School of Computing and Information Technology

CSIT115
Data Management and Security
Singapore Institute of Management

(Online) Final Examination Paper
Session 2 2021

Exam duration	2 hours + 1 hour (allowance for download and upload of Qns / Ans)
Weighting	70 % of the subject assessment
Marks available	70 marks
Items permitted by examiner	Nil / Non-programmable calculator
Directions to students	7 questions to be answered. Marks for each question are shown beside the question. All document submissions are to be uploaded in Moodle. Please follow strictly the deadline for submission (displayed in Moodle). Late submissions will attract penalty of 1 mark per minute late. Submissions exceeding 1 hr after deadline will not be accepted.

QUESTION 1 (10 marks)

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

The high school volleyball games are starting soon, and you are tasked to design a database that contains information about the volleyball teams, volleyball players, coaches, and games played by the teams.

A volleyball team is described by a team name, the name of school, and its address. An address consists of street name, a number, and a postal code. There are no two schools having the same name, and the team's name is unique.

A full name, date of birth, height, and weight describe a player. Players have the player numbers, which are unique within a team. The players are also described by the total number of games played, and specialization (such as setters, middle hitters, etc.). Some players may have two specializations (e.g. the player can be specialize in setters as well as middle hitters).

A player belongs to a team. The database should contain information when a player joined a team and for how long.

The teams play the games. A game involves two teams: home team and away team. A game is described by a date and the school where it has been played, and which team win the game. A date and the school uniquely identify a game. A team plays at least one game as a home team, and at least one game as an away team.

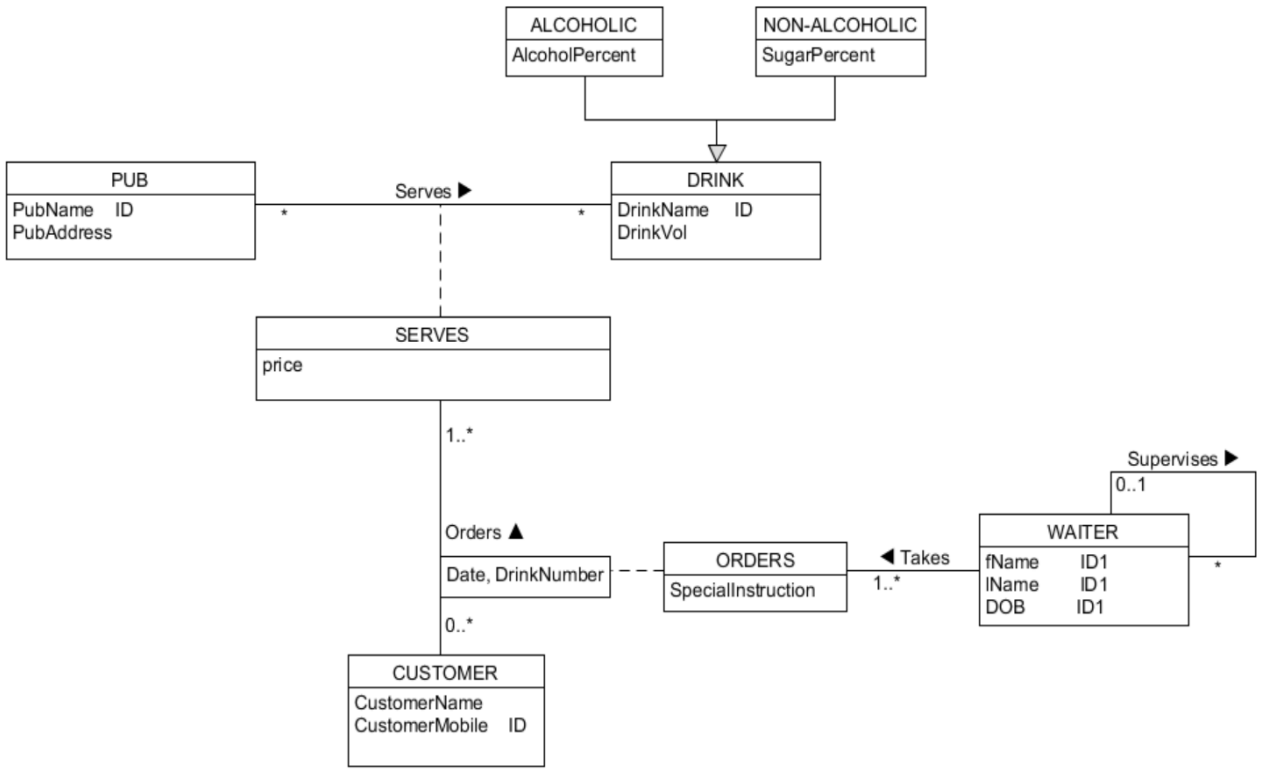
Coaches take care of the teams. A coach is described by full name and end of contract date. A coach is identified by a full name. Some coaches belong to a company, and they are further described by the company name, and a monthly pay. Some coaches are freelancer, and they have an hourly wage. A coach is only able to coach one team, and a team can only afford to have one coach. Sometimes, as the coach have ended his/her contract and before a new coach join, the team may have no coach.

