

ECS 735P/U: THE SEMANTIC WEB

FINAL COURSE WORK

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BASIC TASK:

T-Box Creation using Protégé : I created an ontology about Basketball players.

Step1: Creating Class Hierarchy

For this I created the class hierarchy as follows-

BasketballPlayer

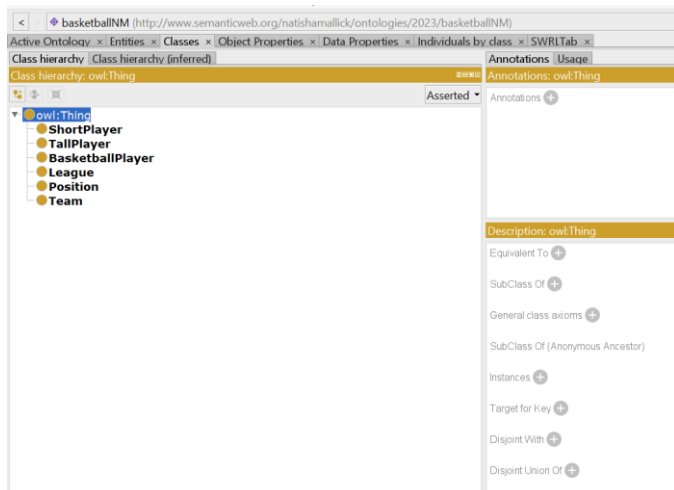
League

Position

Team

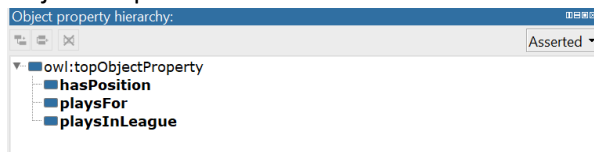
Keeping in mind the last task of the coursework-SWRL Rules:

I also added two more classes TallPlayer & ShortPlayer



Step2: Adding data & object properties -

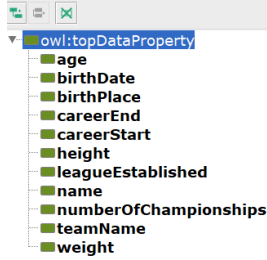
Object Properties:



ObjectProperty	Domain	Range	Characteristic
hasPosition	BasketballPlayer	Position	Functional
playsFor	BasketballPlayer	Team	InverseFunctional
playsInLeague	Team	League	Transitive

Data Properties:

Data property hierarchy: owl:topDataProperty



The domain and ranges for the different data properties were set as follow:

DataProperty	Domain	Range	Characteristic
age	BasketballPlayer	xsd:decimal	Functional, irreflexive
birthDate	BasketballPlayer	xsd:date	Functional, irreflexive
birthplace	BasketballPlayer	xsd:rdf:Literal	Functional, irreflexive
careerEnd	BasketballPlayer	xsd:date	Functional, irreflexive
careerStart	BasketballPlayer	xsd:date	Functional, irreflexive
height	BasketballPlayer	xsd:integer	Functional, irreflexive
leagueEstablished	League	rdfs:literal	Functional
name	BasketballPlayer	rdfs:literal	Functional, irreflexive
numberOfChampionships	Team	rdfs:Literal	Functional, irreflexive
teamName	Team	rdfs:Literal	Functional, irreflexive
weight	BasketballPlayer	Xsd:integer	Functional, irreflexive

