THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF SOFTWARE ENGINEERING – LEVEL 4
FINAL EXAMINATION – ACADEMIC YEAR 2010/2011

ECI4166 - Data modeling and database systems **(Closed Book)**

Date: November 27, 2010 **Time: 1330- 1630 hrs**

Answer any 5 questions.

Question 1 (20 marks)

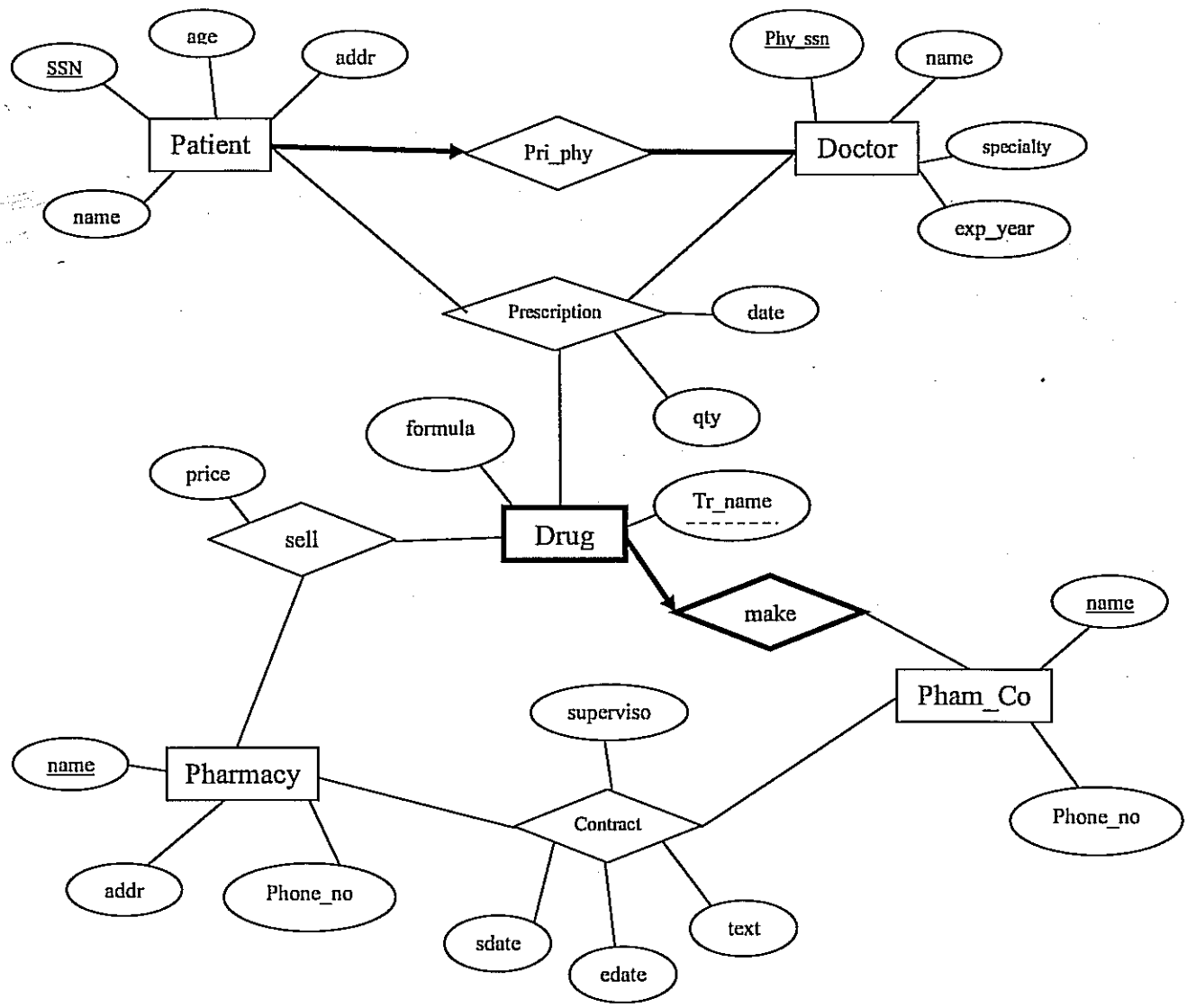
Nowtown Records has decided to store information about musicians who perform on its albums (as well as other company data) in a database.

- Each musician that record at Notown has an SSN, name, an address and a phone number.
- Each instrument that is used in songs recorded at Notwon has a name (e.g. guiter, synthesizer, flute) and a musical key (e.g. C, B-flat, E-flat).
- Each album that is recorded on the Notown label has a title, a copyright date, a format (e.g. CD or MC), and an album identifier.
- Each song recorded at Notown has a title and author.
- Each musician may play several instruments, and a given instrument may be played by several musicians.
- Each album has a number of song s on it, but no song may appear on more than one album.
- Each song is performed by one or more musicians, and a musician may perform a number of songs.
- Each album has exactly one musician who acts as its producer. A musician may produce several albums, of course.

Draw an ER diagram for above requirements. Be sure to indicate all the keys, cardinality constraints and any assumptions that you make.

