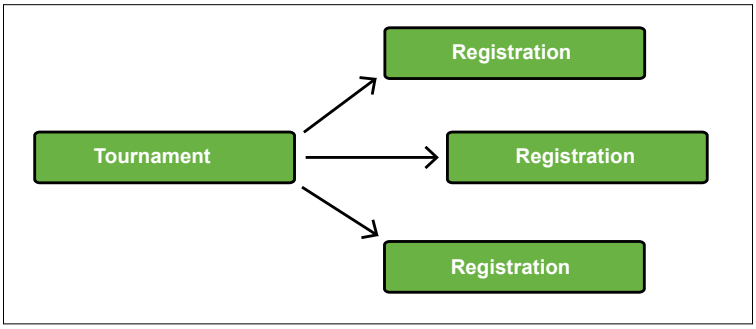
One-to-Many Unidirectional Relationship

In this lesson, we will cover one-to-many relationships and learn about the orphan removal attribute.

We'll cover the following

To show the one-to-many relationship, we will model the case where many players can register for a tournament. We will create a **tournament** table and a **registration** table to model this relationship.

Unidirectional one-to-many relationship means that only one side maintains the relationship details. So given a `Tournament` entity, we can find the `Registration`s but we cannot find the `Tournament` details from a `Registration` entity.



One-to-Many unidirectional relationship

1. To model the one-to-many relationship, create a new package **onetomany.uni** and define a `Tournament` class with three fields: `id`, `name` and `location`. The `id` field is the primary key. We can also save other details like the dates in which the tournament takes place, the type of surface on which it will be played, and the number or rounds etc.

```
package io.datajek.databaserelationships.onetomany.uni;

@Entity
public class Tournament {
    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private int id;
    private String name;
    private String location;
    //getters and setters
    //constructor
    //toString method
}
```

2. Next, define the `Registration` class with just one field, `id`, for now. The `id` field is the primary key for the table. We will add more fields later.

   The `Registration` class can store information about the registration date, the type of match (single/ doubles) for which the player registers, and the rank assigned to the player (seed) etc.

```
package io.datajek.databaserelationships.onetomany.uni;

@Entity
public class Registration {
    @Id
    @GeneratedValue(strategy=GenerationType.IDENTITY)
    private int id;
    //getters and setters
    //constructor
    //toString method
}
```

> Since a player registers for a tournament, a registration object should be associated with a player object.

3. Now, we will update the `Tournament` class to show the registrations. Since a tournament can have multiple registrations, we will add a `List` of `Registration`s as a new field.

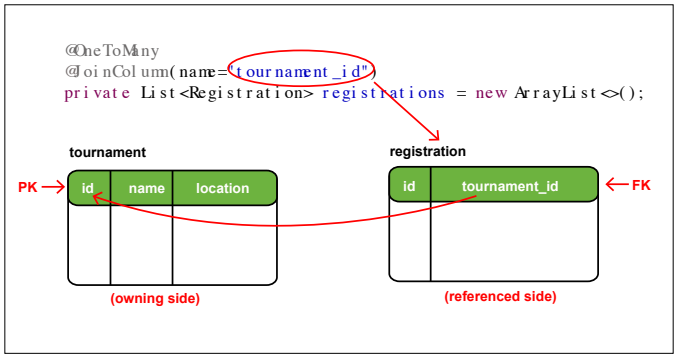
```
public class Tournament {
    //...
    private List<Registration> registrations = new ArrayList<>();
    //generate getter and setter methods
    //update constructor & toString()
}
```

@OneToMany

4. The `Tournament` class has a one-to-many relationship with the `Registration` class as one tournament can have multiple registrations. This can be modelled by the `@OneToMany` annotation. In a one-to-many relationship, the primary key of the *one* side is placed as a foreign key in the *many* side.

   The `@JoinColumn` annotation shows that this is the owning side of the relationship. **tournament_id** will be added as a foreign key column in the **registration** table.

```
@OneToMany
@JoinColumn(name="tournament_id")
private List<Registration> registrations = new ArrayList<>();
```



@JoinColumn annotation

> In the absence of the `@JoinColumn` annotation, Hibernate creates a join table for the one-to-many relationship containing the primary keys of both the tables.

