UNIVERSITY OF WOLLONGONG

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 2013

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 a description of a sample database domain given below.

A database should contain information about the real estate properties, owners of real estate properties, and agents who take care about the properties offered for sale.

The first name, last name, date of birth, and mobile phone number describe an owner. A mobile phone number uniquely identifies each owner. You may also assume that full name and date of birth is unique for each owner.

A property is described by a unique address which consist of city, street, building number for properties of type house or block of land. For properties of type flat or unit a unique address consists of city, street, building number, flat or unit number. The properties are also described by the attributes like total area, total number of bedrooms, and year when built. A property may also be described by the additional comments provided by an owner. A comment is usually a long text and it cannot be used for the identification purposes. However, the comments made by one owner have their unique numbers, e.g. comment 1, comment 2, … etc.

An owner owns one or more properties and each property has one owner. A database must contain information when a property has been purchased by an owner.

Some properties are listed for sale on a real estate market. A real estate property available for sale has a number of real estate agents assigned to it. An agent can be assigned to many real estate properties. We need to keep information about a date when an agent has been assigned to a property.

An agent is described by first name, last name and mobile phone number. A mobile phone number uniquely identifies each agent.

Construct a conceptual schema for a sample database domain described above. To create a conceptual schema you must use a notation of simplified UML class diagrams presented and explained to you during the lecture classes in CSCI235/MCS9235 Databases. It is not allowed to use any other conceptual modeling notation. It is also not allowed to add to your design any attributes which are not listed in a specification above.

Please remember to provide the names, directions, and multiplicities for all associations. Please remember about identification of the classes of objects.

Question 2 **(5 marks)**

Transform a conceptual schema given below into a collection of relational schemas.

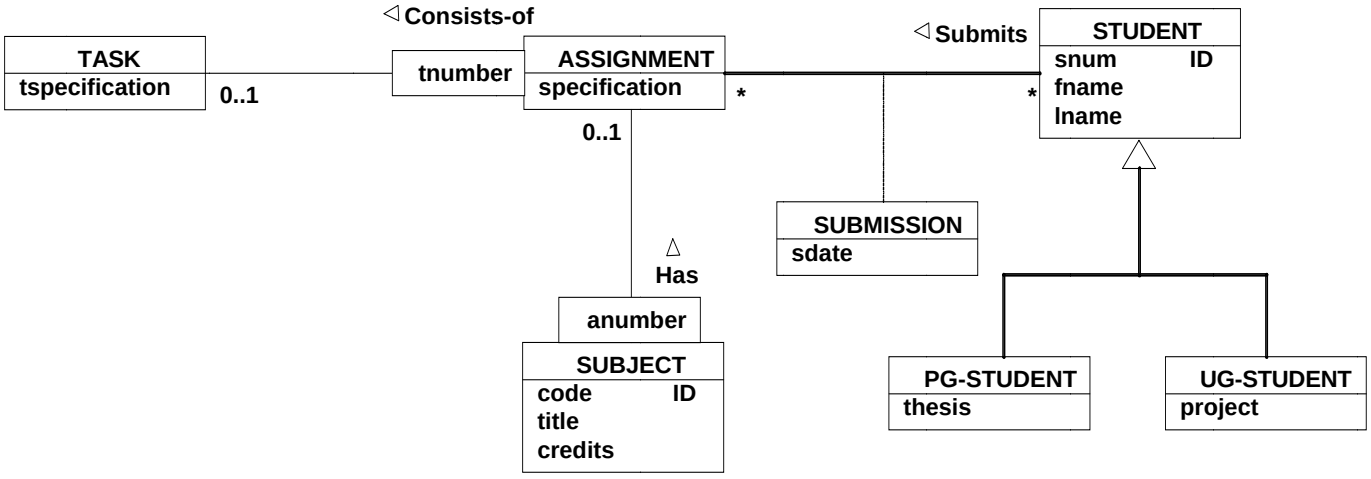
For each relational schema provide its name and the names of its attributes. For each attribute determine with the tags NULL/NOT NULL whether a value of an attribute is optional or compulsory.

For each relational schema determine a primary key and candidate keys (if any).

For each relational schema determine the foreign keys (if any) and provide information about the foreign keys referencing the respective primary keys.

Use a superset method for implementation of generalization.

There is no need to write CREATE TABLE statements unless you really feel that you have to do it for us.



