CMPS 182, Final Exam, Spring 2018, Shel Finkelstein

Multiple Choice Questions (Part I)
Answered on Scantron Sheet

Test Form letter: A

This first Section (Part I) of the Spring 2018 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, C) is the Primary Key for R, Attribute D is Unique and cannot be NULL. Attribute A's domain has 5 different values, B's domain has 4 different values, C's domain has 2 different values, and D's domain has 21 different values. What is the maximum number of different tuples that can be in an instance of R?

a) 5
b) 20
c) 21
d) 22
e) 40

Question 3: We discussed ACID properties of transactions. What does Atomicity (the "A" 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 always maintained by the database system.
e) Uncommitted (dirty) values from one transaction are never read by any other transaction.

Question 4: Assume that R is a relation, and that c1 and c2 are conditions on R. Here are some statements. Which of them is/are always correct?

Statement 1: σ_{c1} (σ_{c2} (R)) = $\sigma_{c1 \text{ AND } c2}$ (R)
Statement 2: σ_{c2} (σ_{c1} (R)) = $\sigma_{c1 \text{ AND } c2}$ (R)
Statement 3: σ_{c1} (σ_{c2} (R)) = σ_{c2} (σ_{c1} (R))

a) Just Statement 1
b) Just Statement 1 and Statement 2
c) Just Statement 3
d) Statement 1, Statement 2 and Statement 3
e) None 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 all 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 )
    UNION 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 no attributes in common, then the Natural Join of R and S, (written R ⋈ S), is equivalent to:

a) The empty set
b) R ∪ S, the union of R and S
c) R ∩ S, the intersection of R and S
d) R x S, the cross product of R and S
e) None of the Above.

Question 7: If an instance of relation R1(A,B) has 10 different tuples in it, and an instance of relation R2(B,C) has 8 different tuples in it, then how many tuples will there be in the result if the following SQL query is executed on those instances?

```
SELECT *
FROM R1, R2
WHERE R1.B = R2.B;
```

a) 0
b) Exactly 18
c) Exactly 80
d) Between 0 and 18
e) Between 0 and 80

Question 8: In JDBC, what's the difference between a Statement and a PreparedStatement?

a) You supply the query or update when you create a PreparedStatement, but not when you create a Statement.
b) You supply the query or update when you create a Statement, but not when you create a PreparedStatement.
c) You use ExecuteUpdate on a PreparedStatement, and ExecuteQuery on a Statement.
d) You use ExecuteQuery on a PreparedStatement, and ExecuteUpdate on a Statement.
e) There's no such thing as a PreparedStatement in JDBC.

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

```
SELECT s.slopeid, s.color
FROM Slopes s
WHERE s.slopeid =
        ( SELECT a.slopeid
          FROM Activities a);
```

a) There might be a slopeid for which there are no activities.
b) There might be a slopeid for which there is exactly one activity.
c) There might be a slopeid for which there is more than one activity.
d) For some slopeid that appears in an Activities tuple, there might be no tuple with that slopeid in Slopes.
e) There might be more than one tuple with the same color in Slopes.

Question 10: What statement about the three-valued logic used by SQL is correct?

a) UNKNOWN is the same as NULL, but FALSE isn't.
b) The negation of FALSE is TRUE, but the negation of UNKNOWN is UNKNOWN.
c) TRUE OR UNKNOWN equals UNKNOWN.
d) When you execute a SQL query, if the result for some tuples is FALSE, those tuples don't contribute to the answer, but if the result is UNKNOWN, then they do contribute to the answer.
e) If you execute a SQL query and the result for some tuples is UNKNOWN, then there is a runtime error.

Question 11: Suppose that our database schema contains a table Movies, whose key is (title, year). where title is CHAR(40) and year is INTEGER.

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

Our database schema also has a view ParamountMovies defined by:

```
CREATE VIEW ParamountMovies AS
        SELECT title , year
        FROM Movies
        WHERE studioName = 'Paramount ';
```

When will execution of the following statement:

```
INSERT INTO ParamountMovies VALUES ('StarTrek', 1979);
```

result in an error?

a) It will never result in an error.
b) It will result in an error whenever there are no Movies that have studioName 'Paramount'.
c) It will result in an error whenever at least one of the attributes length, genre, studioName, and producerC# doesn't have a default value.
d) It will result in an error whenever at least one of the attributes length, genre, studioName, and producerC# can't be NULL.
e) It will result in an error whenever at least one of the attributes length, genre, studioName, and producerC# doesn't have default value and also can't be NULL.

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

DROP TABLE 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 correctly says that if the value of salary is NULL, then the value of age must also be NULL?

a) CHECK (salary IS NULL AND age IS NULL)
b) CHECK (salary IS NOT NULL OR age IS NULL)
c) CHECK (salary IS NULL OR age IS NOT NULL)
d) CHECK (salary = NULL OR age <> NULL)
e) CHECK (salary <> NULL OR age = NULL)

Question 14: R is a relation, and F is a Functional Dependency X->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) There must be a row in the Fact table for every combination of Dimension table values.
b) In a Fact table, Dimension attributes can be NULL.
c) Fact tables can have only one Dependent attribute.
d) Roll-up of a Fact table corresponds to performing SQL ORDER BY and aggregation.
e) None of the Above statements is correct.

Question 16: For the relations:

Customers(cid, cname, age) and
Activities(cid, slopeid, date)

what does the following Relational Algebra query do?

$\Pi_{\text{Customers.cid, Customers.age}}(\sigma_{\text{Customers.cid=Activities.cid}}(\text{Customer X Activities}))$

a) Finds cid and age for customers who participated in at least one activity.
b) Find cid and age for customers who participated in exactly one activity
c) Finds cid and age for customers who didn't participate in any activity.
d) Finds cid and age for every customer.
e) For every customer, gives cid and age, and counts the number of activities that the customer participated in.

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

```
SELECT title, genre
FROM Movies
WHERE length < 120 AND studioName = 'Paramount';
```

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

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

a) 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.
b) 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.
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, MIN(age), MAX(age)
FROM Employees
GROUP BY department
HAVING salary < 9000;
```

a) The query is a legal SQL query.
b) The query is not a legal SQL query because of the aggregates on age that appear in the SELECT clause.
c) The query is not a legal query because salary appears in the HAVING clause, but salary does not appear in the GROUP BY clause.
d) The query is not a legal SQL query because department appears in the SELECT clause, but department also appears in the GROUP BY clause.
e) The query is not a legal SQL query because name is the primary key for Employees.

Question 20: 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 21: The Union Rule for Functional Dependencies say that:
If $X \rightarrow Y$ and $X \rightarrow Z$, then $X \rightarrow YZ$

We proved that the Union Rule using Armstrong's Axioms. Which of Armstrong's Axioms justifies the step in the proof that marked with *** below?

$X \rightarrow Z$	Given
$XY \rightarrow YZ$	Augmentation
$X \rightarrow Y$	Given
$X \rightarrow XY$	Augmentation
$X \rightarrow YZ$	***

a) Commutativity
b) Reflexivity
c) Augmentation
d) Fidelity
e) Transitivity