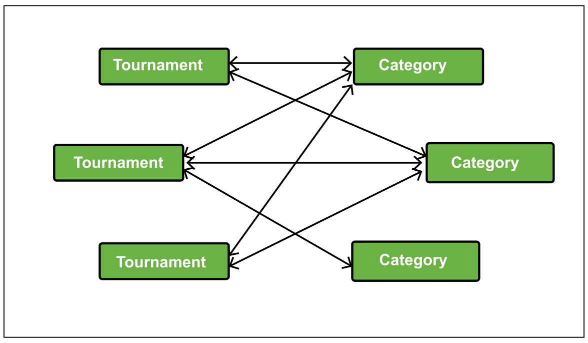
Many-to-Many Unidirectional Relationship

In this lesson, we will learn about implementing a many-to-many relationship using a join table.

We'll cover the following

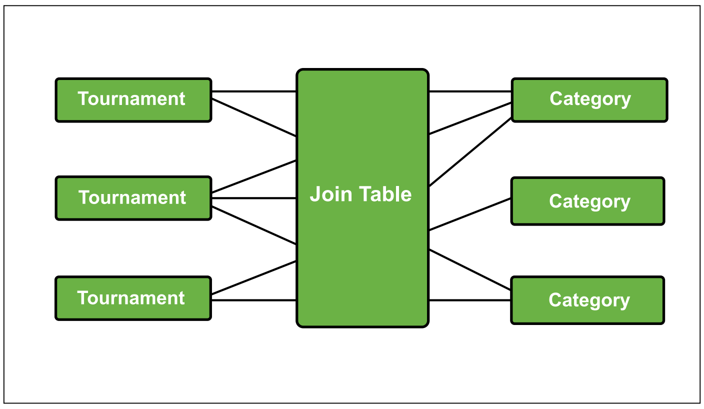
- @ManyToMany
- @JoinTable
- joinColumns and inverseJoinColumns
- Cascade type

Every tournament has some playing categories like singles and doubles for men and/or ladies. In addition, all four grand slam tournaments have the mixed doubles category. Other less known categories are wheelchair tennis and beach tennis. This scenario fits well into the many-to-many relationship where many categories are part of a tournament and many tournaments have the same playing categories.



A tournament has many categories and a category is included in many tournaments.

We have already created the `Tournament` class. In this lesson, we will create the `Category` class and then join the two with a many-to-many relationship. In databases, this relationship is modelled using a join table which has the primary keys of both tables in the relationship.



Many-to-many relationship is implemented using a join table.

We will also model two real life constraints.

- The first one is that one playing category should appear only once in the **category** table (we don't want multiple entries for the same category).
- The second constraint is that when a tournament entry is deleted, the associated playing categories should not be deleted and vice versa.

1. For the many-to-many database relationship example, create a package **manytomany** and copy all the files from the **bi** package inside the **onetomany** package. These include the `Player`, `PlayerProfile`, `Registration` and `Tournament` classes and the associated repository, service and controller classes.
2. We will begin by creating a new class, `Category` in the **io.datajek.databaserelationships.manytomany** package. This class has two fields, id and name, where `id` is the primary key. Since we do not want the same category name to appear more than once, we will impose the unique key constraint using the `unique` attribute of the `@Column` annotation.

```
package io.datajek.databaserelationships.manytomany;

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

    @Column(unique=true)
    private String name;
    //constructors
    //getters and setters
}
```

`@Column(unique=true)` ensures that the same category name is not entered more than once.

3. For a many-to-many relationship, any side can become the parent/ owner. It depends on how the business rules are defined. Let's say, we cannot have a tournament without a category attached to it but we can have a category that is not associated with any tournament. Given this scenario, a category can exist on its own but a tournament needs to have one or more categories associated with it. So, `Category` becomes the owning/parent side and `Tournament` becomes the referenced/ child side.

   In a unidirectional many-to-many relationship, we put the relationship on the child side. So, in the `Tournament` class we have to put a link to the `Category` class. Since a tournament can have more than one categories, we will create a `List` of categories as follows:

```
@Entity
public class Tournament {
    //...

    private List<Category> playingCategories = new ArrayList<>();

    //...
}
```

   Create a getter and setter method for this field.