THE QUESTIONS 3, 4, 5, 6 and 7 REFER TO THE RELATIONAL TABLES LISTED BELOW

The schemas of relational tables, meaning of attributes and specification of primary and foreign keys are given below.

```
CREATE TABLE COMPETITION (
        TITLE       VARCHAR2(200)   NOT NULL,   /* Title of competition */
        STARTD      DATE            NOT NULL,   /* Competition start date */
        ENDD        DATE            NOT NULL,   /* Competition end date */
        CONSTRAINT COMPETITION_PKEY PRIMARY KEY (TITLE));

CREATE TABLE TEAM (
        TNAME       VARCHAR2(20),               /* Team name */
        BUDGET      NUMBER(3),                  /* Budget of the team */
        CHAIRMAN    VARCHAR2(30),               /* Chairman of the team */
        CONSTRAINT TEAM_PK PRIMARY KEY(TNAME),
        CONSTRAINT TEAM_CKEY UNIQUE(CHAIRMAN),
        CONSTRAINT TEAM_CK CHECK (BUDGET > 0 AND BUDGET <= 700));

CREATE TABLE PARTICIPATING (
        TNAME       VARCHAR2(20),               /* Team name */
        TITLE       VARCHAR2(200),              /* Competition number */
        CONSTRAINT PARTICIPATING_PKEY PRIMARY KEY(TNAME, TITLE),
        CONSTRAINT PARTICIPATING_FKEY1 FOREIGN KEY(TNAME) REFERENCES
TEAM(TNAME),
        CONSTRAINT PARTICIPATING_FKEY2 FOREIGN KEY(TITLE)
                REFERENCES COMPETITION(TITLE));

CREATE TABLE TEAMBASE (
        TNAME       VARCHAR2(20),               /* Team name */
        CITY        VARCHAR2(20),               /* City name */
        STREET      VARCHAR2(20),               /* Street name */
        BLDG#       NUMBER(4),                  /* Building number */
        CONSTRAINT TEAMBASE_PKEY
                PRIMARY KEY(TNAME, CITY, STREET, BLDG#),
        CONSTRAINT TEAMBASE_FKEY FOREIGN KEY(TNAME)
                REFERENCES TEAM(TNAME));

CREATE TABLE PLAYER (
        PNAME       VARCHAR2(10),               /* Player's name */
        TNAME       VARCHAR(20),                /* Team name */
        CITY        VARCHAR(20),                /* City */
        STREET      VARCHAR2(20),               /* Street name */
        BLDG#       NUMBER(4),                  /* Building number*/
        CONSTRAINT PLAYER_PKEY PRIMARY KEY(PNAME),
        CONSTRAINT PLAYER_FKEY1 FOREIGN KEY(TNAME,CITY,STREET,BLDG#)
                REFERENCES TEAMBASE(TNAME,CITY,STREET,BLDG#));
```

Question 3 **(8 marks)**

Implement SQL scripts to extend and modify the sample database. Each of the following questions worth 2 marks.

(1) Change the size of the columns TNAME in the tables to maximum 30 characters.

(2) Add a column DOB in the table PLAYER that store the date of birth of players. Add a constraint in the table PLAYER that all players must be born before 1st January, 1995.

(3) Modify the constraint in the table TEAM that the value of BUDGET must be bigger than 0 (zero) and smaller than 900.

(4) Assume there are data have been added into the tables. Add a new column TOTAL_PLAYER in the table TEAM to store number of players for each team. The column TOTAL_PLAYER is a number type with maximum 3 digits, and its value cannot be NULL. Set the correct TOTAL_PLAYER values for each team.

Question 4 **(8 marks)**

Implement SQL scripts to perform the following tasks to the sample database. Each of the following questions worth 2 marks.

(1) A new competition "2013 Australian Soccer Tournament" will start from 10th June 2013 and end at 7th July, 2013. A team "Fly Bear" will participate in the tournament. Assume the team's information has already been recorded in the tables.

(2) A player "Cliff Robert" has left the team "Eagle" and joined the team "Titan", modify the information for the player .

(3) The team "Fly Bill" has moved from "Sydney", "Albert road", building 23 to a new base in "Wollongong", "Mike Street", building 15. Modify related information for the team.

(4) A team has changed its name from "Wollongong Dragon" to "Illawarra Dragon". The other information for the team remains the same. Update the corresponding data in the tables.

Question 5 **(7.5 marks)**

Implement in SQL data manipulations and access control on the sample database. You are not allowed to suspend, delete, and modify any consistency constraints in the sample database. Assume the owner of the relational tables is ALICE. Each of the following questions worth 2.5 marks.

(1) ALICE allows BOB to read and reference to the relational table COMPETITION. When BOB logs in his account, he creates a view COMPETITION2013 that display new competitions start in 2013.

(2) ALICE allows all the users to read data from the relational table PARTICIPATING. ALICE allows BOB to give reading permission to the other users on the table TEAMBASE.

(3) ALICE allows BOB to read information of teams' names and their chairmen.

Question 6 **(12 marks)**

Implement the SQL SELECT statements for the following queries. Each of the following questions worth 3 marks.

(1) Find all the teams' names and base addresses (city, street, bldg#) who participating the competition "2013 Basketball Championship".

(2) Find all the teams' names, chairmen and their base cities which have more than 20 players.

(3) Find all the teams' name, total number of competitions that the teams have participated in since 2012. Include the teams that have not participated in any competition.

(4) Find competition titles that have the largest number of teams participated in.

Question 7 **(6 marks)**

Consider a relational database described above and used in the previous questions. The database contains information about the competitions, teams participating in competitions, players in each team and bases of each team.

Implement a stored PL/SQL function that **lists in one line** the total number of players in a team and the names of players (attribute `pname`) who are the member of given team. Use a colon to separate the total number of players from player names. Use a comma to separate the names of players except the last name in a list. A name of a team (attribute `tname`) must be passed through an input parameter to the function.

Implement `SELECT` statement that uses the function implemented in the previous step and lists the names of teams, the total number of players in each team, and the names of all players in each team.

A solution that lists the total number of players and the names of players in more than one line scores no marks for this task!

Question 8 **(7.5 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 ! Each of the following questions worth 2.5 marks.

(a) PLAYER(pnum, team, name, position, address)
pnum -> team, name, position, address
team -> address

(b) ROOM(bnum, rnum, area, type)
bnum, rnum -> area, type
rnum -> area, type

(c) CONNECTION(bnum, rnum, ip)
bnum, rnum -> ip
ip -> rnum

End of Examination