SCSSE
School of Computer Science and Software Engineering

Student to complete:

Family name	
Other names	
Student number	
Table number	

CSCI235
Databases
Wollongong Campus

Examination Paper
Autumn Session 2014

Exam duration	3 hours
Items permitted by examiner	Nil
Aids supplied	Nil
Directions to students	8 questions to be answered. This paper is worth 60% of the total marks for the subject .

This exam paper must not be removed from the exam venue

Question 1 **(6 marks)**

Read the description of a sample database domain given below.

A travel agency has its own travel management database system that contains information of airlines, flights, accommodations, and customers.

An airline contains airline name (such as Qantas, etc.), phone number, Fax number, and web site. Airline name, phone number, fax number and web site are unique.

An airline has many flights. A flight contains flight number, departure airport, destination airport, departure date (include time), arriving date (include time). Flight number and departure date uniquely identifies a flight.

A flight has seat information includes seat class (Economic, business or first class), price and number of available seats.

An accommodation includes a hotel name, location, contact phone number. Hotel name and its location uniquely identify a hotel. A hotel has many rooms. Room information includes room type (such as twin share, etc.), number of available rooms and price per night.

A customer has a customer id, first name, last name, phone number, home address. The customer id is unique. A customer can book flights, or accommodations through the travel agency. To book a flight, a booking should contain booking time and departure date. To book an accommodation, a booking should contain a booking time, arriving date and how many nights have been booked.

Analysis the requirements given above and construct the UML diagram for the Travel Agency. **No additional attribute allowed.**

Your diagram of conceptual schema **must** be consistent with a graphical notation of simplified UML class diagrams explained to you during the lecture classes in a subject CSCI235 Databases. **Application of another conceptual modeling notation will result in no marks awarded for this task!**

THE QUESTIONS 2, 3, 4, AND 7 REFER TO THE RELATIONAL TABLES LISTED BELOW

The schemas of relational tables, specifications of primary, candidate, foreign keys and check constraints are given below.

```
CREATE TABLE EMPLOYEE(
        E#              NUMBER(12)          NOT NULL,
        FNAME           VARCHAR(50)         NOT NULL,
        INITIALS        VARCHAR(5)          NULL,
        LNAME           VARCHAR(50)         NOT NULL,
        DOB             DATE                NULL,
        ADDRESS         VARCHAR(80)         NOT NULL,
         CONSTRAINT EMPLOYEE_PKEY PRIMARY KEY(E#) );
CREATE TABLE DRIVER(
        E#              NUMBER(12)          NOT NULL,
        L#              NUMBER(8)           NOT NULL,
        STATUS          VARCHAR(10)         NOT NULL,
        CONSTRAINT DRIVER_PKEY PRIMARY KEY(E#),
        CONSTRAINT DRIVER_UNIQUE UNIQUE(L#),
        CONSTRAINT DRIVER_FKEY FOREIGN KEY(E#) REFERENCES EMPLOYEE(E#),
        CONSTRAINT DRIVER_STATUS CHECK ( STATUS IN ('AVAILABLE', 'BUSY', 'ON
LEAVE')) );
CREATE TABLE TRUCK(
        REG#            VARCHAR(10)         NOT NULL,
        CAPACITY        NUMBER(7)           NOT NULL,
        WEIGHT          NUMBER(5)           NOT NULL,
        STATUS          VARCHAR(10)         NOT NULL,
        CONSTRAINT TRUCK_PKEY PRIMARY KEY(REG#),
        CONSTRAINT TRUCK_STATUS CHECK ( STATUS IN ('AVAILABLE', 'USED',
'MAINTAINED')) );
CREATE TABLE TRIP(
        T#              NUMBER(10)          NOT NULL,
        L#              NUMBER(8)           NOT NULL,
        REG#            VARCHAR(10)         NOT NULL,
        TRIP_DATE       DATE                NOT NULL,
        CONSTRAINT TRIP_PKEY PRIMARY KEY (T#),
        CONSTRAINT TRIP_FKEY1 FOREIGN KEY (L#) REFERENCES DRIVER(L#),
        CONSTRAINT TRIP_FKEY2 FOREIGN KEY (REG#) REFERENCES TRUCK(REG#) );
CREATE TABLE TRIPLEG(
        T#              NUMBER(10)          NOT NULL,
        LEG#            NUMBER(2)           NOT NULL,
        DEPARTURE       VARCHAR(30)         NOT NULL,
        DESTINATION             VARCHAR(30)         NOT NULL,
        CONSTRAINT TRIPLEG_PKEY PRIMARY KEY (T#, LEG#),
        CONSTRAINT TRIPLEG_UNIQUE UNIQUE(T#, DEPARTURE, DESTINATION),
        CONSTRAINT TRIPLEG_FKEY1 FOREIGN KEY (T#) REFERENCES TRIP(T#) );
```

Question 2 **(7 marks)**

Implement in SQL data definition and data manipulation statements to perform the following modifications to the sample database.

(1) There is no need to store information about a status of each driver.

(1 mark)

(2) Remove an employee number 20 from the database.

(1 mark)

(3) Change a number of a trip from 30 to 36. Assume that a trip number 36 does not exist in the database.

(1 mark)

(4) We should store the total number of trips for each driver in the table DRIVER. Add a column TOTTRIPS to the table DRIVER and update the column by finding the correct values from the database tables.

(2 marks)

(5) Create a table ADMIN that contains columns E# and ROOM#. Add administrators' information from the database into the table ADMIN. The administrators are those employees who are not drivers. The value of ROOM# should be set as G03 for all administrators.

(2 marks)

Question 3 **(8 marks)**

Implement the following queries as SELECT statements of SQL. An implementation technique, like for instance join queries, nested queries, group by, having etc is up to you.

