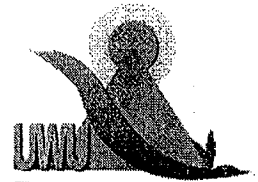




Uva Wellassa University, Sri Lanka

Faculty of Science and Technology

First Semester Examination Feb/Mar 2012



**Uva Wellassa  
University**

**CST 325-2/IIT411-2/CST425-2 Advanced Database Management Systems**

Time Duration : Two Hours (02)

Index Number :

Number of Pages : Three (03)

### Instructions to Candidates

Read the instructions given for question carefully. Answer **All** questions. Each question carries **20** marks.

### Question 1

- I. Explain what are meant by a Database and Database Management Systems.
- II. Express the advantages of DBMS over File Systems.
- III. What is a Data Model?
- IV. Briefly describe categories of data models.
- V. What is an E-R model?
- VI. Explain the terms Entity (Strong, Weak), Attribute (Simple, Composite, Multi-valued, Derived), Relationship and Key attribute
- VII. A University System has been represented using its relational model as shown below.  
STUDENT (Id, Name, Year)  
LECTURER (Name, OfficeNo)  
NEW-STUDENT (Id, Name, Year)  
REPORT (StudentId, CourseNo, Marks)  
COURSE (CourseNo, Title, LecturerName)

Using the above relations, write out the relational SQL queries that would derive the following results.

- a. List the Id, Name, and Year of both new and current students who are in year 2012.
- b. Generate a list containing, for all the current students only, their Ids, Names, Years, CourseNos and Marks for that course.
- c. Find the number of the courses that each current student does not take.  
Result Should contain the student Name, CourseNo pair.
- d. Find the OfficeNo of the lecturer who teaches course CST 425-2.

## Question 2

Consider the following requirements for a university database:

- A Person has a NIC (unique), age and a name.
- Professor is a Person with the following attributes: rank and research specialty.
- Projects have a project number (unique), a sponsor, a starting date, ending date and a budget.
- Graduate students are also persons. Graduate students need to store information about the degree program (e.g. B.Sc., M.Sc. or PhD) that they are enrolled.
- Each project is managed by one professor (known as the project's principal investigator).
- A project must have a principal investigator.
- Each project is worked on by one or more professors (known as co-investigators).
- Professors can manage and/or work on multiple projects.
- Each project is worked on by one or more graduate students (known as project's research assistants).
- Graduate students can work on multiple projects.

Draw an E-ER diagram for the above requirements.

## Question 3

Consider the following relational schema. An employee can work in more than one department; the *pct-time* field of the Works relation shows the percentage of time that a given employee works in a given department.

**Emp**(*eid*: integer, *ename*: string, *age*: integer, *salary*: real)

**Works**(*eid*: integer, *did*: string, *pct-time*: integer)

**Dept**(*did*: string, *budget*: real, *managerid*: integer)

Write the following queries in SQL:

- Print the names and ages of each employee who works in both the Hardware department and the Software department.
- Print the name of each employee whose salary exceeds the budget of all of the departments that he or she works in.
- Find the *managerids* of managers who manage only departments with budgets greater than \$1,000,000.
- Find the *enames* of managers who manage the departments with the largest budget.
- If a manager manages more than one department, he or she *controls* the sum of all the budgets for those departments. Find the *managerid* of managers who control more than \$5,000,000.
- Find the *managerid* of managers who control the largest amount.

#### Question 4

- I. Briefly describe a transaction in the database context and its properties.
- II. Explain why concurrent execution of transactions is desirable.
- III. Answer the following with regard to *Strict Two Phase Locking Protocol* (also written as Strict 2PL).
  - a. Explain Strict 2PL Protocol.
  - b. What is meant by a *cascading abort*? What is the cause for a *cascading abort*? Give an example of a schedule with a cascading abort. How does Strict 2PL protocol *avoid cascading aborts*?
  - c. What is meant by an *unrecoverable* schedule? Give an example of a schedule with an *unrecoverable* schedule. How does Strict 2PL protocol ensure *recoverable* schedules?

#### Question 5

- I. What are the steps in Query Processing? Explain each step.
- II. What is the goal of Query optimization? Why is it important?
- III. What types of information is stored in the system catalogs? Why?
- IV. Consider the following schema:

Sailors(sid, sname, rating, age)  
Boats(bid, bname, color)  
Reserves(sid, bid, day)

Consider the following query:

```
SELECT S.sname
FROM Sailors S, Reserves R, Boats B
WHERE S.sid = R.sid AND R.bid = B.bid AND B.color = 'red'
```

- a. Create the relational algebra expression for the query above.
- b. Draw the graphical representation of the relational algebra expression