT TELL
1.	a, c → d, e			
2.	b → f			
3.	a, e → c			

ii) (3 marks) Suppose that in a table T(a, b, c, d, e), (c, d) is the **only** candidate key. Check the appropriate column for each dependency below:

		TRUE	FALSE	CAN NOT TELL
1.	c, d → e			
2.	a, b, e → c, d			
3.	d → a			

Part B Normalization (continued)

Question 3: (9 marks)

Consider table T(A,B,C,D,E,F,G), which has the following functional dependencies:

1) B -> C
2) B -> G
3) C,G -> D
4) C,G -> F
5) A -> E

- Identify the candidate key(s)? (1 mark)
- Give one reason why T is not normalized. Be specific. (1 mark)

- Decompose relation T into a normalized set of relations following the process and notation used in class. For full marks, your decomposition should show all of your steps and clearly identify your resulting normalized set of relations **and constraints**. (7 marks).

Part C – SQL (14 Marks)

Fewbahr Department Store maintains a database for its three outlets in Ottawa, New York, and London. 4 tables track product sales and performance of sales employees. A set of sample rows for the tables are shown below.

EMPLOYEES

EID	NAME
101	Seth Myers
103	Jack Carson
105	David Spade
104	Jim Fallon
107	Conan Obrien

PRODUCTS

PID	DESCRIPTION	PRICE
FRN101	Oak Table	800
FRN102	Pine Desk	440
LGH205	Lamp Post	250
BED301	Double Bed	700
BED303	Nightstand	250

CUSTOMERS

EID	Name	City
20	Jason Jones	Ottawa
21	Samantha Bee	Ottawa
22	Lilly Singh	New York
23	Rachel Riley	London
24	Jim Kimmel	New York

SALES

PRO_ID	QUANTITY	EMP_ID	Cus_ID
FRN102	10	101	20
FRN101	10	105	22
FRN102	20	105	23
BED301	30	101	22
LGH205	10	104	21
FRN101	5	103	22
FRN101	10	104	21

Here are a few notes about this database:

- *EID* uniquely identifies an employee.
- *PID* uniquely identifies a product.
- *CID* uniquely identifies a customer.
- *PRO_ID, EMP_ID,* and *CUS_ID* are each foreign keys referencing *PID, EID,* and *CID*, respectively.
- The first three characters of a PID indicate the type of product - *FRN* indicates a *Furniture* product, *LGH* indicates a *Lighting* product, and *BED* indicates a *Bedroom* product.
- Each Customer is associated with the city of the closest store outlet.

Develop Oracle SQL queries to answer the following questions.

2) (4 marks) List the description (and type in parentheses) of all products that have had total sales exceed $10,000. The format of the output should be as shown in the adjacent table.

```
Pine Desk (Furniture)
Oak Table (Furniture)
Double Bed (Bedding)
```

Part C – SQL (continued) - The tables are repeated here for your convenience.

EMPLOYEES

EID	NAME
101	Seth Myers
103	Jack Carson
105	David Spade
104	Jim Fallon
107	Conan Obrien

PRODUCTS

PID	DESCRIPTION	PRICE
FRN101	Oak Table	800
FRN102	Pine Desk	440
LGH205	Lamp Post	250
BED301	Double Bed	700
BED303	Nightstand	250

CUSTOMERS

EID	Name	City
20	Jason Jones	Ottawa
21	Samantha Bee	Ottawa
22	Lilly Singh	New York
23	Rachel Riley	London
24	Jim Kimmel	New York

SALES

PRO_ID	QUANTITY	EMP_ID	CUS_ID
FRN102	10	101	20
FRN101	10	105	22
FRN102	20	105	23
BED301	30	101	22
LGH205	10	104	21
FRN101	5	103	22
FRN101	10	104	21

---

2) (4 marks) For each city display a list of the total sales for furniture products, non-furniture products (*Other*) as well as the total of all products. The output of your query would look like this if the tables were limited to the data shown above.

CITY	FURNITURE	OTHER	TOTAL
London	8800	0	8800
New York	12000	21000	33000
Ottawa	12400	2500	14900

Part C – SQL (continued) - The tables are repeated here for your convenience.

EMPLOYEES

EID	NAME
101	Seth Myers
103	Jack Carson
105	David Spade
104	Jim Fallon
107	Conan Obrien

PRODUCTS

PID	DESCRIPTION	PRICE
FRN101	Oak Table	800
FRN102	Pine Desk	440
LGH205	Lamp Post	250
BED301	Double Bed	700
BED303	Nightstand	250

CUSTOMERS

EID	Name	City
20	Jason Jones	Ottawa
21	Samantha Bee	Ottawa
22	Lilly Singh	New York
23	Rachel Riley	London
24	Jim Kimmel	New York

SALES

PRO_ID	QUANTITY	EMP_ID	CUS_ID
FRN102	10	101	20
FRN101	10	105	22
FRN102	20	105	23
BED301	30	101	22
LGH205	10	104	21
FRN101	5	103	22
FRN101	10	104	21

---

3) (6 marks) For each employee, list their Ottawa sales, New York sales and total sales. The output of your query would look like this if the tables were limited to the data shown above.

EID	Name	OTTAWA	NEW YORK	TOTAL
101	Myers	4400	21000	25400
103	Carson	0	4000	4000
104	Fallon	10500	0	10500
105	Spade	0	8000	16800
107	Obrien	0	0	0