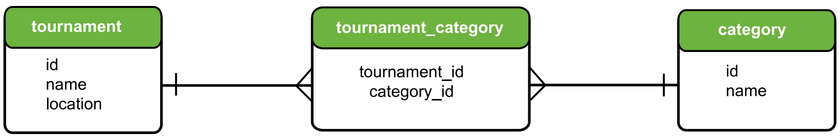
`@ManyToMany`

4. The `@ManyToMany` annotation is used to create a many to many relationships between two entities.

```
@ManyToMany
private List<Category> playingCategories = new ArrayList<>();
```

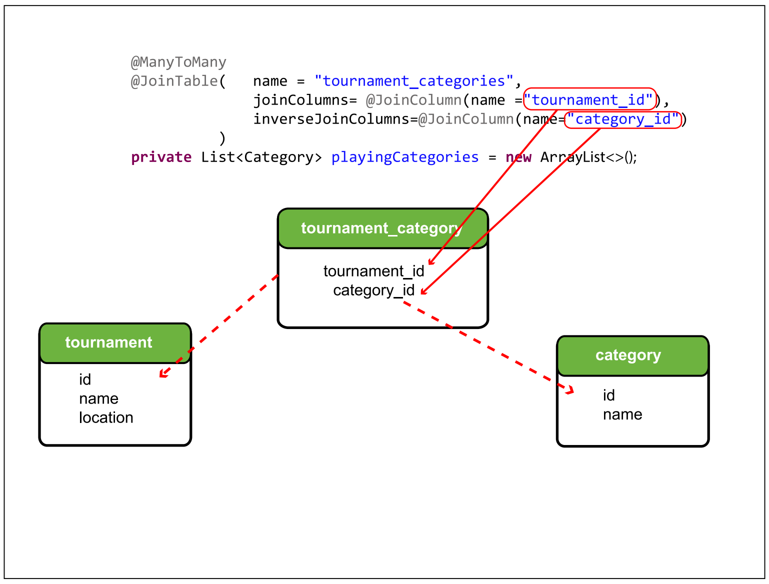
`@JoinTable`

5. The many-to-many relationship is different from the relationships that we have seen so far. Here, the foreign keys are stored in a separate table called a join table instead of being placed inside the parent table or the child table. The join table connects two tables and contains the foreign keys of both the tables. The tournament and category tables do not contain the keys of each other, rather the primary keys of both these tables go in the join table.



`joinColumns` and `inverseJoinColumns`

6. `joinColumns` attribute specifies the column(s) in the owner table that becomes a foreign key in the join table. `inverseJoinColumns` attribute specifies the foreign key column(s) from the inverse side.



```
@ManyToMany
@JoinTable(    name = "tournament_categories",
               joinColumns= @JoinColumn(name ="tournament_id"),
               inverseJoinColumns=@JoinColumn(name="category_id")
           )
private List<Category> playingCategories = new ArrayList<>();
```

@JoinTable annotation

For a unidirectional relationship, the `Category` class does not need any information about the tournaments. Here, we are setting the category in the tournament. When a tournament is saved, it creates a join table entry with the appropriate keys.

The `addCategory` method in the `Tournament` class sets up the many-to-many relationship:

```
//set up many-to-many relationship
public void addCategory(Category category) {
    playingCategories.add(category);
}
```

In the TournamentController we will add a **PUT** mapping **/{id}/categories/{category_id}** to assign a Category with **category_id** to a Tournament with **id** as key.

```
@PutMapping("/{id}/categories/{category_id}")
public Tournament addCategory(@PathVariable int id, @PathVariable int category_id) {
    Category category = categoryService.getCategory(category_id);
    return service.addCategory(id, category);
}
```

The corresponding method in the TournamentService class are shown below:

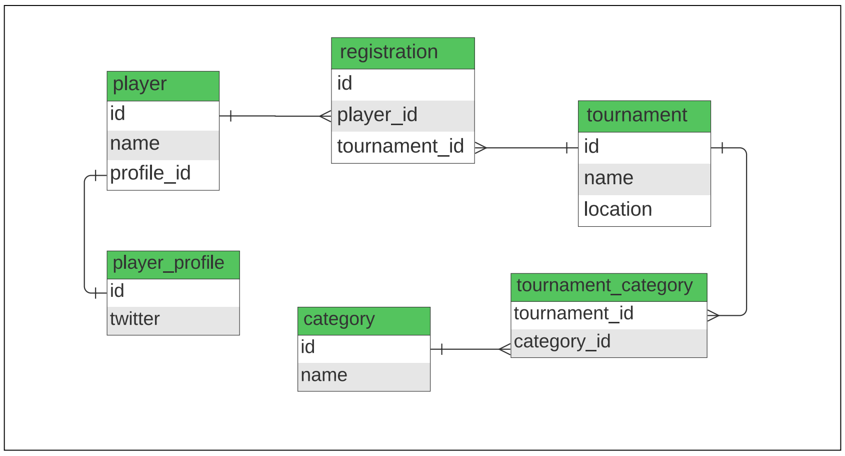
```
public Tournament addCategory(int id, Category category) {
    Tournament tournament = repo.findById(id).get();
    tournament.addCategory(category);
    return repo.save(tournament);
}
```

Cascade type

7. We will not use cascade type REMOVE as we do not want to delete tournaments when we delete a category. We will also not use cascade type PERSIST, because that will cause an error if we try to add a tournament with nested category values.

