Ontologies and the Semantic Web Project
Sports Ontology

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This is an ontology about Sports field that shows the most important athletes, coaches, teams, venues etc. We are going to focus on Football sport as the main class.

Step 1 Defining Classes:

1. **Sports** (Main Super-class of our ontology) (Sub-class of Thing) (Abstract)
2. **Athletes** (Concrete)
3. **Coaches** (Concrete)
4. **Teams** (Concrete)
5. **Venues** (Concrete)
6. **Competitions** (Concrete)

Step 2 Defining Data Properties:

Athletes Class Data Properties: Athlete_Age (integer), Athlete_Name (string), Athlete_Nationality (string), Athlete_Salary (float), Height (float)

Coaches Class Data Properties: Coach_Age (integer), Coach_Name (string), Coach_Nationality (string), Coach_Salary (float)

Teams Class Data Properties: Budget (float), Number_of_players (integer), Team_Name (string)

Venues Class Data Properties: Address (string), Capacity (integer), Venue_Name (string)

Competitions Class Data Properties: Governing_body (String), Number_of_participants (Integer), Prize_money (float), Competition_Name (string)

Step 3 Defining object properties:

participates_in: This property relates a team to a competition they participate in. For example, an instance of the object property "participates_in" could connect an instance of a Team class to an instance of the Competition class, indicating that the team participates in that particular competition.

belongs_to: This property relates an athlete to a team they belong to. For example, an instance of the object property "belongs_to" could connect an instance of the Athlete class to an instance of the Team class, indicating that the athlete belongs to that team.

takes_place_at: This property relates a competition to a venue where it takes place. For example, an instance of the object property "takes_place_at" could connect an instance of the Competition class to an instance of the Venue class, indicating that the competition takes place at that particular venue.

coached_by: This property relates a team to the coach who coaches them. For example, an instance of the object property "coached_by" could connect an instance of the Team class to an instance of the Coach class, indicating that the team is coached by that particular coach.

defeated_by: This property relates a team to another team that defeated them in a competition. For example, an instance of the object property "defeated_by" could connect an instance of the Team class to another instance of the Team class, indicating that the first team was defeated by the second team in a competition.

Has_home_venue: This property relates a team to a venue where the team plays home matches.

Step 4 Defining Restrictions:

- Each team **is coached** by exactly one coach.
- Each team **participates in** a minimum number of 1 competition and maximum number of 7 competitions.
- Each team **is defeated** by a maximum number of 20 teams as it is the maximum number of teams in a single competition.
- Each team **has home venue** of exactly 1 venue.
- Each competition **takes place at** a minimum of 1 venue.
- Each athlete **belongs to** exactly one team.

Step 5 Defining Data properties constraints:

- **Athlete_Salary** range should be 10,000-500,000,000.
- **Governing_Body** must be of specific values which are: “UEFA” (European continent governing body), “AFC” (Asia), “CONMEBOL” (South America), “LIBERTADORES” (North America) or “CAF” (Africa).
- **Capacity** must be of at least 5,000 and of maximum 150,000 seats.
- **Number of participants** is at least 2 teams in a competition and maximum of 256.
- **Athlete_Age** range should be 15-100.
- **Number of players** in a team is at least 1 and does not exceed 100.

- **Budget** must be in the range of 1,000,000 – 2,000,000,000.
- **Prize money** of competitions should be in the range of 100,000 – 1,000,000,000.
- **Coach_Age** range should be 15-100.
- **Coach_Salary** range should be 10,000-500,000,000.

Step 6 Defining Instances:

Teams:

1. ***Arsenal*** (coached by Arteta) (their home venue is the Emirates) (they participate in Champions League and Premier League competitions) (they were defeated by Manchester City) (number of players is 36) (budget is 300,000,000)
2. ***Chelsea*** (coached by Tuchel) (they were defeated by Arsenal & Liverpool & Manchester City) (their home venue is the Stamford Bridge) (they participate in both Champions League and Premier League competitions) (their budget is 600,000,000) (they have 55 players)
3. ***Liverpool*** (Klopp is their coach) (they were defeated by Arsenal and Manchester United) (their home venue is the Anfield) (they participate in the Champions League and the Premier League) (250,000,000 budget) (they have 30 players)
4. ***Manchester United*** (coached by Mourinho) (were defeated by Arsenal and Liverpool and Manchester City) (their home venue is the Old Trafford) (they participate in the Premier League only) (have 46 players) (their budget is 460,000,000)
5. ***Manchester City*** (coached by Guardiola) (were defeated by Liverpool) (their home venue is the Etihad) (they participate in Champions League and Premier League) (they have 40 players) (their budget is 700,000,000)

Athletes:

1. ***Salah*** (plays for Liverpool) (31 years old) (Egyptian) (salary is 31,000,000) (his height is 175 cm)
2. ***Firmino*** (plays for Liverpool) (33 years old) (Brazilian) (15,000,000 salary)
3. ***Halaand*** (plays for Manchester City) (21 years old) (Norwegian) (40,000,000 salary) (his height is 194 cm)
4. ***De Bruyne*** (plays for Manchester City) (31 years old) (Belgian) (30,000,000 salary)
5. ***Kante*** (plays for Chelsea) (32 years old) (French) (25,000,000 salary)
6. ***Azpilicueta*** (belongs to the Chelsea team) (32 years old) (Spanish nationality) (his salary is 12,000,000)
7. ***Rooney*** (plays for Manchester United) (40 years old) (British) (salary is 17,000,000)
8. ***Ronaldo*** (plays for Manchester United) (38 years old) (Portuguese) (salary is 100,000,000)
9. ***Odegaard*** (plays for Arsenal) (23 years old) (Norwegian) (his salary is 13,000,000)
10. ***Ramsdale*** (plays for Arsenal) (24 years old) (British) (salary is 5,000,000)

