Llandwp Sports Club

CS27020 Assignment

This assignment counts for 30% of the marks for CS27020

Deadline: 11th March 2011

Introduction

One of the members of the Llandwp sports and recreational club has created a database to keep track of members, sports, teams and sponsors. However, although the enterprise rules are reasonably well understood, the implementation is not very good. Your task is to develop a better implementation.

The following sections describe the enterprise rules for the sports club database, the database implementation, problems that have been identified with the database and what you are asked to do to help solve those problems.

Enterprise Rules

Every member of Llandwp Sports club plays at least one sport; for example, Fred Jones plays soccer, rugby and badminton, and Joanna Taylor plays table tennis. Every sport is played by at least one club member.

Some sports have one or more teams, but a sport need not have any team – some sports are purely recreational. Each team is for one and only one sport.

Every team has at least one player and may have more. A player on a team must be a club member, and must play the sport in question. A club member may belong to no teams, or to one team, or to several teams.

A team may have at most one sponsor. A sponsor sponsors zero or more teams.
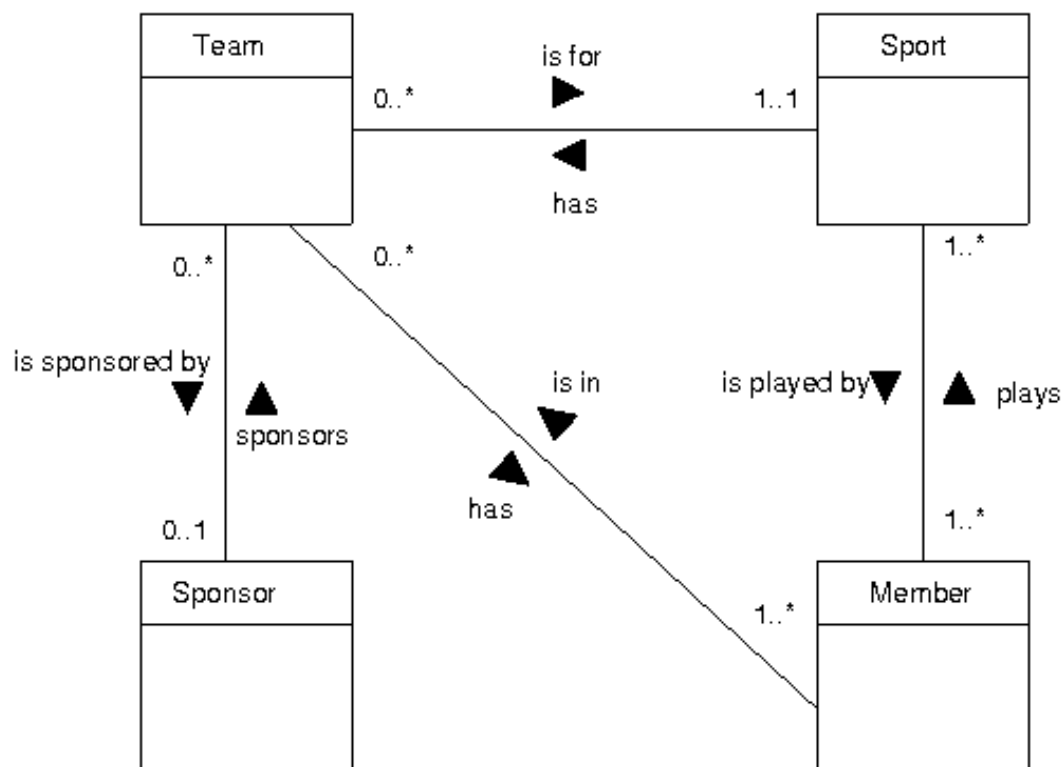

Illustration 1: Enterprise rules for the sports club

The Faulty Implementation

Here are the 'CREATE TABLE' commands that were used to create the Llandwp Sports Club database. This implementation does not accurately model all the relationships in described in Illustration 1, and gives rise to several problems with the database.

```
CREATE TABLE sport (
      name text primary key
);

CREATE TABLE team (
      team_id varchar(10) primary key,
      name text not null,
      member_id varchar(10),
      sport text references Sport (name)
);

CREATE TABLE member (
      member_id varchar(10) primary key,
      given_name text not null,
      family_name text not null,
      dob date,
      postcode text,
      house text,
      locality text,
      plays text references sport,
      teams varchar(10) references team
);

CREATE TABLE sponsor (
      sponsor_id varchar(7) primary key,
      name text,
      teams varchar(10) references team (team_id)
);
```

These commands include some common faults in relational implementation of entity-relationship models, and those faults have given rise to the problems described in the following section.

