University of Victoria
Department of Computer Science

Winter Mid Term Examinations 2003
CSC370
(Database Systems)

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Instructions
- ➤ Duration: 1 hours
- ➤ A single, letter sized, hand-written page is the only help permissible for this exam.
- ➤ The exam consists of 13 sections on **4 pages** (including cover page). Students must check that all pages are present in this exam paper before beginning to write, and report any discrepancy immediately to the invigilator.
- ➤ Each question/task is associated with a number of points gained for a fully correct answer.
- ➤ Most questions are "multiple choice":
  - o Clearly mark your chosen answers by encircling its leading letter.
  - o More than one answer can be true for each question.
  - o The score for multiple choice question is determined by adding one point for each correct marking and subtracting one point for each incorrect marking.
  - o Positive points accumulate as well as negative points.
  - o Markings considered ambiguous by the marker at the time of marking the exam are considered wrong.
- ➤ The total number of points is 63.
- ➤ Please write your name and student id on *each* page. This will enable us to associate pages that got torn off.
- ➤ Please write with a *clearly readable handwriting*. Answers that cannot be read by the marker at the time of marking will be considered missing.

Page #	Points Maximum	Points Scored
1	4	
2	6	
3	6	
4	6	
5	6	
6	6	
7	5	
8	5	
9	5	
10	5	
11	2	
12	3	
13	4	
SUM	63	

1. What are general advantages of using database management systems over file-based information systems? (4 points)
   a. Reduced application development time
   b. A larger amount of data can be stored
   c. Faster access because application code is integrated tighter with the data structures used.
   d. Facilitated evolution due to abstraction

2. Entity-Relationship (ER) Modeling (as presented in our textbook)… (6 points)
   a. Is a technique used for designing conceptual data structures
   b. Is a technique used for designing relational data schemas
   c. Can be used to express business rules
   d. Can be used to express business processes
   e. Can express attributes with primitive domain only
   f. Can express relationships between relationships

3. Consider the following ER diagram. Which errors does it contain? (6 points)
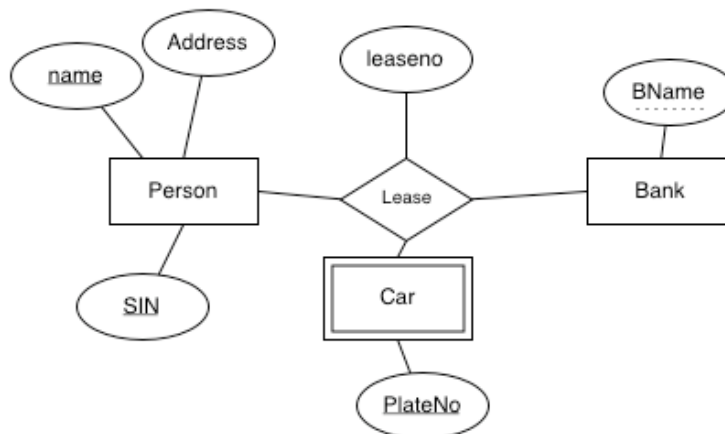
   a. Entity set "Person" should just have one key and not two keys, as specified in the diagram.
   b. Attribute "leaseno" of relationship set "Lease" has to be underlined, i.e., it has to be a key
   c. Attribute "Address" of entity set "Person" is ill-modelled if it is intended to store structured data (e.g., number, street, city, zip etc.).
   d. The link between weak entity "Car" and relationship "Lease" should have an arrow pointing to "Lease" and should be bold. (identifying relationship)
   e. "Car" is not a weak entity
   f. "Bank" should not have a partial key

4. Please encircle the true statements about our ER method: (6 points)
   a. An identifying relationship is always a one-to-one relationship
   b. Only a single key can be specified per entity set.
   c. Entity sets that are generalized in the same ISA relationship can have overlapping instances
   d. By default (unless specified otherwise) we assume that two or more entity sets that have the same generalization can have overlapping instances

    e. Every instance of a generalized entity set has to be an instance of one of its specializations

    f. Every ternary relationship can be decomposed in one or more binary relationships without loss of information

5. Please encircle the true statements about the relational data model: (6 points)
   a. The order of rows in relational tables is significant for query results
   b. Foreign key attributes have to have the same name as the columns they are referring to
   c. Foreign key attributes have to have the same domain as the columns they are referring to
   d. Foreign keys are pointers to rows in other tables (or other rows on the same table).
   e. There can only be one primary key per relation
   f. Any superkey can be chosen as the primary key

6. Please encircle the true statements about the relational data model: (6 points)
   a. If a given relation contains only unique values in a particular column, this column can be considered a key column
   b. Values in a foreign key column may be null
   c. Values in a primary key column not be null
   d. Values of foreign keys imply the existence of identical key values in the referenced relation
   e. Foreign keys refer to primary keys only
   f. In general, a foreign key in table A referencing table B represents a one-to-many relationship between rows in table A and B, respectively.

7. Please encircle the true statements about the transformation into the relational data model: (5 points)
   a. Generally, each entity set gives rise to one relation table
   b. Generally, each relationship set gives rise to a foreign key
   c. Generally, each underlined attribute of an entity set gives rise to a key in the relational model
   d. Generally, data redundancy can be minimized if inheritance hierarchies in the ER model are collapsed into one single table with a discriminator attribute.
   e. Generally, weak entity sets are added to the same relation table that was created for their owner entity set.

8. Rewrite the following RA expression with only basic RA operators: (5 points)
   $(A \bowtie c\ B) \setminus C$

9. Encircle the following generally true statements about the RA: (5 points)
   a. $\sigma_{c1}(\sigma_{c2}(R)) = \sigma_{c2}(\sigma_{c1}(R))$
   b. $\pi_a(\sigma_c(R)) = \sigma_c(\pi_a (R))$
   a. It is possible to rewrite the following natural join expression $R \bowtie S$ into an equi-join expression?
   c. It is possible to do an outer join with the Relational Algebra?
   d. The relational algebra is less expressive a language than the relational calculus

10. Encircle the following true statements about the relational calculus: (5 points)
    a. The relational calculus is relationally complete.
    b. In a DRC expression {x|p(x)}, x has to be bound by an existential or universal quantifier in *p*.
    c. In a DRC expression, *p* is an operator that returns the result relation *x*.
    d. The negation operation may not be used in *p* to avoid unsafe queries.
    e. DRC queries always deliver finite result sets.

11. Encircle the following true statements about the SQL: (2 points)
    a. SQL is based on the relational calculus
    b. SQL is computationally complete

12. For the following relation, show the results of the following query: (3 points)

        select Dnum, Avg(Salary)
        from Emp
        group by Dnum
        having Avg(Salary) > 5000

	Emp	
Pnum	Dnum	Salary
1	D1	5000
2	D2	1000
3	D1	4500
4	D1	8000
5	D2	7000

13. Consider the relation: Emp(SSN, Dno). Furthermore, here are four queries that operate on this relation: (4 points)

I.
```
(select *
from Emp
where Emp.Dno = 1)
     intersect
(select *
from Emp
where Emp.Dno = 2)
```

II.
```
select *
from Emp
where (Dno = 1) and (Dno = 2)
```

III.
```
(select *
from Emp
where Emp.Dno = 1)
     union
(select *
from Emp
where Emp.Dno = 2)
```

IV.
```
select *
from Emp
where (Dno = 1) or (Dno = 2)
```

Clearly mark all above queries (if any) that correctly give the answer if we wanted to find all people working in department #1 and department #2.

(END OF EXAM)