King Fahd University of Petroleum and Minerals

Department of Information and Computer Science

ICS 424-01: Advanced Database Systems

Semester 063

Time Allowed: 100 Minutes

Student ID: _____

Name: _____

Instructor: Muhammad Waheed Aslam

Problem	Points	Score
Question 1:	18	
Question 2:	26	
Question 3:	20	
Question 4:	10	
Question 5:	16	
Question 6:	20	
Question 7:	15	
Total	**125**	

Notes:

➤ Please skim through all the questions, make sure that you understand them, and then attempt to answer them with a time-allocation in mind. If any question is not clear, get it clarified during the <u>first fifteen minutes</u>.

➤ If you need to make any assumptions, please document them as part of your answers.

➤ There are seven questions in this exam each focusing on a distinct aspect. You are expected to answer <u>all</u> of them.

July 18, 2007

Question 1

(a) Data redundancy is one of the major drawbacks of the file processing approach. Lists two of the main problems caused by redundancy and explain how the database approach overcomes the redundancy drawback?　　　　**(6 Points)**

(b) Use the following table to briefly describe two of the advantages and disadvantages of using a DBMS:　　　　**(8 points)**

Advantages	Disadvantages

(c) Briefly describes the difference between *entity integrity* and *referential integrity* constraints.　　　　**(4 points)**

Question 2 (26 points)

(a) Briefly describe the following DBMS component modules: **(6 Points)**

1) The Stored Data Manager:

2) The Precompiler:

3) The Query Compiler

(b) Explain the client-server multi-user database application architecture. Compare client-server architecture with file-server architecture. **(10 points)**

(c) An application program is a program written in a host language like C, COBOL, Pascal, etc. To interact with the database, the program contains DML statements (like embedded SQL). Explain how a DBMS transforms the application program into an executable code? **(10 points)**

Question 3 (20 points)

Consider the problem of designing a database for a department-wide grading system for the ICS department at KFUPM.

The department has a number of teachers (each has a teacher number, name, email) who teach sections of courses. Courses are described by a course number and a course title. Sections of courses are offered in a particular term (e.g. 071, 072, 081, etc.) and have a computer number (a 5-digit numeric) which is unique within the term for all sections in that term. Teachers also designate grade cutoff percentages for each of the letter grades A+, A, B+, B, C+, C, and D+, D for each section they teach.

The department has students described by student number, name, email. The students enroll in sections. For each section, the teacher designates a number of grading components such as homework 1, mid term, final, project 1, etc. Each component has a maximum score out of which the student's work is graded. Each component is also assigned a weight (e.g. mid term is worth 25%). Finally for each enrolled student in a section, the teacher grades each component of that section, and assigns a score to the student for that particular component.

Design an E-R schema for the grading system described here.

Question 4   (10 points)

Following is an ER diagram of a bank database. Suppose that it is necessary to keep track of different types of accounts (savings, checking, …) and loans (car-loan, home-loan, …).

Suppose that it is also desirable to keep track of each account's transactions (deposits, withdrawals, checks, …) and each loan's payments; both of these include the amount, date, time, … Modify the diagram using EER concepts. State any assumptions you make about the additional requirements.
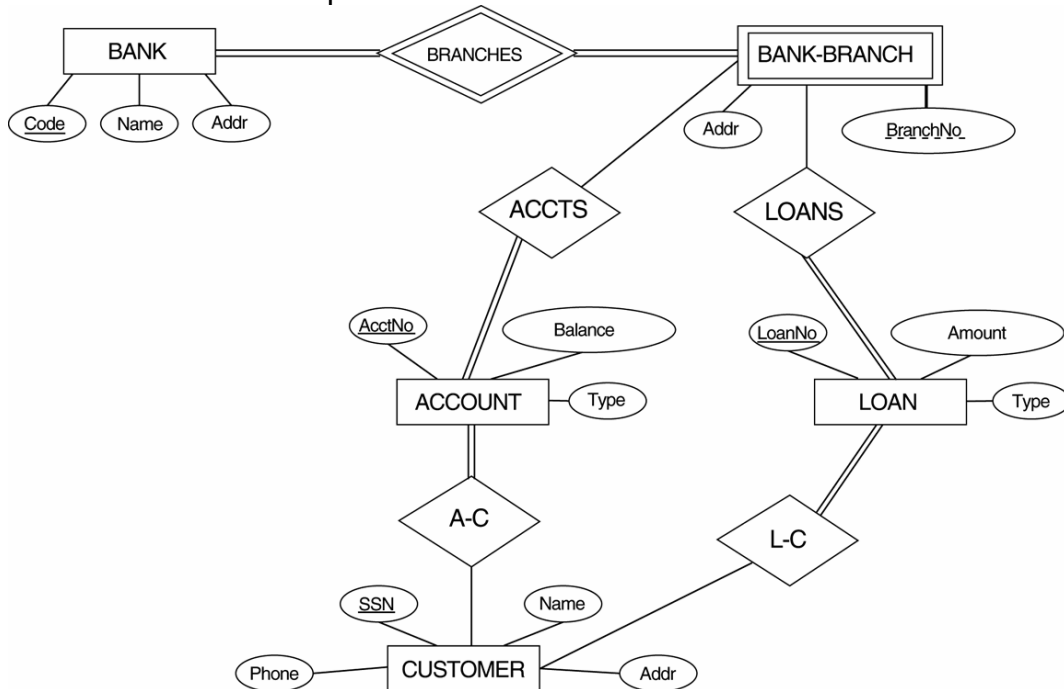
Question 5 (16 points)

(a) Given the relational database instance below, indicate whether each of the following update operations are acceptable or not, and if not why?