If the application is run, it creates the database structure shown below. Here **tournament_id** is the foreign key column. We can verify this using the H2 web console (at http://localhost:8080/h2-console with *jdbc:h2:mem:testdb* as the connection URL).

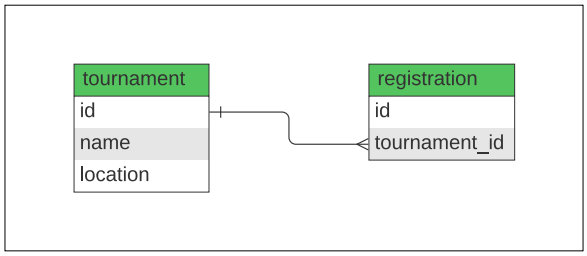


Table structure

Cascade type

5. Next, we will choose the cascade type for this relationship. When a tournament is deleted we will delete the associated registrations as well. This can be achieved by choosing `CascadeType.ALL`.

```
@OneToMany(cascade=CascadeType.ALL)
@JoinColumn(name="tournament_id")
private List<Registration> registrations = new ArrayList<>();
```

6. To set up the association between tournament and registration, we will add a method in the `Tournament` class that assigns a `Registration` object to a `Tournament` object.

```
public void addRegistration(Registration reg) {
    registrations.add(reg);
}
```

7. Now we will create the repository, service and controller classes for `Registration` and `Tournament` in the appropriate packages. The repository interfaces are named `TournamentRepository` and `RegistrationRepository` and extend the `JpaRepository` interface.

   The REST controllers `TournamentController` and `RegistrationController` have a `@RequestMapping` of **/tournaments** and **/registrations** respectively. The controller classes call methods the in service layer classes, `TournamentService` and `RegistrationService`.

   All the above mentioned interfaces and classes are shown in the code widget below.

8. We need a **PUT** mapping in the `TournamentController` class to assign a registration to a tournament. The `addRegistration` method with **/{id}/registrations/{registration_id}** mapping adds a registration with `registration_id` to a tournament with `id` as its key.

```
@PutMapping("/{id}/registrations/{registration_id}")
public Tournament addRegistration(@PathVariable int id, @PathVariable int registration_id) {
    Registration registration = registrationService.getRegistration(registration_id);
    System.out.println(registration);
    return service.addRegistration(id, registration);
}
```

   The corresponding service layer method in `TournamentService` class is shown:

```
public Tournament addRegistration(int id, Registration registration) {
    Tournament tournament = repo.findById(id).get();
```

```
    tournament.addRegistration(registration);
    return repo.save(tournament);
}
```

Registration.java

Search in directory...

/
Registration.java
Tournament.java
RegistrationRepository.java
TournamentRepository.java
RegistrationService.java
TournamentService.java
RegistrationController.java
TournamentController.java
DatabaseRelationshipsApplication.java

```
package io.datajek.databaserelationships.onetomany.uni;

import javax.persistence.Entity;
import javax.persistence.GeneratedValue;
import javax.persistence.GenerationType;
import javax.persistence.Id;

@Entity
public class Registration {
    @Id
    @GeneratedValue(strategy=GenerationType.IDENTITY)
    private int id;

    public Registration() {
    }

    public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;
    }

    @Override
    public String toString() {
        return "Registration [id=" + id + "]";
    }
```

Run Save Reset

Your app can be found at: https://ed-6231652667490304.educative.run/tournaments

> For the code widget given above, use the URL at which the application is running in place of http://localhost:8080/. For example, /**tournaments** means http://localhost8080/tournaments for *local dev environment*. If using POSTMAN with code widget above, use the URL shown under the code widget to access /**tournaments**.