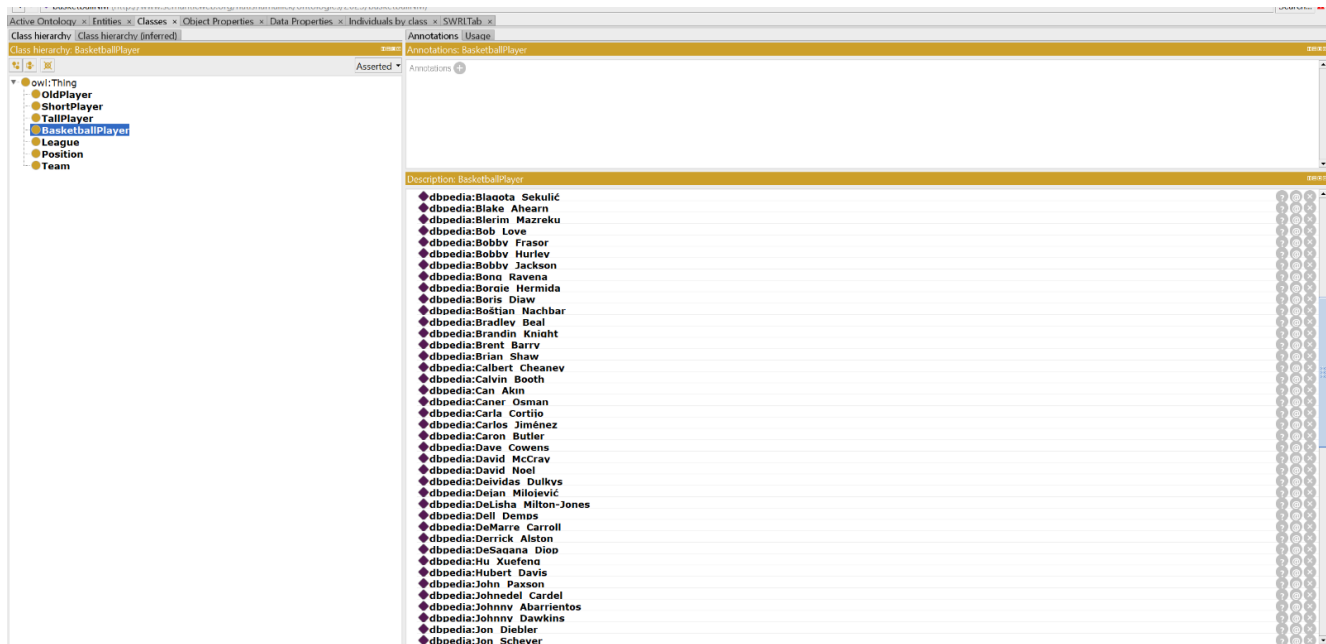
Step3: Data Population from dbpedia: <https://dbpedia.org/ontology/>

For this I created a python script- basketball-dbpedia.py which contains a sparql query to create an RDF dump for the ontology from dbpedia and creates a new file called- basketballNM_dbpedia_dump.ttl in turtle format.

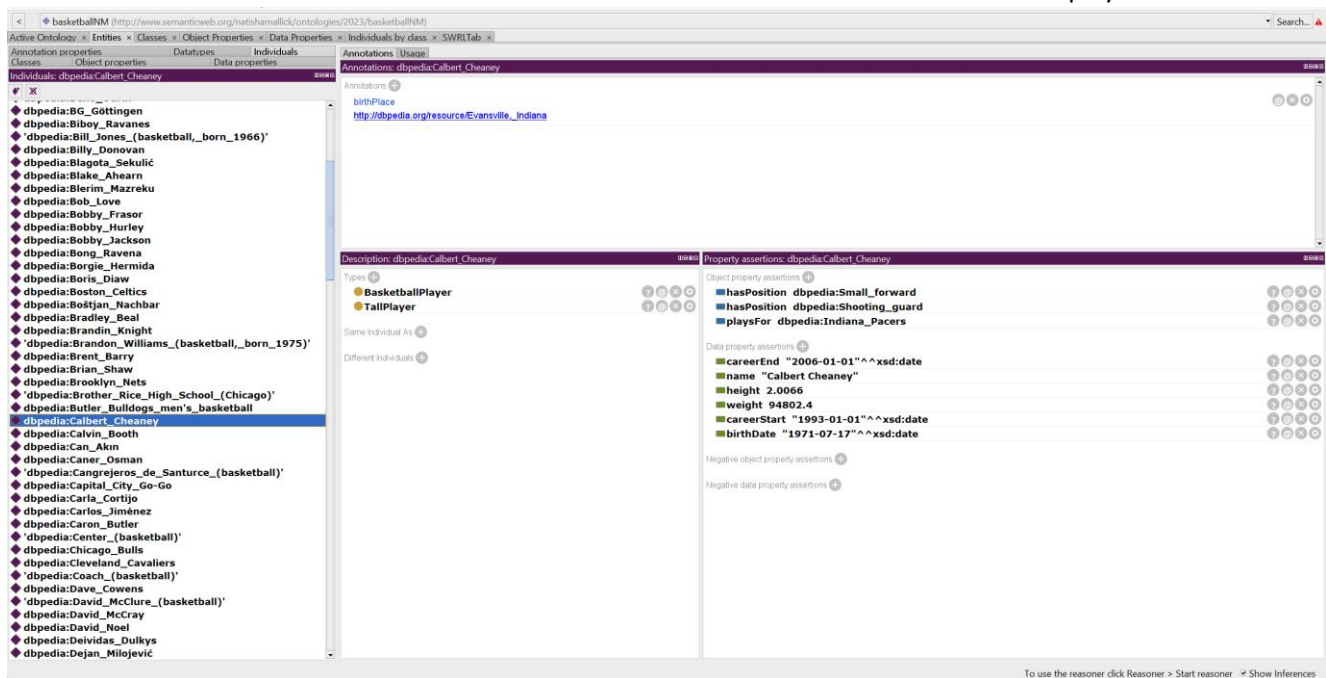
This .ttl file is used to load data into the ontology- using the direct imports in the Active Ontology tab

