

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 **60** 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	
Total		100	

1. [**25 Points**] The following information pertains to a product catalog:
 - (a) Each vendor has a name containing at most 20 characters. No two vendors have the same name.
 - (b) Each product is made by one vendor and is identified uniquely among that vendor's products by a product number, which is an integer. Each product also has a description, which is a string of at most 50 characters.
 - (c) Each product may also be cross listed by any number of vendors. For each cross listing, there is a cross reference number, which is an integer.
 - (d) Each vendor is distributed by one or more dealers. Each dealer is distinguished by a URL, which is a string of at most 25 characters.
 - (e) Each dealer may optionally designate a favorite product.
 - (f) Wines constitute a special subclass of products. Each wine has a color, which is one of red, white, and rosé.

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 product catalog:
- (a) Each vendor has a name containing at most 20 characters. No two vendors have the same name.
 - (b) Each product is made by one vendor and is identified uniquely among that vendor's products by a product number, which is an integer. Each product also has a description, which is a string of at most 50 characters.
 - (c) Each product may also be cross listed by any number of vendors. For each cross listing, there is a cross reference number, which is an integer.
 - (d) Each vendor is distributed by one or more dealers. Each dealer is distinguished by a URL, which is a string of at most 25 characters.
 - (e) Each dealer may optionally designate a favorite product.
 - (f) Wines constitute a special subclass of products. Each wine has a color, which is one of red, white, and rosé.

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:

$A \rightarrow C$
 $B \rightarrow E$
 $D \rightarrow A$
 $D \rightarrow B$
 $DA \rightarrow E$
 $DB \rightarrow C$
 $EF \rightarrow A$
 $EF \rightarrow C$

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) $AC \rightarrow B$, $C \rightarrow D$, and $A \rightarrow E$
 - (b) $A \rightarrow B$, $AE \rightarrow C$, and $B \rightarrow D$