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 (10 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). Where applicable, assume, that **superset method** must be used to implement a generalization.

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

```
CREATE TABLE BRANCH (
  BranchName              VARCHAR(10)   NOT NULL,     /* Branch Name */
  BranchDescription       VARCHAR(50)   NULL,         /* Branch Description */
  BranchPhone             VARCHAR(10)   NOT NULL,     /* Branch Phone number */
  BranchAddress           VARCHAR(45)   NOT NULL,     /* Branch Address */
  CONSTRAINT BRANCH_PKEY PRIMARY KEY (BranchName)
);

CREATE TABLE THERAPIST (
  TherapistID       VARCHAR(10)   NOT NULL,     /* Therapist ID */
  TherapistName     VARCHAR(15)   NOT NULL,     /* Therapist Name */
  DOB               DATE          NOT NULL,     /* Therapist Date of Birth */
  BranchName        VARCHAR(10)   NULL,         /* Branch Name */
  CONSTRAINT THERAPIST_PKEY PRIMARY KEY (TherapistID),
  CONSTRAINT THERAPIST_FKEY1 FOREIGN KEY (BranchName) REFERENCES BRANCH (BranchName)
);

CREATE TABLE SPECIALIZATION (
  Speciality        VARCHAR(20)   NOT NULL,     /* Therapist Speciality */
  TherapistID       VARCHAR(10)   NOT NULL,     /* Therapist ID */
  CONSTRAINT SPECIALIZATION_PKEY PRIMARY KEY (Speciality, TherapistID),
  CONSTRAINT SPECIALIZATION_FKEY1 FOREIGN KEY (TherapistID) REFERENCES THERAPIST
(TherapistID)
);

CREATE TABLE CLIENT (
  ClientID          VARCHAR(10)   NOT NULL,     /* Client ID */
  ClientName        VARCHAR(20)   NOT NULL,     /* Client Name */
  DOB               DATE          NOT NULL,     /* Client Date of Birth */
  ClientMobile      VARCHAR(10)   NOT NULL,     /* Client Mobile number */
  CONSTRAINT PATIENT_PKEY PRIMARY KEY (ClientID)
);

CREATE TABLE THERAPYSESSION (
  TherapistID             VARCHAR(10)   NOT NULL,     /* Therapist ID */
  ClientID                VARCHAR(10)   NOT NULL,     /* Client ID */
  SessionDate             DATE          NOT NULL,     /* Date of Session */
  SessionTime             VARCHAR(10)   NOT NULL,     /* Start time of Session */
  SessionDuration         DECIMAL(5,2)  NOT NULL,     /* Duration of Session */
  CONSTRAINT THERAPYSESSION_PKEY PRIMARY KEY (TherapistID, ClientID, SessionDate),
  CONSTRAINT THERAPYSESSION_FKEY1 FOREIGN KEY (TherapistID) REFERENCES THERAPIST
(TherapistID),
  CONSTRAINT THERAPYSESSION_FKEY2 FOREIGN KEY (ClientID) REFERENCES CLIENT (ClientID)
);
```

QUESTION 3 (10 marks)

Write data definition statements of SQL that modify the structures of a database listed on a page 4 of the examination paper in the following ways.

