

CMPS 182, Final Exam, Spring 2019, Shel Finkelstein

Multiple Choice Questions (Part I) Answered on Scantron Sheet

Test Form letter: A

This first Section (Part I) of the Spring 2019 CMPS 182 Final is multiple choice and is double-sided. Answer all multiple choice questions on your Scantron sheet. You do not have to hand in this first Section of the Exam, but you must hand in the Scantron sheet, with your Name, email and Student ID on that Scantron sheet. Please be sure to use a #2 pencil to mark your choices on this Section of the Final.

Name and Student ID must also be filled in by shading letters/numbers on the form. You must also mark the **version** (“Test Form letter **A**”) of the Final that you took. The box for Test Form letter is at the top of the Scantron sheet, just to the left of the multiple choice questions.

The separate second Section (Parts II and III) of the Final is not multiple choice and is single-sided, so that you have extra space to write your answers. If you use that extra space, please be sure to write the number of the problem that you’re solving next to your answer. Please write your name, email and student id on the second Section of the Exam, which you must hand in. You may use any writing implement on this Section of the Exam.

At the end of the Final, please be sure to hand in **both your Scantron sheet for this first Section of the Exam** and also the separate second Section of the Exam, and show your UCSC id when you hand them in.

Part I: (42 points, 2 points each)

Answer the questions in Part I on your Scantron sheets, which should have your name, email and UCSC id on them. Select the **best answer** for each of the following. For some questions, a choice may be “**All of the Above**” or “**None of the Above**”, so read answer choices carefully.

Question 1: The relational model has physical independence. What does “physical independence” mean for the relational model?

- a) When you write queries, you don’t have to know how the tables used are stored, or what indexes exist.
- b) If you change what’s a table and what’s a view, then your queries will still work.
- c) You can port a Relational Database System on different hardware and operating systems and it will still run.
- d) You can also write your queries using a Navigational Model, with links.
- e) None of the Above.

Question 2: Let $R(A,B,C,D)$ be a relation, where (A, B) is the Primary Key for R , attribute C is Unique and can be NULL, and attribute D is Unique and cannot be NULL. Attribute A ’s domain has 3 different values, B ’s domain has 8 different values, C ’s domain has 5 different values, and D ’s domain has 10 different values. What is the maximum number of different tuples that can be in an instance of R ?

- a) 5
- b) 6
- c) 10
- d) 11
- e) 24

Question 3: We discussed the ACID properties of transactions. What does Consistency (the “C” in ACID) mean for transactions?

- a) Transaction execution is as if transactions were executed one at a time.
- b) Transactions happen completely or not-at-all.
- c) If a transaction commits, its changes are permanent, even if there are failures, although they can be changed by later transactions.
- d) Business rules and other constraints are maintained by the database system.
- e) Uncommitted (dirty) values from one transaction are never read by any other transaction.

Question 4: Which statement about keys and superkeys is correct?

- a) Every superkey is a key.
- b) If (A,B) is a key for relation R(A,B,C,D), then (A,B,C) can't be a superkey for R.
- c) If (A,B) is a key for relation R(A,B,C,D), then there can't be more than one tuple in R that has the same value for A.
- d) If (A,B,C) is a key for relation R(A,B,C,D), then no subset of (A,B,C), **other than (A,B,C) itself**, can be a superkey for R.
- e) All of the Above.

Question 5: An instance of relation R(A,B,C) has m tuples in it, all exactly the same, and an instance of relation S(A,B,C) has n tuples in it, all of which are exactly the same as the tuples in R(A,B,C). If R and S are Union-Compatible, then how many tuples are there in the result of the following query?

```
( SELECT * FROM R )  
  INTERSECT ALL  
( SELECT * FROM S );
```

- a) 1
- b) $m + n$
- c) $m * n$
- d) $\min(m, n)$
- e) $\max(m, n)$

Question 6: If R and S are relations that have all attributes in common, then the Natural Join of R and S, (written $R \bowtie S$), is equivalent to:

- a) The empty set
- b) $R \cup S$, the union of R and S
- c) $R \cap S$, the intersection of R and S
- d) $R \times S$, the cross product of R and S
- e) None of the Above.