(1) Find the licence numbers and full names of all drivers who used both trucks PKR768 and SYF777. (2 marks)

(2) Find the license numbers, full names and dates of birth of drivers who visited Wollongong at least one time in 2014.

(2 marks)

(3) Find the full names and driver license numbers of all drivers who made a trip that started in Sydney, then first passed through Melbourne and then returned to Sydney.

(2 marks)

(4) Find the employee numbers and full names of the oldest driver.

(2 marks)

Question 4 **(9 marks)**

Implement in SQL data manipulations, access control, and PL/SQL on the sample database. You are not allowed to suspend, delete, and modify any consistency constraints in the sample database.

(1) Decrease by 10% capacity of all trucks that have been used the largest number of times.
(1 mark)

(2) Create a relational view VISITS(L#, CITY, TOT) that contains information about the driving license numbers (L#) and the total number of times (TOT) a driver visited a city (CITY). A view must contain information about all drivers and all cities included in the database. If a driver has not visited a city the a value of attribute TOT must be equal to zero.
(2 marks)

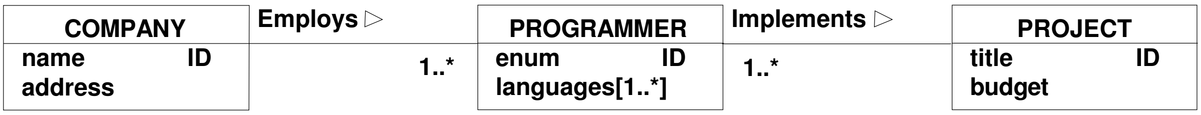
(3) Grant to a user *john* the right to read information of all drivers' full names, their drivers' license numbers, trip numbers, trip dates.
(1.5 marks)

(4) Create a relational table TRIPLENGTH(L#, T#, LENGTH) that contains information of drivers' license numbers, trip numbers and total length of each trip (each leg counted as one trip). Add correct data into the table TRIPLENGTH.
(1.5 marks)

(5) Implement a PL/SQL stored function **FindDrivers** that takes a truck's REG# as a parameter and return the list of drivers' license numbers and their full names that have driven the truck. Drivers' information should be separated by commas (',').
(3 marks)

Question 5 **(8 marks)**

Consider the following conceptual schema representing a simple database domain of software companies, programmers, and software projects implemented by the programmers. Each company employs many programmers and each programmer knows one or more programming languages. The programmers work on projects. Each project is implemented by one or more programmers.



(1) Write XML document with the sample contents of a database consistent with a conceptual schema given above. Insert into your document information about at least one instance of an object from each class. (3 marks)

(2) Write Document Type definition (DTD) that validates XML documents that contain information represented by the conceptual schema above. (5 marks)

Question 6 **(8 marks)**

Consider the following XML document.

```
<plants>
  <plant>
    <common>bloodroot</common>
    <light>mostly shady</light>
    <availability>
      <nursery>
        <name>Green finger</name>
        <price currency="AUD">2.44</price>
      </nursery>
      <nursery>
        <name>flower power</name>
        <price currency="USD">3.00</price>
      </nursery>
    </availability>
    </plant>
    <plant>
      <common>columbine</common>
      <light>mostly shady</light>
      <price>$9.37</price>
      <availability>
        <nursery>
          <name>Annandale garden centre</name>
          <price currency="AUD">5.00</price>
        </nursery>
      </availability>
    </plant>
   </plants>
```

(1) Implement the following queries in XPath:

(i) Find the common names (element `common`) of all plants such that their price is listed in `AUD`.

(ii) Find the common names (element `common`) of all plants whose selling status is unknown, i.e. an element available is missing from their description.

(4 marks)

(2) Implement the following queries in XQuery:

(i) List the common names of all plants sold by a nursery `Green Finger`.

(ii) Find the common names of plants sold by more than one nursery.

(4 marks)

Question 7 **(8 marks)**

(1) Implement the following database transactions as the sequences of SQL statements. The constants used in SQL statements are up to you.

The first transaction retrieves a single row from a relational table `DRIVER`*, then it inserts a row into a relational table* `TRIP`*, then it updates a single row in relational table* `DRIVER`*, and finally it commits all operations.*

The second transaction inserts a row into a relational table `DRIVER`*, then it retrieves the same row from a relational table* `DRIVER`*, then it updates a row in a relational table* `TRIP` *and finally it commits all operations.*

Both transactions supposed to run at `READ COMMITTED` isolation level.

(2 marks)

(2) Write a sample concurrent execution of both transactions such that the execution ends up in a deadlock situation.

Use a technique of presentation of concurrent execution of two database transactions explained to you during the lecture classes and such that the statements of the first transaction are listed on the left-hand side of a page and the statements of the second transaction are listed on the right-hand side of a page. Make sure that each statement starts in a different line to represent a different moment in time when its execution starts. (6 marks)

Question 8 **(6 marks)**

Read and analyse the relational schemas and functional dependencies valid for each one of the relational schemas given below.

For each one of the relational schemas, determine the highest normal form which is valid for a schema. Justify your answer.

Justification must include the derivations of minimal keys from the functional dependencies and testing the validity of normal forms against the relational schemas, minimal keys, and functional dependencies.

A correct guess without the comprehensive justifications scores no marks !

(1) SECTION(dname, snumber, head, location)
dname, snumber → head
dname, snumber → location
dname → snumber

(2 marks)

(2) BOOK(call#, isbn, title, price)
isbn → title
isbn → price
call# → isbn

(2 marks)

(3) BUILDING(bnum, rnum, item, area)
bnum → rnum
bnum, rnum → item, area

(2 marks)

End of Examination