9. To test the application, first add two tournaments using the following **POST** requests to /**tournaments**:

```
{
    "name": "Canadian Open",
    "location": "Toronto"
 }
```

```
{
    "name": "US Open",
    "location": "New York City"
 }
```

Next, we will add four registrations by sending **POST** request with an empty body to /**registrations**:

```
{}
```

Out of the four registrations, we will associate one with the first tournament and three with the second tournament. This can be achieved by sending the following **PUT** requests:

http://localhost:8080/tournaments/1/registrations/3 http://localhost:8080/tournaments/2/registrations/1
http://localhost:8080/tournaments/2/registrations/2 http://localhost:8080/tournaments/2/registrations/4

A **GET** request to /**tournaments** shows the tournaments along with their registrations. The same can be verified using the H2 web console.

> Creating a *Collection* from the above mentioned POST and PUT requests can help reduce setup time for subsequent tests.

Tournaments along with registrations

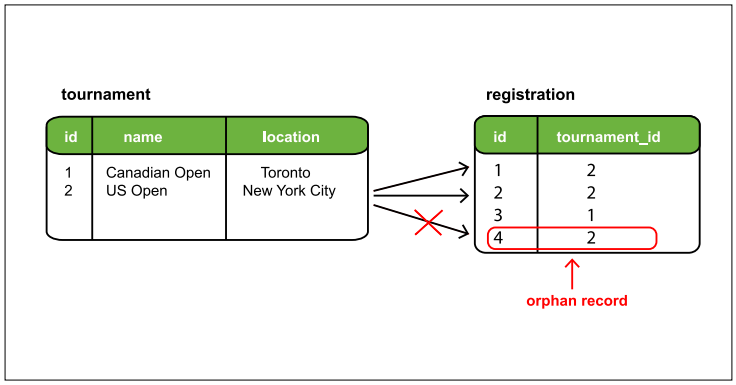
If we delete the tournament with `id` 2 by sending a **DELETE** request to **/tournaments/2**, the tournament is deleted along with its three registrations. The **registration** table has only one registration left.

After deleting tournament with id 2

Orphan records

10. An orphan record is a record with a foreign key value that points to a primary key value that no longer exists. Orphan records point to a lack of referential integrity which means that the data in the tables is not in a consistent state.

    In our example, the registration record has a foreign key value of `tournament_id`. We can remove a registration from a tournament by breaking the association between the two. In such a case, the record in the registration table would become an orphan as it is no longer linked to any entry in the tournament table. The following figure shows an orphan record:



To demonstrate the concept, we will create a method `removeRegistration` which breaks the association between a `Tournament` and a `Registration` object.

```
public void removeRegistration(Registration reg) {
    if (registrations != null)
        registrations.remove(reg);
}
```

We will create a new **PUT** mapping of **/tournaments/{id}/remove_registrations/{registration_id}** in the `TournamentController` class. The `removeRegistration` method removes the registration entity having `registraion_id` as its key from the `Tournament` entity specified using `id`.

```
@PutMapping("/{id}/remove_registrations/{registration_id}")
public Tournament removeRegistration(@PathVariable int id, @PathVariable int registration_id) {
    Registration registration = registrationService.getRegistration(registration_id);
    return service.removeRegistration(id, registration);
}
```

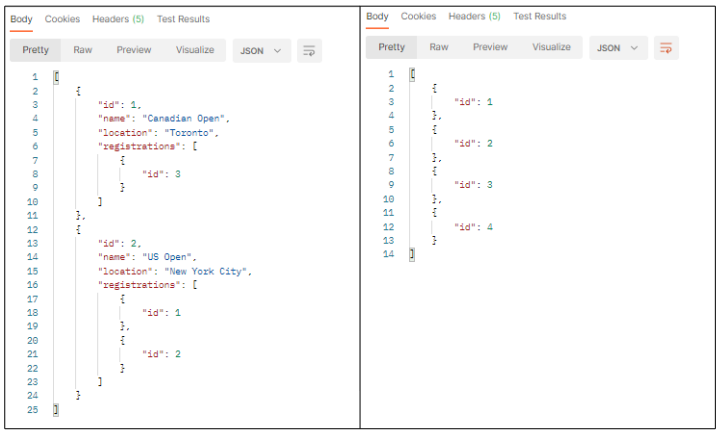
Notice, that the controller calls the service class method, `removeRegistration`, which simply delegates the call to the `removeRegistration` method of the `Tournament` class.