1) Insert the tuple < 'ICS1', 'Mulhem',2175 > into OWNER.

2) Delete the BOOK tuple with CODE = 'ICS1'.

3) Modify the CODE of the BOOK tuple with TITLE = 'AI' to 'ICS4'.

4) Modify the BCODE of the OWNER tuple with PHONE = 3345 to 'ICS5'.

BOOK	CODE	TITLE	AUTHOR	YEAR
	ICS1	Databases	Ullman	1990
	ICS2	Data Structures	Knuth	1987
	ICS3	AI	Rich	1986
	ICS4	Logic	Manna	1986

OWNER	BCODE	NAME	PHONE
	ICS1	Maghrabi	4698
	ICS2	Najjar	3345
	ICS4	Ghanta	2356
	ICS3	Maghrabi	4698

Question 6   (20 Points)

Below find an ER diagram representing the conceptual design of a database system for a Dental Center Use the procedure in the text to develop the logical design for this database. In particular you are required to follow the steps of the procedure to convert the entities and relationships in this diagram into relational schema. (For complete marks you need to show your works in detail):
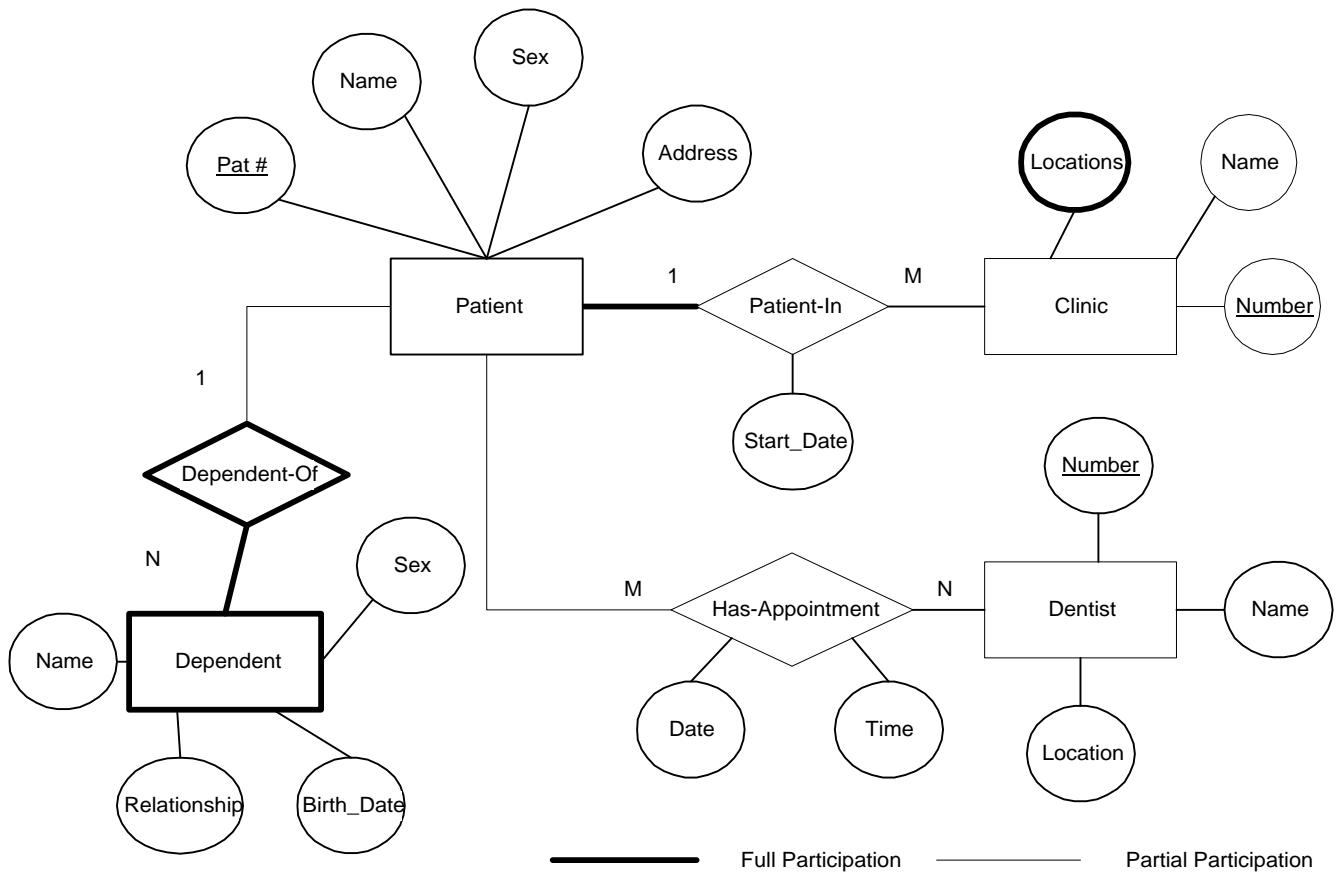
Question 7 (15 Points)

(a) Suppose that we have an ordered file with r = 15,000 records stored on a disk with block size B = 1024 bytes. File records are of fixed size and are unspanned, with record length R = 50 bytes. Calculate the following:

- Blocking Factor
- Number of blocks needed for the file:
- Number of block accesses when binary search is made

(b) Define primary, secondary and clustering indexes. Which of these indexes are dense and which are not.