School of Computing and Information Technology

Student to complete:

Family name	
Other names	
Student number	
Table number	

CSIT115
Data Management and Security
Wollongong Campus

Examination Paper
Spring Session 2018

Exam duration	3 hours
Weighting	60 %
Items permitted by examiner	None
Aids supplied	None
Directions to students	6 questions to be answered.

This exam paper must not be removed from the exam venue

QUESTION 1 (10 marks)

Read and analyse the following specification of a sample database domain.

A network of vehicle repair services would like to create a database to store information about their activities.
The network consists of a number of vehicle repair centers located all over a country. A vehicle repair center is described by a unique address (city name, street name, and building number), unique phone number, unique fax number, and unique web site address. A vehicle repair center is also described by its maximum capacity, i.e. the largest number of cars and the largest number of trucks that can be repaired at a moment.

The network specializes in the repairs of vehicles such as cars and trucks and no other vehicles. Information about a vehicle left by an owner for repair includes a vehicle registration number, make, model, and telephone contact number to an owner. Additionally, trucks are described by a capacity and manufacturing date.

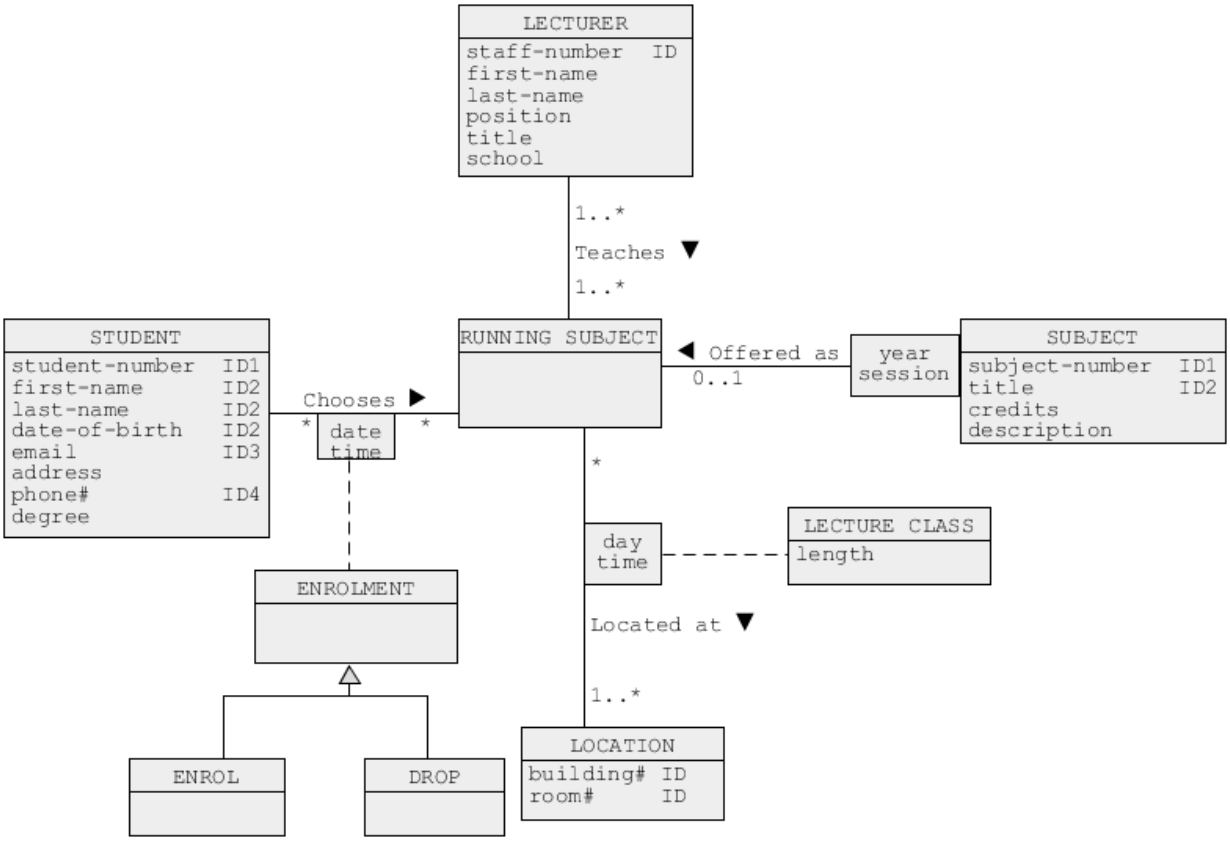
A vehicle can be repaired many times in many different vehicle repair centers. The network records date and time when a vehicle has been brought to a garage by an owner, a short description of a problem, date and time when a vehicle was released from a vehicle repair center and collected by an owner, and short description of the outcomes. Note, that when a vehicle is brought to a garage, release date and time, and the outcomes are still unknown.