Venues:

1. ***Etihad*** (located in Manchester) (55,000 capacity)
2. ***Emirates*** (Located in London) (60,000 capacity)
3. ***Old Trafford*** (located in Manchester) (65,000 capacity)
4. ***Anfield*** (Address: Liverpool) (Capacity: 50,000)
5. ***Stamford Bridge*** (located in London) (45,000 capacity)

Coaches:

1. ***Arteta*** (45 years old) (Spanish nationality) (salary is 6,000,000)
2. ***Klopp*** (salary is 10,000,000) (German) (53 years old)
3. ***Mourinho*** (60 years old) (Portuguese) (18,000,000 salary)
4. ***Guardiola*** (55 years old) (Spanish) (salary is 15,000,000)
5. ***Tuchel*** (42 years old) (German) (16,000,000 salary)

Competitions:

1. ***Champions League*** (takes place at the Anfield) (32 participating teams) (prize money is 1,000,000,000) (Governing body is the UEFA)
2. ***Premier League*** (takes place at Anfield & Emirates & Etihad & Old Trafford & Stamford Bridge) (governing body is the UEFA) (20 teams participates in this competition) (the prize money is 900,000,000)

Step 7 SPARQL Queries:

Query 1: [returns athletes & their coaches & their ages, then orders results by age]

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>

SELECT  (str(?x) as ?label0) (str(?y) as ?label1) (str(?z) as ?label2)

where {

?athlete a uri:Athletes.

?team a uri:Teams.

?coach a uri:Coach.

?athlete uri:belongs_to ?team.

?athlete uri:Athlete_Name ?x.

?athlete uri:Athlete_Age ?z.

?team uri:coached_by ?coach.

?coach uri:Coach_Name ?y.

}

Order BY ?z
```

Query 2: [returns athletes that play for a team participating in Champions League and has a name starting with the letter 'R']

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>

SELECT (str(?x) as ?label0)

where
```

```
{ ?athlete a uri:Athletes.
  ?team a uri:Teams.
  ?competition a uri:Competitions.
  ?competition uri:Competition_Name "ChampionsLeague".
  ?athlete uri:belongs_to ?team.
  ?team uri:participates_in ?competition.
  ?athlete uri:Athlete_Name ?x.
  FILTER REGEX(?x,"^R","i").
}
Order BY ?x
```

Query 3: [returns athletes that play for Arsenal or Liverpool or Manchester City, and optionally returns each player's height]

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>
SELECT  (str(?x) as ?label0) (str(?y) as ?label1) (str(?z) as ?label2)
where {
?athlete a uri:Athletes.
?team a uri:Teams.
?athlete uri:belongs_to ?team.
{?team uri:Team_Name "Arsenal".}
UNION
{?team uri:Team_Name "Liverpool".}
UNION
{?team uri:Team_Name "ManCity".}
?athlete uri:Athlete_Name ?x.
?team uri:Team_Name ?y.
OPTIONAL {?athlete uri:Height ?z.}
}
Order BY ?x
```

Query 4: [returns teams & their athletes & their coach that does not participate in Champions League]

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>
SELECT  (str(?x) as ?label0) (str(?y) as ?label1) (str(?z) as ?label2)
where {
?athlete a uri:Athletes.
?team a uri:Teams.
?coach a uri:Coach.
?competition a uri:Competitions.
OPTIONAL {?team uri:participates_in ?competition.
?competition_name uri:Competition_Name "ChampionsLeague".}
FILTER (!BOUND(?competition_name))
?athlete uri:belongs_to ?team.
?team uri:coached_by ?coach.
?team uri:Team_Name ?x.
?athlete uri:Athlete_Name ?y.
?coach uri:Coach_Name ?z.
}
Order BY ?x
```

Query 5: [returns the number of venues that has more than 55,000 seats or equal]

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>
SELECT  (COUNT (?venue) as ?label0)
where {
?venue a uri:Venues.
?venue uri:Capacity ?capacity.
FILTER (?capacity >=55000)
}
```

Query 6: [returns the average salary per nationality, ordered in an ascending order]

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>
SELECT ?label0 (AVG(?athlete_salary) as ?label1)
where {
?athlete a uri:Athletes.
?athlete uri:Athlete_Salary ?athlete_salary.
?athlete uri:Athlete_Nationality ?label0.
}
GROUP BY ?label0
ORDER BY ?label1
```

Query 7: [returns the biggest stadium in the city of London or the city of Liverpool, and returns the highest budget found in the teams of the city of London or the city of Liverpool]

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>
SELECT (MAX(?capacity) as ?label0) (MAX(?budget) as ?label1)
where {
?venue a uri:Venues.
?team a uri:Teams.
?venue uri:Address ?address.
FILTER (?address = "London" || ?address = "Liverpool")
?venue uri:Capacity ?capacity.
?team uri:has_home_venue ?venue.
?team uri:Budget ?budget.
}
```

Query 8: [returns teams that play in Champions League, that has not been defeated by Liverpool, other than Liverpool itself]

```
PREFIX uri:<http://www.semanticweb.org/salma/ontologies/2023/4/untitled-ontology-46#>
SELECT  (str(?team_name) as ?label0)
where {
?team a uri:Teams.
?competition a uri:Competitions.
```

```
?competition uri:Competition_Name "ChampionsLeague".
?team uri:participates_in ?competition.
MINUS{?team uri:defeated_by ?winner_team.
?winner_team uri:Team_Name "Liverpool".}
MINUS{?team uri:Team_Name "Liverpool".}
?team uri:Team_Name ?team_name.
}
Order BY ?team_name
```