   ```
   @ManyToMany(Cascade = CascadeType.MERGE, CascadeType.DETACH, CascadeType.REFRESH)
   ```

The ERD of the project is shown below. The same table structure can be verified from the web console of H2 database (at http://localhost:8080/h2-console with *jdbc:h2:mem:testdb* as the connection URL). Note that the code widget below does not show the implementation of all classes.



```
package io.datajek.databaserelationships.manytomany;

import java.util.ArrayList;
import java.util.List;

import javax.persistence.CascadeType;
import javax.persistence.Entity;
import javax.persistence.FetchType;
import javax.persistence.GeneratedValue;
import javax.persistence.GenerationType;
import javax.persistence.Id;
import javax.persistence.JoinColumn;
import javax.persistence.JoinTable;
import javax.persistence.ManyToMany;
import javax.persistence.OneToMany;

import com.fasterxml.jackson.annotation.JsonIgnoreProperties;

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

        private String name;
        private String location;

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

> 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**.

To test the many-to-many relationship, we will add two tournaments by sending **POST** requests to **/tournaments** as follows:

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

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

Next, we will add five categories by sending **POST** requests to **/categories** as follows:

```
{
    "name" : "Men's Singles"
}
```

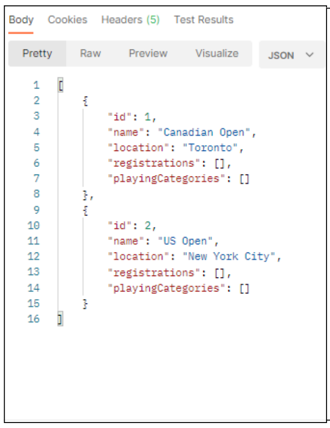
```
{
    "name" : "Men's Doubles"
}
```

```
{
    "name" : "Ladies Singles"
}
```

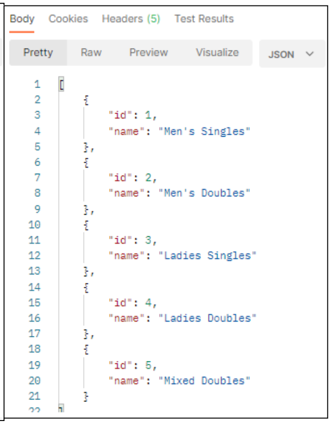
```
{
    "name" : "Ladies Doubles"
}
```

```
{
    "name" : "Mixed Doubles"
}
```

GET request to **/tournaments** and **/categories** has the following response:



```
[
    {
        "id": 1,
        "name": "Canadian Open",
        "location": "Toronto",
        "registrations": [],
        "playingCategories": []
    },
    {
        "id": 2,
        "name": "US Open",
        "location": "New York City",
        "registrations": [],
        "playingCategories": []
    }
]
```



```
[
    {
        "id": 1,
        "name": "Men's Singles"
    },
    {
        "id": 2,
        "name": "Men's Doubles"
    },
    {
        "id": 3,
        "name": "Ladies Singles"
    },
    {
        "id": 4,
        "name": "Ladies Doubles"
    },
    {
        "id": 5,
        "name": "Mixed Doubles"
    }
```

Right now, the `Tournament` and `Category` objects are not connected. We will assign categories with `id` 1 and 2 to *Toronto Open* having `id` 1 by sending the following **PUT** requests:

/tournaments/1/categories/1

/tournaments/1/categories/2

Assign all 5 categories to the *US Open* having `id` 2 with the following **PUT** requests:

/tournaments/2/categories/1

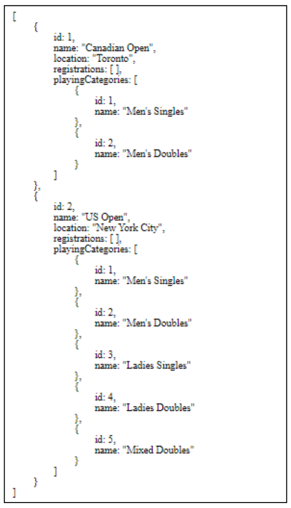
/tournaments/2/categories/2

/tournaments/2/categories/3

/tournaments/2/categories/4

/tournaments/2/categories/5

> Grouping these requests in a *Collection* can help reduce the run time.

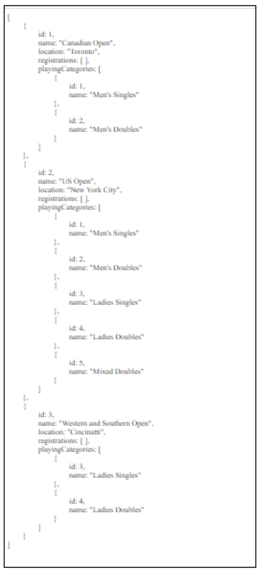