Each repair needs zero or more spare parts used. A spare part is described by a unique name, unique bar code, and price. The network would like to store in the database information about all parts used for each repair.

Draw a conceptual schema for the specification of a database domain listed above. Use a notation of UML simplified class diagrams explained to you during the lecture classes in the subject.

There is NO NEED to provide a detailed analysis how a conceptual schema has been created. The final conceptual schema expressed in a notation of UML simplified classes is completely sufficient.

QUESTION 2 (8 marks)
Consider a conceptual schema given below.



Your task is to perform a step of logical database design, i.e. to transform a conceptual schema given above into a collection of relational schemas.

For each relational schema clearly list the names of attributes, primary key, candidate keys (if any), and foreign keys (if any). Assume that **superset method** must be used to implement a generalization.

THE QUESTIONS 3, 4, 5 and 6 REFER TO THE RELATIONAL TABLES LISTED BELOW

```
CREATE TABLE Department (
        DNumber     DECIMAL(5)      NOT NULL,   /* Department number          */
        DName       VARCHAR(30)     NOT NULL,   /* Department name            */
        Manager     CHAR(5)         NOT NULL,   /* Department manager number */
        MSDate      DATE,                       /* Manager start date         */
        CONSTRAINT Department_PK PRIMARY KEY(DNumber),
        CONSTRAINT Department_CK UNIQUE(DName)
);

CREATE TABLE DeptLocation (
        DNumber     DECIMAL(5)      NOT NULL,   /* Department number  */
        Address     VARCHAR(50)     NOT NULL,   /* Department location  */
        CONSTRAINT DeptLocation_PK PRIMARY KEY(DNumber, Address),
        CONSTRAINT DeptLocation_FK FOREIGN KEY(DNumber) REFERENCES
Department(DNumber)
);

CREATE TABLE Employee (
        ENumber     CHAR(5)         NOT NULL,   /* Employee number    */
        Name        VARCHAR(30)     NOT NULL,   /* Employee name      */
        DOB         Date,                       /* Date of birth      */
        Address     VARCHAR(50),                /* Home address       */
        Sex         CHAR,                       /* M-Male, F-Female   */
        Salary      DECIMAL(7,2),               /* Salary             */
        Supervisor  CHAR(5),                    /* Supervisor number  */
        DNumber     DECIMAL(5),                 /* Department number  */
        CONSTRAINT Employee_PK PRIMARY KEY(ENumber),
        CONSTRAINT Employee_FK1 FOREIGN KEY (Supervisor) REFERENCES
Employee(ENumber),
        CONSTRAINT Employee_FK2 FOREIGN KEY (DNumber) REFERENCES Department
(DNumber)
);

CREATE TABLE Project (
        PNumber     DECIMAL(10)     NOT NULL,   /* Project number     */
        PTitle      VARCHAR(30)     NOT NULL,   /* Project title      */
        Sponsor     VARCHAR(30),                /* Project sponsor name */
        DNumber     DECIMAL(5)      NOT NULL,   /* Department number  */
        Budget      DECIMAL(10,2)   NOT NULL,   /* Project budget     */
        CONSTRAINT Project_PK PRIMARY KEY(PNumber),
        CONSTRAINT Project_FK FOREIGN KEY (DNumber) REFERENCES Department(DNumber),
        CONSTRAINT Project_CK UNIQUE (PTitle)
);

CREATE TABLE WorksOn (
        ENumber     CHAR(5)         NOT NULL,   /* Employee number          */
        PNumber     DECIMAL(10)     NOT NULL,   /* Project number           */
        Hours       DECIMAL(3,1)    NOT NULL,   /* Working hours per week   */
        CONSTRAINT WorksOn_PK PRIMARY KEY(ENumber, PNumber),
        CONSTRAINT WorksOn_FK1 FOREIGN KEY(ENumber) REFERENCES Employee(ENumber),
        CONSTRAINT WorksOn_FK2 FOREIGN KEY(PNumber) REFERENCES Project(PNumber)
);
```

QUESTION 3 (10 marks)
Write the data definition statements of SQL that modify the structures of a database listed on a page 4 of the examination paper in the way described below. Note, that some of the modification may require more than one data definition statements of SQL statement.