Question 2 (20 marks)

Convert the following ER diagram to the relational model. You do not need to specify the domains of attributes.



Question 3 (20 marks)

Consider the following relational schema. Enrolled has one record per student-class pair to show that such student is enrolled in the class. There is a teacher for each class.

Student (*snum*:char(5), *sname:* string, *age:* int)

Enrolled (*snum*:char(5), *cname*:string)

Class (*name*:string, *meets_at*:time, *room*:string, *tid*:int)

Teacher (*tid*:int, *tname*:string, *deptid*:int)

(a.) Create the above relational schema using SQL statements. Make sure to add all primary key, foreign key constraints and the following check constraints.
Rule 1: *snum* attribute of student relation should start with "CS".
Rule 2: *age* attribute of Student relation should between 0 and 120.

(7 marks)

(b.) Write SQL statement(s) to insert the following information about a student to the schema above. Assume that Class relation contains information about all courses.

Snum	Sname	Age	Cname
CS123	Kamal Dissanayake	23	Database Systems

(2 marks)

(c.) Write SQL statement(s) to increase the age by 3 years for "Kamal Dissanayake".

(5 marks)

(d.) Write SQL statement to delete all students who have enrolled for Database Systems.

(6 marks)

Question 4 (20 marks)

Consider the following database which records information in a video rental store.

Film (filmno, title, year, dailyrate)

Tape (tapeno, Filmno)

Rental (tapeno, Customerno, date, numdays)

Customer (customerno, name, address, phone)

Information about rentals is kept indefinitely. The cost of a rental is simply the daily rate (*dailyrate*) for that film multiplied by the number of days the tape is out.

Write SQL statements for the following:

(a.) Print the customer name and phone number of R1096 (i.e. customerno).

(2 marks)

(b.) List Filmno, title, year, dailyrate of all the films sorted by ascending order of year.

(4 marks)

(c.) List the names and phone numbers of customers who have not rented a video since 31/12/2009.

(4 marks)

(d.) For customers who borrowed more than two tapes, print their customerno and the number of tapes each of them borrowed, and give the alias of "total _tapes" for the number of tapes.

(5 marks)

(e.) Find the most demanding film. Print film title and year of it.

(5 marks)

Question 5 (20 marks)

Consider the following relation,

Branches (brName, bankcode, brNum, brAddr, brMgr, brNumStaff)

And assume the following set of functional dependencies,

F = { (brNum → brName),
(brAddr → brMgr, brNumStaff),
(bankcode, brNum → brAddr) }

The key of the relation is **(bankcode,brNum).**

If the relation is **not in** Third Normal Form (3NF), provide a loss-less join decomposition to 3NF.

Normalized step by step by removing functional dependencies and explain which Normal Form it is.

Question 6 (20 marks)

Consider the following *bib.xml* file which has stored in MS Server 2008. Translate the following queries into FLWOR expressions and integrate those with the functions available in DBMS.

Note: answers should contain FLWOR expression and expected output of it.

```
- <bib>
  - <book year="1994" type="paper">
      <title>TCP/IP Illustrated</title>
      <author>Stevens, W.</author>
      <publisher>Addison-Wesley</publisher>
      <price>965.95</price>
    </book>
  - <book year="1992" type="paper">
      <title>Advanced Programming in the Unix environment</title>
      <author>Stevens, W.</author>
      <publisher>Addison-Wesley</publisher>
      <price>1165.95</price>
    </book>
  - <book year="2000" type="paper">
      <title>Data on the Web</title>
      <author>Abiteboul, Serge</author>
      <author>Buneman, Peter</author>
      <author>Suciu, Dan</author>
      <publisher>Morgan Kaufmann Publishers</publisher>
      <price>39.95</price>
    </book>
  - <book year="1999" type="journal">
      <title>The Digital TV</title>
      <editor>Gerbarg, Darcy</editor>
      <publisher>Kluwer Academic Publishers</publisher>
      <price>129.95</price>
    </book>
</bib>
```

Part A: FLWOR expressions

(a) Return the title element of all books which are published by *Morgan Kaufmann Publishers* and authored by *Gerbarg, Darcy.*

(2 marks)

(b) Consider *third* book information from all *journal* publications and return title, author and price.

(3 marks)

(c) Return all title of books published after 2005. Format output as followed. If it is a paper tag as *researchPaper* else check for journal and tag as *journalPape.* Otherwise tag as an *article.*

(3 marks)

Part B: Relational Algebra

Consider the following schema:

Suppliers (*sid*: integer, *sname*: string, *address*: string)

Catalog (*sid*: integer, *pid*: integer, *cost*: real)

Parts (*pid*: integer, *pname*: string, *color*: string)

Write **relational algebra** expressions for the following:

(a.) Find the *names* of suppliers who supply red parts.

(2 marks)

(b.) Find the *sids* of suppliers who supply red or green part.

(3 marks)

(c.) Find the *sids* of suppliers who supply some red part and some green part that costs less than 100 dollars.

(3 marks)

(d.) Find the *sids* of suppliers that supply every red part.

(4 marks)

--- End of the Question Paper ---