```
[
    {
        id: 1,
        name: "Canadian Open",
        location: "Toronto",
        registrations: [ ],
        playingCategories: [
            {
                id: 1,
                name: "Men's Singles"
            },
            {
                id: 2,
                name: "Men's Doubles"
            }
        ]
    },
    {
        id: 2,
        name: "US Open",
        location: "New York City",
        registrations: [ ],
        playingCategories: [
            {
                id: 1,
                name: "Men's Singles"
            },
            {
                id: 2,
                name: "Men's Doubles"
            },
            {
                id: 3,
                name: "Ladies Singles"
            },
            {
                id: 4,
                name: "Ladies Doubles"
            },
            {
                id: 5,
                name: "Mixed Doubles"
            }
        ]
    }
]
```

We can also add a tournament with nested category objects as follows:

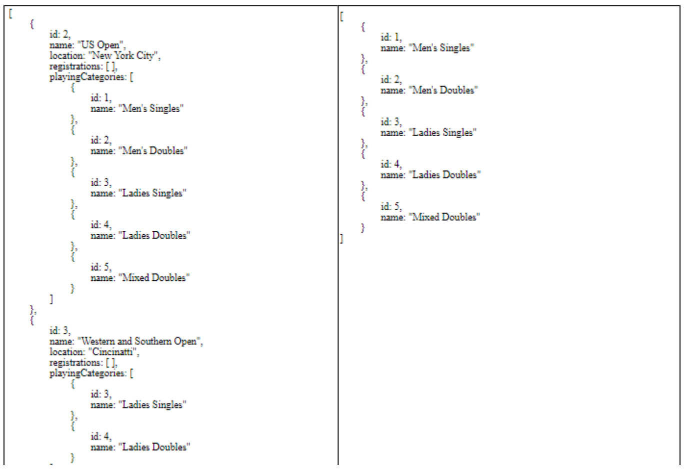
```
{
    "name":"Western and Southern Open",
    "location":"Cincinatti",
    "registrations": null,
    "playingCategories":[{
        "id":3
    },
    {
        "id":4
    }]
}
```

A **GET** request to /**tournaments** shows the three tournaments along with their categories.



```
[
    {
        id: 1,
        name: "Canadian Open",
        location: "Toronto",
        registrations: [ ],
        playingCategories: [
            {
                id: 1,
                name: "Men's Singles"
            },
            {
                id: 2,
                name: "Men's Doubles"
            }
        ]
    },
    {
        id: 2,
        name: "US Open",
        location: "New York City",
        registrations: [ ],
        playingCategories: [
            {
                id: 1,
                name: "Men's Singles"
            },
            {
                id: 2,
                name: "Men's Doubles"
            },
            {
                id: 3,
                name: "Ladies Singles"
            },
            {
                id: 4,
                name: "Ladies Doubles"
            },
            {
                id: 5,
                name: "Mixed Doubles"
            }
        ]
    },
    {
        id: 3,
        name: "Western and Southern Open",
        location: "Cincinatti",
        registrations: [ ],
        playingCategories: [
            {
                id: 3,
                name: "Ladies Singles"
            },
            {
                id: 4,
                name: "Ladies Doubles"
            }
        ]
    }
]
```

We can test cascade by deleting a tournament and seeing if the categories also get deleted. Send a **DELETE** request to /**tournaments/1** to delete tournament with `id` 1. **GET** request to /**tournaments** and /**categories** show that the tournament gets deleted but the categories are not deleted.



```
[
    {
        id: 2,
        name: "US Open",
        location: "New York City",
        registrations: [ ],
        playingCategories: [
            {
                id: 1,
                name: "Men's Singles"
            },
            {
                id: 2,
                name: "Men's Doubles"
            },
            {
                id: 3,
                name: "Ladies Singles"
            },
            {
                id: 4,
                name: "Ladies Doubles"
            },
            {
                id: 5,
                name: "Mixed Doubles"
            }
        ]
    },
    {
        id: 3,
        name: "Western and Southern Open",
        location: "Cincinatti",
        registrations: [ ],
        playingCategories: [
            {
                id: 3,
                name: "Ladies Singles"
            },
            {
                id: 4,
                name: "Ladies Doubles"
            }
```

```
[
    {
        id: 1,
        name: "Men's Singles"
    },
    {
        id: 2,
        name: "Men's Doubles"
    },
    {
        id: 3,
        name: "Ladies Singles"
    },
    {
        id: 4,
        name: "Ladies Doubles"
    },
    {
        id: 5,
        name: "Mixed Doubles"
    }
]
```