(1) Add a foreign key constraint in the database that a department manager is an employee.

(2 marks)

(2) Add a check constraint in the database that the value of the attribute Sex is either `M` or `F`.

(2 marks)

(3) It is possible that the salary of an employee can be up to `$999999.99`.

(2 marks)

(4) In the future information about a department manager will be optional.

(2 marks)

(5) We would like to store information in the database about the percentage of an employee works on a project. The value of a percentage is between `0` and `1`. For example, 0.25 means 25%, and 1.0 means 100%.

(2 marks)

QUESTION 4 (8 marks)
Write the data manipulation statements of SQL that modify the contents of a database listed on page 4 of the examination paper in the ways described below. Note, that you are not allowed to modify and/or to drop any consistency constraints. Also note, that to implement some of the modifications listed below you may need more than one data manipulation statement of SQL.

(1) Insert into the database information about a new project. The project number is `1010`, title is Puzzle, the sponsor is `ABC Ltd`, done by the department number 5, and budget is $180000.00.

Two employees work on the new project. Employee `00107` has been assigned to the project. She spends `15` hours on the new project. Employee `00187` project has been changed to this new one. He spends `30` hours on the new project.

(2 marks)

(2) The project `1005` has been cancelled. Remove the related data from the database.

(2 marks)

(3) An employee `00187` (neither a manager nor a supervisor) decided to quit a job. Remove all information about the employee from the database.

(2 marks)

(4) An employee `00110` starts to work in the department `ACCOUNTING` as a manager at `01/09/2018`. An employee `00120` starts to work in the department `SALES` as a manager at the same day.
Note: The employees supervised by their department managers should also be updated.

(2 marks)

QUESTION 5 (12 marks)
Write `SELECT` statements that implement the following queries. Write one statement for each question.

(1) Find the names of all the departments that located in `Sydney`.

(2 marks)

(2) Find employee number and name for the employees who work on both projects `1002` and `1004`.

(2 marks)

(3) Find employee number and name (in uppercase) for all employees who were born after `1990`. Format the results in the descending order of their names.

(2 marks)

(4) For each department, find the department name and total budgets of the projects allocated for the department.

(2 marks)

(5) Find the names of the all employees who work in the department `GAMES`, and work on the projects that the budgets are more than `$100000`.

(2 marks)

(6) Find the number and name for the employees who have no project.

(2 marks)

QUESTION 6 (12 marks)

(1) MySQL allows for specification of domain constraints as so called `CHECK` constraint in `CREATE TABLE` statement of SQL. However, at the moment, the latest version of MySQL does not automatically enforce such constraints in a database.

It is possible to enforce a domain constraint in a different way than directly through `CREATE TABLE` statement.

Implement SQL script that enforces a constraint listed below in the sample database.

The total hours for each employee works on the projects must be less than or equals to 40 hours.

List the employee number, name and the message "works on the projects more than 40 hours" for the employees who violate the above constraint.

(5 marks)

(2) Assume that `CREATE TABLE` statements given on page 4 of the examination paper are included in a script file `dept.sql`. Assume that a user `root` with a password `'root'` would like to create a database called `dept` and inside the database the user `root` would like to create the tables given on page 4 of the examination. Write SQL script that performs all action listed below as a user `root`.

a) Then, a user `root` would like to create a new user account called `admin` with a password `'admin'`.

b) The new user `admin` must have access in read mode to the relational tables `Department`, `Employee` and `Project`.

c) The new user `admin` must have access in write mode to information about the employee works on projects. The new user has the right to propagate such privilege to other users.

d) The new user `admin` must have the rights to execute `CREATE TABLE` and `CREATE VIEW` statements with no right to propagate the privilege to the other users.

e) The new user `admin` must have the rights to reference the primary keys in the tables `Employee` with no rights to propagate the privilege to the other users.

f) The new user `admin` must have the rights to create at any time only one connection to the database.

(7 marks)