(a) The centre has decided to increase the length of the branch address to 50 characters, and it should be an optional field.

(b) New mandatory information about therapist's `mobile` should be stored in the appropriate table. The column storing therapist's `mobile` should allow only numbers of at most 10 figures to be stored. A constraint also needs to be added so that `mobile` stays above 3999999999. (Note: it is possible to write more than one SQL statement for this question)

(c) The centre has decided that Branch Description is unnecessary thus the specific column will need to be removed.

(d) The centre has decided to replace the existing primary key of `BRANCH` table with a new primary key `BranchID`. The new primary key should allow alphanumeric values of at most 8 characters to be stored. (Note: it is possible to write more than one SQL statement for this question)

QUESTION 4 (10 marks)

Write data manipulation statements of SQL (in the correct sequence!) 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. (Note: you are to ignore the changes made in question 3)

(a) A new therapist `Charlie` has joined an existing branch, `Abundance`. The therapist is NOT in the database, and you should give it a Therapist ID: `T0881` with a date of birth `9th August 1981`. `Charlie` has speciality of `Massage` and `chiropractic`.

Write SQL statement(s) to effect the above modifications to the database.

(b) A newly joined therapist `Elle` (there is no other therapist with the name of `Elle` in the centre) has resigned from the centre. As `Elle` has only joined for one week, she has not been assigned therapy sessions with clients. `Elle` has a speciality of `Meditation`.

Write SQL statement(s) to effect the above modifications to the database.

(c) A branch `Recovery` has changed the phone number to 6566668888 because of feng shui.

Write SQL statement(s) to effect the above modifications to the database.

QUESTION 5 (12 marks)

Write SELECT statements that implement queries on a database listed on a page 4 of the examination paper in the following ways. (Note: you are to ignore the changes made in question 3)

(a) Find the names of therapist working in the branch `Abundance`.

(b) Find the names of client who have not signed up any therapy session. (Note: you must use 'EXISTS' or 'NOT EXISTS' in your answer)

(c) Find the names of branch that are having therapist with the speciality of `Meditation` or `Massage`. Sort the results in descending order.

(d) Find the names of therapist, and the total hours (duration) worked by each of the therapists. (Note: you must use 'GROUP BY' in your answer)

(e) Find the ID of therapist where the therapist is NOT assigned to a branch yet.

(f) Create a View called `AbTherapist` that will show only the name of therapist and the speciality of all therapists who work in the branch that is having the phone number of `6588662222`.

QUESTION 6 (10 marks)

Assume that a user `root` with a password `'root'` has created a database called `THERAPY` and inside the database the user `root` has created the tables given on page 4 of the examination. (Note: you are to ignore the changes made in question 3)

Write SQL statements that performs the action listed in the following as a user `root`.

(a) The user `root` would like to create a new user account called `Jabesh` with a password `'verypower'`. The total number of times `Jabesh` can connect to the server per hour must be set to `11`. (Note: you can only use one SQL statement)

(b) The new user `Jabesh` must have the rights to execute CREATE TABLE and CREATE VIEW statements in the database `THERAPY` with right to propagate the privilege to the other users.

(c) The new user `Jabesh` must have access in write mode to the relational tables `THERAPIST, BRANCH` with NO right to propagate such privilege to other users.

(d) The new user `Jabesh` must have the UPDATE privilege to a relational table `BRANCH` and column `BranchName` with rights to propagate the privilege to the other users.

(e) The management wanted to remove all privileges from an existing user `Jabesh` to the database `THERAPY`.

QUESTION 7 (8 marks)

The management wants to implement a policy and a view that fulfill the following requirements. The database is listed on a page 4 of the examination paper, and the database name is `THERAPY`. (Note: you are to ignore the changes made in question 3)

All branches with more than 5 therapists and the total session duration exceeds 500 hours needs to submit a special report to the management

Implement SQL script to find all cases that violate the following consistency constraint.

"Branch with more than `5 therapists` and the total session duration exceeds `500` hours need to submit a special report to the management"

The script must list the outcomes of verification of the consistency constraint as a single column table with the following messages as the following rows.

<insert Branch Name here> has more than 5 therapists and the total session duration exceeds 500 hours

Use a function CONCAT to create the messages above.

End of Examination