

## MCS-274 Intra-term Exam 2

Serial #:

This exam is closed-book and mostly closed-notes. You may, however, use a single 8 1/2 by 11 sheet of paper with *hand-written* notes for reference. (Both sides of the sheet are OK.)

Please write your name only on this page. Be sure to look at all problems before deciding which one to do first. Some problems are easier than others, so plan your time accordingly. You have 50 minutes to work.

Write the answer to each problem on the page on which that problem appears. You may also attach additional paper, which should be labeled with your test number and the problem number.

**You must sign the honor pledge below and abide by it.**

Printed name: \_\_\_\_\_

On my honor, I pledge that I have not given, received, nor tolerated others' use of unauthorized aid in completing this work.

Signature for above honor pledge: \_\_\_\_\_

Problem	Page	Possible	Score
1	2	25	
2	3	25	
3	4	25	
4	5	25	
<b>Total</b>		100	

1. [ **25 Points** ] The following information pertains to a sports league:
  - (a) Each team has a name containing at most 30 characters and a city containing at most 15 characters. No two teams have the same name.
  - (b) Each player belongs to one team and is identified uniquely among that team's members by a jersey number, which is an integer. Each player also has a name, which is a string of at most 35 characters, and one or more nicknames, each of which is a string of at most 12 characters.
  - (c) Each player may also be a former member of any number of teams. For each former membership, a year is recorded, which is an integer no less than 1950.
  - (d) Each player may optionally aspire to be a member of one other team.
  - (e) International teams constitute a special subclass of teams. Each international team has a country code, which consists of exactly two letters.

Capture as much of this information in an E-R diagram as is possible.

2. [ **25 Points** ] In the previous problem, you drew an E-R diagram based on the following information about a sports league:
- (a) Each team has a name containing at most 30 characters and a city containing at most 15 characters. No two teams have the same name.
  - (b) Each player belongs to one team and is identified uniquely among that team's members by a jersey number, which is an integer. Each player also has a name, which is a string of at most 35 characters, and one or more nicknames, each of which is a string of at most 12 characters.
  - (c) Each player may also be a former member of any number of teams. For each former membership, a year is recorded, which is an integer no less than 1950.
  - (d) Each player may optionally aspire to be a member of one other team.
  - (e) International teams constitute a special subclass of teams. Each international team has a country code, which consists of exactly two letters.

Now provide a set of CREATE TABLE statements that capture as much of this information as possible (even information that didn't make it into your E-R diagram). You should include PRIMARY KEY, FOREIGN KEY, CHECK, and NOT NULL constraints where appropriate.

3. [ **25 Points** ] Consider the following set of functional dependencies:

$A \rightarrow B$   
 $A \rightarrow C$   
 $B \rightarrow D$   
 $AC \rightarrow D$   
 $AB \rightarrow E$   
 $C \rightarrow E$   
 $DF \rightarrow C$   
 $DF \rightarrow E$

Answer the following questions about that set of FDs:

- (a) Reduce the set of FDs to a minimal basis. (Hint: this entails eliminating three of them.)
- (b) List all keys for the relation  $R(A, B, C, D, E, F)$ .
- (c) Synthesize a collection of 3NF relations for this example. (This should be a lossless, dependency-preserving decomposition.)

4. [ **25 Points** ] Suppose the relation  $R(A, B, C, D, E)$  is decomposed into  $R_1(A, B, C)$ ,  $R_2(A, D)$ , and  $R_3(A, C, E)$ . Use the chase test to determine whether this decomposition is lossless, given each of the following sets of functional dependencies:
- (a)  $AB \rightarrow C$ ,  $C \rightarrow B$ , and  $A \rightarrow D$
  - (b)  $A \rightarrow B$ ,  $C \rightarrow B$ , and  $CE \rightarrow A$