Problems with the database

Here is a display of the team table:

```
eds=> select * from team;
 team_id |                   name                  | member_id |    sport
---------+-----------------------------------------+-----------+--------------
 ttA     | Llandwp and District table tennis A     | JP22      | table tennis
 ttB     | Llandwp and District table tennis B     |           | table tennis
 rugbyA  | Fire Eaters A                           | JT3       | rugby
 tennisA | Llandwp Thumpers                        | JP22      | tennis
 soccerA | Blue Lagoon A                           | JJ1       | soccer
 soccerB | Blue Lagoon B                           |           | soccer
 badA    | Feathers                                | JP22      | badminton
(7 rows)
```

Illustration 2: The Team Table

And here is a display of the member table:

```
eds=> select * from member;
 member_id | given_name | family_name |    dob     | postcode |        house          | locality |   plays      |  teams
-----------+------------+-------------+------------+----------+-----------------------+----------+--------------+---------
 JT1       | Joanna     | Taylor      | 1992-01-12 | SY23 3DD | 21 Elmwood Crescent   | Llandwp  | badminton    | badA
 JJ1       | John       | Jones       | 1995-05-22 | SY23 3DW | Is-y-Coed, Seapoint Road | Llandwp | soccer     | soccerA
 JM3       | James      | Moynihan    | 1997-05-31 | SY23 3DD | 26 Pinetree Road      | Llandwp  | chess        |
 JT12      | Joanna     | Taylor      | 1992-01-12 | SY23 3DD | 21 Elmwood Crescent   | Llandwp  | soccer       | soccerB
 JM77      | Jessica    | Morris      | 1999-06-12 | SY23 3DD | 21 Elmwood Crescent   | Llandwp  | chess        |
 MB23      | Mary       | Brown       | 2002-12-08 | SY23 3DB | 12 Alpine Terrace     | Llandwp  | soccer       | soccerA
 JB12      | Jeremy     | Brown       | 2001-02-18 | SY23 3DB | 12 Alpine Terrace     | Llandwp  | badminton    | soccerA
 JB7       | Jeremy     | Brown       | 2001-02-18 | SY23 3DB | 12 Alpine Terrace     | Llandwp  | chess        | badA
 JT5       | Joanna     | Taylor      | 1992-01-12 | SY23 3DD | 21 Elmwood Crescent   | Llandwp  | badminton    | badA
 AA7       | Anthony    | Armstrong   | 1998-05-12 | SY23 3CW | 19 Richmond Road      | Llandwp  | tennis       | tennisA
 JB2       | Jeremy     | Brown       | 2001-02-18 | SY23 3DB | 12 Alpine Terrace     | Llandwp  | table tennis |
 AB7       | Ambrose    | Bradshaw    | 1996-12-12 | SY23 3AB | 45 New Street         | Llandwp  | soccer       | soccerB
 JP22      | Jemima     | Puddleduck  | 1998-06-14 | SY23 3DB | 24 Elmwood Crescent   | Llandwp  | rugby        | rugbyA
 EN5       | Emily      | Nugent      | 1991-09-15 | SY23 3CW | 24 New Street         | Llandwp  | soccer       | soccerA
 WC2       | William    | Craig       | 1994-01-16 | SY23 3AA | 22 Richmond Road      | Llandwp  | soccer       | rugbyA
 CL42      | Caroline   | Lewis       | 1995-04-01 | SY23 3DB | 72 Orange Tree Avenue | Llandwp  | bowls        | rugbyA
 KM3       | Katherine  | Meyer       | 1989-11-14 | SY23 3CW | 44 Waterville Terrace | Llandwp  | soccer       | soccerA
 JJ0       | Jonathan   | Jones       | 1995-08-23 | SY23 3CW | 22 Richmond Road      | Llandwp  | chess        | soccerA
 OB5       | Oliver     | Byrne       | 1996-06-05 | SY23 3CW | 17 High Street        | Llandwp  | soccer       | soccerA
 JT3       | Joanna     | Taylor      | 1992-01-12 | SY23 3DD | 21 Elmwood Crescent   | Llandwp  | chess        |
 JE7       | Jennifer   | Ellis       | 1989-05-12 | SY23 3DB | 82 Victoria Parade    | Llandwp  | soccer       | soccerA
(21 rows)

eds=>
```

Illustration 3: The member table

Problem 1

Looking at the Member table, you can see that details for the same member can be entered more than once. For example, Joanna Taylor of 21 Elmwood Crescent, Llandwp appears three times in the member table.

