60-315 Winter 2018
Final Examination PRACTICE
Examiner: Dr. C. I. Ezeife: To be Given: Thurs., April 12, 2018
Student Name:_____
Student Number:_____

INSTRUCTIONS (Please Read Carefully)
Examination Period is 2 hours 30 minutes
Answer all questions. Write your answers in the spaces provided in the question paper. This is closed book and closed notes test. WRITE IN PEN.
Total Marks =100. 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!!!
****Note: Only a sample and not a replica of the exam.**

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 (30 marks for 15 multiple choice questions)	/30
Section B	
Que 1 (20 marks)	/20
Que 2 (15 marks)	/15
Que 3 (20 marks)	/20
Que 4 (15 marks)	/15
Total	/100

Section A
30 marks for 15 Multiple Choice Questions. Each question in this section is worth 2 marks.

R

key	A
1	a1
2	a2
3	a2
4	a3

S

key	A
1	a1
2	a2
3	a4
4	a5

Use relations R and S above to answer the next few questions

1. Are the relations R and S union compatible in SQL?

   A. YES
   B. NO
   C. NOT APPLICABLE
   D. DON'T KNOW
   E. None of the above

2. In SQL, the result of R(A) UNION ALL S(A) is _____.

   A. a1, a1, a2, a2, a2, a3, a4, a5
   B. a1, a2, a3, a4, a5
   C. a1, a2
   D. a3
   E. None of the above

3. In SQL, the result of R(A) EXCEPT S(A) is _____.

   A. a1, a1, a2, a2, a2, a3, a4, a5
   B. a1, a2, a3, a4, a5
   C. a1, a2
   D. a3
   E. None of the above

4. With SQL, to present the values of S(A) sorted in descending order, we use the query _

A. Select * from S desc;
B. Select A from S order by A desc ;
C. Select A from S order by A asc;
D. Select A order by A from S;
E. None of the above

Given the following mini world where sailors reserve boats, use tables S1 and R1 to answer the next few questions.

Sailor S1

Sid	Sname	Rating	age
28	YUPPY	9	35
31	LUBBER	8	55
44	GUPPY	5	35
58	RUSTY	10	35

Reserves R1

Sid	Bid	day
22	101	10/10/2011
58	103	11/12/2011

5. What is retrieved by the following SQL query from S1, R1 database above?

SELECT s.age from S1 s where s.name LIKE 'Y-%Y';

A. 28
B. 35
C. 55
D. 58
E. None of the above

6. What is retrieved by the following SQL query from S1, R1 database?

Select s.sname from S1 s where s.sid IN
(select R.sid from R1 R where R.bid=103);

A. YUPPY
B. LUBBER
C. GUPPY
D. RUSTY
E. None of the above

7. The SQL query in question 6 above can also be expressed as ____ .

A. Select s.sname from S1 s where EXISTS
(select * from R1 R where R.bid=103 AND s.sid = R.sid);
B. Select s.sname from S1 s, R1 R where
R.bid=103 AND s.sid = R.sid;
C. Select s.sname from S1 s where R.bid=103 AND s.sid = R.sid;
D. both A and B
E. None of the above

8. The result of the following relational algebra query on the S1 and R1 database above is:
Assume result is presented in correct tabular format with comma meaning start new line.

$\pi_{sname}(\sigma_{rating > 8 \text{ and } age = 35}(S1))$

A. YUPPY
B. LUBBER
C. GUPPY
D. YUPPY, RUSTY
E. none of the above

9. The relational algebra query for the SQL query "Select s.sname from S1 s, R1 R where R.bid=103 AND s.sid = R.sid;" is ____.

A. $\pi_{sname, rating}(\sigma_{rating > 8 \text{ and } age = 35}(S1))$.
B. $\pi_{rating}(\sigma_{rating > 8 \text{ and } age = 35}(S1))$
C. $\pi_{sname}(\sigma_{bid=103}(R1))$
D. All of the above
E. None of the above

10 . A relational algebra query for getting sid in S1 who are also sid in R1 is _____.