Question 7: If an instance of the relation R(A,B) has 7 different tuples in it, and an instance of the relation S(B, C) has 3 different tuples in it, then how many tuples are there in the result if the following SQL query is executed on those instances?

```
SELECT *  
FROM R, S  
WHERE R.B = S.B;
```

- a) 0
- b) Exactly 10
- c) Exactly 21
- d) Between 0 and 10; could be 0 and could be 10
- e) Between 0 and 21; could be 0 and could be 21

Question 8: When you write a C application using embedded SQL:

- a) The C programmer must write the application code using CLI library calls for SQL calls, similar to what JDBC does for Java.
- b) The C programmer must write the application code using a stored procedure language such as PSM, PL/SQL or PL/pgSQL for SQL calls.
- c) The application code can be compiled as is by the C compiler as written.
- d) The application code can mix C and SQL statements, with no special syntax needed for SQL statements. But the code must go through a pre-processor before it can be compiled by the C compiler.
- e) The application code can mix C and SQL statements, with EXEC SQL before each SQL statement and shared variables starting with a colon when used in SQL. But the code must go through a pre-processor before it can be compiled by the C compiler.

Question 9: Why might there be a runtime error when the following statement is executed on tables Customers(cid, cname, age) and Activities(cid, slopeid, date)?

```
SELECT c.cname  
FROM Customers c  
WHERE c.cid =  
      ( SELECT a.cid  
        FROM Activities a);
```

- a) There may be a customer cid for which there are no activities.
- b) There may be a customer cid for which there is exactly one activity.
- c) There may be a customer cid for which there is more than one activity.
- d) For some cid that appears in an Activities tuple, there might be no tuple with that cid in Customers.
- e) There might be more than one tuple with the same cname in Customers.

Question 10: Which statement is true about Views in SQL?

- a) The description of the view and the contents of the view are both stored in the database.
- b) The description of the view is stored in the database but the contents of the view is not stored in the database.
- c) The contents of the view is stored in the database but the description of the view is not stored in the database.
- d) Neither the description of the view nor the contents of the view is stored in the database
- e) There are no Views in SQL.

Question 11: Our database schema contains a table Movies, whose primary key is (title, year). where title is CHAR(40), year is INTEGER, and studioName is CHAR(20).

Movies(title, year, length, genre, studioName, producerC#)

Assuming that there are no tuples in Movies that have title 'StarTrek' and year 1979, what will happen when we execute the following statement?

```
INSERT INTO Movies(title, year, studioName)
VALUES ('StarTrek', 1979, 'Paramount');
```

- a) It will result in an error if there are tuples in Movies whose studioName is 'Paramount'.
- b) It will result in an error whenever at least one of the attributes length, genre, and producerC# doesn't have a default value.
- c) It will result in an error whenever at least one of the attributes length, genre and producerC# can't be NULL.
- d) It will result in an error whenever at least one of the attributes length, genre and producerC# doesn't have default value and also can't be NULL.
- e) It will never result in an error.

Question 12: Customers(cid, cname, age) is a table in your database. What happens when the following statement is executed?

DELETE FROM Customers;

- a) The Customers table and all the tuples in the Customers table are deleted.
- b) All the tuples in the Customers tables are deleted, but the Customers table still exists.
- c) The Customers table is deleted, but all the tuples in the Customers tables still exist.
- d) The statement causes a runtime error if there are any tuples in the Customers table.
- e) This is not a legal SQL statement, so no database change will occur.

Question 13: Employees(name, age, salary) is a relation whose Primary Key is name. Which CHECK constraint says that if age is under 18 then the salary must be NULL?

- a) CHECK (age < 18 AND salary IS NULL)
- b) CHECK (age < 18 AND salary = NULL)
- c) CHECK (age < 18 OR salary IS NULL)
- d) CHECK (age < 18 OR salary = NULL)
- e) CHECK (age >= 18 OR salary IS NULL)

Question 14: R is a relation, and F is a Functional Dependency $X \rightarrow A$, where X is a set of attributes of R and A is an attribute of R. You inspect 10 million instances of R, and FD F holds for all of them. But there are other instances of R. Which statement is correct?

- a) There cannot be a relation R and a Functional Dependency F that holds for 10 million instances of R.
- b) FD F must hold for all instances of R.
- c) There must be an instance of R for which F does not hold.
- d) It's possible that FD F holds for all instances of R, but it's also possible that there is an instance of R for which FD F does not hold.
- e) None of the Above.

Question 15: Which statement about OLAP is correct?

- a) In a Fact table, Dimension attributes can be NULL.
- b) Fact tables can't have more than one Dependent attribute.
- c) There must be a row in the Fact table for every combination of Dimension table values.
- d) Roll-up of a Fact table corresponds to performing SQL GROUP BY and aggregation.
- e) None of the Above.

Question 16: For the relations:

Sailors(sid, sname, rating, age) and
Reserves(sid, bid, day)

what does the following Relational Algebra query do?