Cascade type `REMOVE` only cascades the delete operation to child records which are linked to the parent. To show how it works, we will create the same scenario as before (with 2 tournaments and 4 registrations by assigning one registration to the first tournament and three registrations to the second tournament).

With the above changes in place, run the application again and create two tournaments and four registrations. Then associate the registrations with the two tournaments as described above.

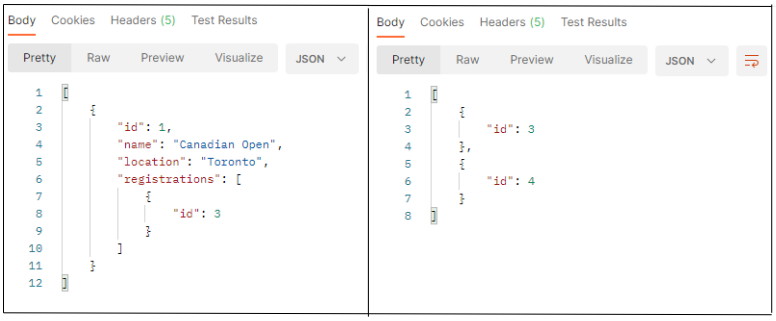
We will remove one registration from tournament with `id` 2 by sending a **PUT** request to **/tournaments/2/remove_registrations/4**. Now the tournament has two registrations left. Note, that we did not delete the registration, but only removed it from the tournament. The registration record is not associated with any tournament and is an orphan record.

The current state of the database is reflected from the response to **GET** requests to **/tournaments** and **/registrations** as shown below:



After removing a registration from tournament 2

Next, delete the tournament by sending a **DELETE** request to **/tournaments/2**. The delete operation is cascaded to the **registration** table and two records associated with the tournament are deleted. If we perform a **GET** on **/registrations**, we can see the orphan record with `id` 4 is still in the table.



Registration table contains an orphan record

`orphanRemoval` attribute

The `@OneToMany` annotation has an `orphanRemoval` attribute which can be used to delete records which have been orphaned.

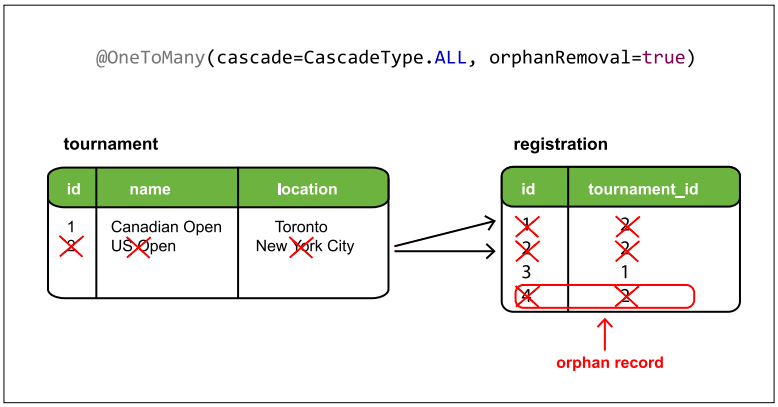
```
@OneToMany(cascade=CascadeType.ALL, orphanRemoval=true)
@JoinColumn(name="tournament_id")
private List<Registration> registrations = new ArrayList<>();
```

To test how this attribute differs from `CascadeType.REMOVE`, we will recreate the same scenario with two tournament and four registration entries and establish one-to-many associations as mentioned above.

Remove registration with `id` 4 from tournament 2 using a **PUT** request to **/tournaments/2/remove_registrations/4**. The `orphanRemoval` attribute triggers a remove operation for the `Registration` object no longer associated with the `Tournament` object thereby leaving the database in a consistent state.

Orphan record from registration table removed

Now we can delete tournament with `id` 2. **GET** request to **/registrations** shows one registration remaining in the table. The registration which was assigned to tournament with `id` 2 and later removed became an orphan and was removed because we set the `orphanRemoval` attribute to true.



The difference between `orphanRemoval` and `CascadeType.REMOVE` should be clear from the above example. Using cascade type `REMOVE` only deleted the two registrations associated with the tournament and left the orphaned record in the table.