Problem 2

You can also see that, according to the member table, several club members appear to belong to 'rugbyA', the Fire Eaters A team. However the Team table only refers to the third entry for Joanna Taylor, whose value for 'teams' is NULL (and who is in any event shown as a chess player).

Problem 3

More generally, there is a lack of consistency between the sports each member is shown as playing, and the sports played by their teams. For example, Caroline Lewis is listed as a bowls player who belongs to the Fire Eaters A rugby team.

Problem 4

A related problem is highlighted by the queries displayed in Illustration 4. The first query, from the Member table, shows Jemima Puddleduck is a member of the Fire Eaters A rugby team. The second query, on the Team table, shows Jemima Puddleduck as a member of a table tennis team, a badminton team and a tennis team.

```
eds=> select * from member where given_name like 'Jemima';
 member_id | given_name | family_name |    dob     | postcode |        house         | locality | plays | teams
-----------+------------+-------------+------------+----------+----------------------+----------+-------+--------
 JP22      | Jemima     | Puddleduck  | 1998-06-14 | SY23 3DB | 24 Elmwood Crescent  | Llandwp  | rugby | rugbyA
(1 row)

eds=> select * from team where member_id in (select member_id from member where given_name like 'Jemima');
 team_id |               name                 | member_id |    sport
---------+------------------------------------+-----------+--------------
 ttA     | Llandwp and District table tennis A | JP22      | table tennis
 tennisA | Llandwp Thumpers                   | JP22      | tennis
 badA    | Feathers                           | JP22      | badminton
(3 rows)
```

Illustration 4: Entries for Jemima Puddleduck in the Member Table and in the Team Table

Problem 5

It is impossible for a sponsor to sponsor more than one team, but a team can have multiple sponsors, which is against club policy.

Your Task

- Draw a UML class diagram to illustrate the relational model implemented by the SQL CREATE TABLE commands given above. Explain how the relationships implemented by the script fail to capture the relationships shown in *Illustration 1* and how this leads to the database problems listed above.

- Draw a second UML class diagram showing the correct way to implement the entity-relationship model shown in *Illustration 1* above. Explain the extent to which correct use of link relationships and primary and foreign keys will enforce the enterprise rules. Indicate where these will not be sufficient to avoid the problems listed above. (Look back at Entity Relationship Translation in the lecture materials if you are unsure about this.)

- Write new SQL commands to implement the database correctly. Where possible, enterprise rules should be enforced using primary and foreign key references and/or uniqueness constraints. Where these are not sufficient, add constraints at table or database level.

- Devise and run some tests to show how the problems described above are avoided with your new implementation.

Submission

Completed work, comprising

1. A signed declaration of originality
2. A UML class diagram illustrating the relational model implemented by the SQL script given above, with an explanation describing how the model embodied in this script fails to capture the required enterprise rules and so leads to the problems described above.
3. A UML class diagram illustrating your recommended implementation, with an explanation describing the extent to which your new model enforces the constraints implied by the enterprise rules, and indicating where these will not be enforced.
4. A correct implementation of the database, using primary and foreign keys and/or uniqueness constraints to implement enterprise rules where possible, and using more general constraints where necessary.
5. A script or collection of screenshots showing that your new implementation avoids the problems with the original implementation.

should be uploaded to Blackboard by 6pm on Friday March 11th, 2011.

Feedback will be returned on Friday April 8th 2011 (check this date).

In case of any personal, financial or health problems affecting this coursework, please provide a special circumstances form to your year coordinator (for second year Computer Science students, this is Rhys Parry, rrp@aber.ac.uk).

Late submissions should be made via the Departmental Office and should include a late submission form duly completed. This form is also available via the Office.

If you have specific questions relating to the assignment itself, please contact Edel Sherratt, eds@aber.ac.uk