$\pi_{\text{Sailors.sid, Sailors.sname}} (\sigma_{\text{Sailors.age} > 20} (\text{Sailors})) -$
 $\pi_{\text{Sailors.sid, Sailors.sname}} (\sigma_{\text{Sailors.sid} = \text{Reserves.sid}} (\text{Sailors X Reserves}))$

- a) Finds sid and sname for Sailors who didn't reserve any boats.
- b) Finds sid and sname for Sailors whose age is greater than 20 and who didn't reserve any boats.
- c) Finds sid and sname for Sailors who reserved least one boat.
- d) Finds sid and sname for Sailors whose age is greater than 20 and who reserved least one boat.
- e) Finds sid and sname for Sailors whose age is greater than 20 and who reserved at least two boats.

Question 17: Which is the best index for the following query on the table:
Movies(title, year, length, genre, studioName , producerC#)?

```
SELECT title, year  
FROM Movies  
WHERE length < 90 AND studioName = 'Paramount';
```

- a) An index on title
- b) An index on (title, year)
- c) An index on studioName
- d) An index on (length, studioName)
- e) An index on (studioName, length)

Question 18: What is a difference between XML and the Relational Model?

- a) Relational tables are not in First Normal Form, because relational tables allow arbitrarily many appearances of elements in a document, but XML requires First Normal Form.
- b) XML documents are not in First Normal Form, because XML allows arbitrarily many appearances of elements in a document, but the Relational Model requires First Normal Form.
- c) Relational requires that data be in Boyce-Codd Normal Form, but XML does not.
- d) Relational requires that data be in Third Normal Form, but XML does not.
- e) None of the Above.

Question 19: Assume that Employees(name, salary, age, department) is a table, where name is the primary key. Which statement about the following query is correct?

```
SELECT department, salary, MAX(age)  
FROM Employees  
WHERE name = 'Cho'  
GROUP BY department  
HAVING MAX(age) >= 18;
```

- a) The query is a legal SQL query.
- b) The query is not a legal SQL query because department appears in the SELECT clause, and also appears in the GROUP BY clause.
- c) The query is not a legal SQL query because salary appears in the SELECT clause, but does not appear in the GROUP BY clause.
- d) The query is not a legal SQL query because name appears in the WHERE clause, but does not appear in the GROUP BY clause.
- e) The query is not a legal SQL query because MAX(age) appears in the SELECT and HAVING clauses, but age does not appears in the GROUP BY clause.

Question 20: For a database with the following relations, with primary keys underlined:

Employees(empid, name, dept, salary)

Departments(dept, manager, address)

Here are three queries.

Q1: SELECT e.empid, e.salary
 FROM Employees e, Departments d
 WHERE e.dept = d.dept
 AND e.salary > 8000;

Q2: SELECT e.empid, e.salary
 FROM Employees e
 WHERE e.salary > 8000
 AND EXISTS (SELECT *
 FROM Departments d
 WHERE e.dept = d.dept);

Q3: SELECT e.empid, e.salary
 FROM Employees e
 WHERE e.salary > 8000
 AND e.dept IN (SELECT d.dept
 FROM Departments d);

Which of these queries are equivalent?

- a) All 3 queries are equivalent.
- b) Q1 and Q2 are equivalent, but Q3 is not equivalent to them.
- c) Q1 and Q3 are equivalent, but Q2 is not equivalent to them.
- d) Q2 and Q3 are equivalent, but Q1 is not equivalent to them.
- e) None of the Above.

Question 21: Students(student_id, name, address, age, major) is a table where student_id is the Primary Key. If (1234, 'Eliza Doolittle', 'Higgins Place', 18, 'ENGL') is a tuple in that table, and the following is executed, with no other work going on:

```
BEGIN TRANSACTION;
```

```
UPDATE Students  
SET age = age + 1  
WHERE name = 'Eliza Doolittle';
```

```
UPDATE Students  
SET major = 'CMPS'  
WHERE age = 19;
```

```
ROLLBACK TRANSACTION;
```

then afterwards, what will be in the tuple that has student_id 1234?

- a) (1234, 'Eliza Doolittle', 'Higgins Place', 18, 'ENGL')
- b) (1234, 'Eliza Doolittle', 'Higgins Place', 19, 'ENGL')
- c) (1234, 'Eliza Doolittle', 'Higgins Place', 18, 'CMPS')
- d) (1234, 'Eliza Doolittle', 'Higgins Place', 19, 'CMPS')
- e) None of the Above.