A. $\pi_{S1.sid}(S1) \cap \pi_{R1.sid}(R1)$
B. $\pi_{S1.sid}(S1) \cup \pi_{R1.sid}(R1)$.
C. $\pi_{S1.sid}(S1) - \pi_{R1.sid}(R1)$.
D. All of the above.
E. None of the above

11. A correct tuple relational calculus query in the S1 and R1 database above is_____.

A. {s.sname | R1(s)}
B. {r.sid | S1(r) and r.sid = 31}
C. {s.sname | EMPLOYEE(s)}.
D. All of the above.
E. None of the above.

12. Which of the following statements are true of indexes

A. They are data files that can be stored on disk.
B. Indexes have two fields as the index key and the disk block address.
C. B-tree and B+tree indexes are multilevel indexes commonly used in RDBMS.
D. All of the above
E. None of the above

13 . With B+-tree Indexes, all data nodes are stored on the leaf nodes.

A. YES
B. NO
C. NOT APPLICABLE
D. DON'T KNOW
E. None of the above

14. A primary index _____:

A. Has its index field the same as the ordered key field in the primary data file.
B. Is the same as a secondary index.
C. Has to be a single level index.
D. All of the above
E. None of the above

15. While inserting records in the database, possible integrity constraint violation is:

A. Domain constraint.
B. Entity constraint.
C. Referential integrity constraint.
D. All of the above
E. None of the above

Section B (70 marks):
This section has 4 questions :

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.

Question 1: (total marks: 20 for 10 + 5 + 5)

a. Design an ER model database representation for this order-processing database, clearly specifying entities and relationships, attributes, identifying their primary keys and candidate key attributes, and all constraints. (10 marks)
b. Write all the SQL instructions to create all database tables with all constraints specified. (5 marks)
c. Write a nested SQL query for an English query you posed on your database (5 marks)

Que. 1 (20 marks for all of a to c)

Sub question	Answers
a.. (10 marks)	a.
b.. (5 marks)	b.

c. (5 marks)	c.

Question 2: (total marks = 15 for 5 + 5 + 5)

a. Design a simple database with at least 5 relations for such applications as “students taking courses taught by faculty in class rooms at a specific time” (5 marks)
b. Is the relation R in 3NF? Explain your answer using functional dependencies. (5 marks)
c. If your R above is in 3NF, create at least one table from your database that is not in 3NF. If your R is not in 3NF, decompose R into 3NF relations. In each case, you are required to specify the primary keys and the functional dependencies that exist in each of the relations and thus, in the database with some discussions.(5 marks)

Que 2 (15 marks for all of a to c)

(a) (5 marks)	a.

(b). (5 marks)	b.
(c) (5 marks)	c.

Question 3: (total marks = 20 for 10 + 10)

Create an instance of either your database of Question 2 above or the order-processing database of question 1 of section B and use that to answer the following queries in (i) SQL, (ii) Relational algebra and (iii) Relational Calculus as well as showing the (iv) result of each query. Note: specify any needed aggregate function or group by attributes within your relational calculus and algebra queries appropriately.

(a). Retrieve the quantity and price of items ordered by a customer. (10 marks)

(b). Retrieve the city, order date and shipment date of an order. (10 marks)

Que 3 (20 marks for all of a and b)

(a) Query in SQL, Relational Algebra, Relational Calculus, Result (10 marks)	(a) SQL: Relation Algebra: Relational Calculus:

	Query Result:
(b) Query in SQL, Relational Algebra, Relational Calculus, Result (10 marks)	(b) SQL: Relational Algebra: Relational Calculus: Result:

Question 4 : (total marks = 15 for 7.5 + 7.5)

(a). Given the following unique id for some database records of a relation, construct the B-tree index structure of order p=3 (or with maximum of 3 pointers) for speeding up retrieval of these records from their primary data file stored on disk. The data to build index file for are:
8, 5, 1, 7, 3, 12, 9, 6, 2, 10
Show the steps through arriving at your final tree before giving your final tree.

(7.5 marks)

Solution (a) (7.5marks)

Final B-tree is given below:

Steps for Getting the final B-tree are given below:

(b). Using the same data set of 8, 5, 1, 7, 3, 12, 9, 6, 2, 10, construct a B+-tree index structure of order p=3 (or with 3 [pointers for internal nodes and 2 data entries for leaf nodes).
Show the steps through arriving at your final tree before giving your final tree. (7.5 marks)

Solution (b) (7.5 marks)

Final B+-tree is given below:

Steps for Getting the final B-tree are given below: