

2.1) The Conceptual Design of our Application

For clarity, I have split this section up into 2 portions: one for the design of all the entities and relations (what we went with, and how everything ties together), and one to explain our assumptions for cardinality and participation between the most important entities.

Section 1: Our Entities and Relations Explained

Users:

Every time a new person goes to register for our health and fitness center, a new user entity is created. This entity stores information such as the username, password, and the role the person will play (between a member, a personal trainer, and an administrator). Depending on the role selected, the person will then receive the corresponding ID, and will have access to the functions provided to each type of person.

Members:

Members are the clients of the health and fitness center. Upon starting, they will be asked to enter personal health information, such as their weight, height, age, and some fitness goals they would like to focus on. Once accomplished, the member will have access to all the club's services, including booking a 1 on 1 personal training session, or joining a group class led by a personal trainer. The members will also have a list of achievements they can potentially earn, which can range from showing up once a week every month for a certain period of time, to joining and completing 10 group classes. These achievements will be stored and can be viewed at any time from the member's profile. The member also has a bill associated with their account, and will be charged one monthly fee for all amenities provided.

Trainers:

Personal trainers handle all of the member training at the club. They can either run a 1 on 1 training session with a given client, where they can leave notes at the end of every session, or they can be in charge of running an entire class, which allows many members to join and learn together. The personal training sessions would be more specific, with the personal trainer able to see the member's fitness goals and plan a workout based on those, and the group classes would be more general, allowing members to see what they want to work on or just to socialize with others.

Admins:

Administrators handle all of the logistical aspects of the club. Their main role is to oversee everything going on, such as watching over classes, personal training sessions, and monitoring fitness equipment and handling room bookings. They do this to ensure that everything is up to proper standards, and can step in and change things as needed. They also handle the billings, which involves sending invoices to members, issuing loyalty points for all transactions, and creating / canceling memberships as needed.

Classes:

Classes are group sessions which have 1 trainer teaching a group of members some general fitness activity. This could range from a cardio session, to learning the proper form for weight lifting, to tips for planning a workout. These group sessions can have any number of people, though if an administrator notices there are too many people in one class, they can split it up into 2 smaller classes to ensure that one instructor is not overwhelmed.

Personal Training:

Personal training sessions are 1 on 1 coaching sessions between a personal trainer and a member. This is a much more specialized event where the trainer sees what the member wants to do (based on their fitness goals), and crafts a workout to suit their needs. A member must register themselves for a personal training session, and the trainer can decide to join or let someone else cover it. Personal training sessions are covered in the monthly fee the members pay, but it is up to the administrators to ensure that people aren't taking advantage of this system.

Other:

The other entities / relations are still important, but not the primary focus of our application. These involve things like achievements, fitness equipment, and room bookings. These store records of information that can be accessed by a person with the appropriate rank (fitness equipment can only be monitored by administrators, as an example).

Section 2: Assumptions for Cardinality and Participation

Users:

For any person joining the club, an entry is made for them in the *User* entity before then giving them the role of Member, Trainer or Administrator. As such, our ER diagram shows that there is a 1 to 1 cardinality between a user and each of the 3 roles, as every user must be in exactly 1 of the 3 roles.

There is also partial participation between the user and the other 3 entities, but total participation back. This shows that not all users are in all 3 of the roles at once, but every person in each of the roles must be a user.

Classes:

There are 3 main assumptions we made involving classes:

1. A member can register themselves in multiple classes at a time, and every class can have more than one member at a time. However, while each member does not *need* to be enrolled in a class, a class does need at least 1 member to be registered in order to run.
2. Trainers can run multiple classes at a time, but each class can only be run by 1 trainer at once. A class also cannot be run if there are no trainers to run it.
3. A class must be overseen by 1 and only 1 administrator to ensure everything is up to proper standards. This involves making sure the class has a manageable amount of members involved (opening a new class if there are too many people), and making sure everyone is getting sufficient attention while in the class. An administrator can oversee multiple classes at once, but each class can only have 1 administrator overseeing it.

Personal Training:

The main assumption we made here is that it is the member's responsibility to register themselves for a personal training session. A member can register in any number of personal training sessions (so long as they are being offered), and trainers can run any number of personal training sessions. Personal training sessions must include 1 member and 1 trainer, otherwise the session will be canceled. Each personal training session must be overseen by 1 administrator to ensure everything is alright.

Billing:

Every member has a monthly bill they must pay which covers the cost of all of the services offered in the club, including personal training sessions and classes. An

administrator is required to manage the billing process, which includes sending invoices and reminders to the member, handling loyalty points, and so on. Each administrator can handle multiple billings, but each billing requires exactly 1 administrator to be overseeing it. Each member has their own separate bill, which means we cannot have multiple members working out under the same bill, each member must be uniquely registered and have their billing handled separately.

Achievements:

Achievements are milestones that a member can accomplish while training at the club. A member can earn any number of achievements, and they will be added to the member's record for later viewing. Achievements will still exist regardless of if they have been earned or not, and so it is possible for only certain members (or none) to earn specific achievements and have them added to their record.

Miscellaneous:

Other relations, such as managing fitness equipment or managing room bookings are done by the administrators. Each administrator can be in charge of managing multiple room bookings or maintaining several pieces of fitness equipment, and each of these must be handled by 1 administrator at a time.