A screenshot of the Protégé ontology editor interface. The 'Ontology metrics' tab is active, displaying various counts for the ontology. The metrics include: Axioms (981), Logical axiom count (116), Declaration axioms count (20), Class count (5), Object property count (4), Data property count (12), Individual count (84), and DL expressivity (AUI IFF(D)). The 'Class axioms' section shows counts for SubClassOf (0), EquivalentClasses (0), DisjointClasses (0), GCI count (0), and Hidden GCI Count (0). The 'Object property axioms' section shows counts for SubObjectPropertyOf (2), EquivalentObjectProperties (0), InverseObjectProperties (0), DisjointObjectProperties (0), FunctionalObjectProperty (0), InverseFunctionalObjectProperty (0), TransitiveObjectProperty (0), SymmetricObjectProperty (0), AsymmetricObjectProperty (0), ReflexiveObjectProperty (0), IrreflexiveObjectProperty (0), ObjectPropertyDomain (3), ObjectPropertyRange (3), and SubPropertyChainOf (0). The 'Data property axioms' section shows counts for SubPropertyChainOf (0) and SubPropertyOf (0). The 'Ontology imports' section shows the 'Ontology: /Prefixed: General class axioms' and 'Imported ontologies' section with a direct import from 'file:/C:/Users/Natisha/Downloads/basketballNM_dbpedia_dump.ttl'.

Once the data is loaded – The File is now an **A-Box**



The data loaded can also be viewed from the instances tab to see more details about the players



Step4: Querying the local ontology using sparql

The following code is used to query the local ontology using sparql

```
# Define the name of the BasketballPlayer you want to retrieve the position for
BasketballPlayer_name = 'Ben Sullivan'

# Define the SPARQL query to retrieve the position of the named basketballPlayer
query = prepareQuery(
    ...
    SELECT ?height
    WHERE {
        ?BasketballPlayer rdf:type fa:BasketballPlayer .
        ?BasketballPlayer fa:name ?name .
        ?BasketballPlayer fa:height ?height .
        FILTER (regex(?name, "%s", "i"))
    }
    ... % BasketballPlayer_name,
    initNs=NAMESPACE
)

# Execute the SPARQL query and print the result
for result in g.query(query):
    height = result.height
    print(f'{BasketballPlayer_name} has height {height}')
```

Ben Sullivan has height 2.0828

BONUS TASK 1: Fusing information from a non-semantic data source

For this task, I used a CSV file containing the following information about the basketball players- name, birthDate, age, height, weight, position, team, league, leagueEstablished, numberOfChampionships, careerStart, careerEnd

Another python script- called basketballcsv_dump.py is created to load the data into the existing ontology with the help of csv_dump.ttl again using the import tool in the Active ontology tab-

File Edit View Reasoner Tools Refactor Window Help

Active Ontology: <http://www.semanticweb.org/natishamallick/ontologies/2023/basketballNM>

Ontology header: <http://www.semanticweb.org/natishamallick/ontologies/2023/basketballNM>

Ontology Version: e.g. <http://www.semanticweb.org/natishamallick/ontologies/2023/basketballNM/1.0.0>

Annotations

Ontology metrics:

Metric	Count
Axioms	1136
Logical axiom count	145
Declaration axiom count	20
Class count	5
Object property count	4
Data property count	12
Individual count	111
DL expressivity	ALHFI(D)

Class axioms:

Axiom	Count
SubClassOf	0
EquivalentClasses	0
DisjointClasses	0
GCI count	0
Hidden GCI Count	0

Object property axioms:

Axiom	Count
SubObjectPropertyOf	2
EquivalentObjectProperties	0
InverseObjectProperties	0
DisjointObjectProperties	0
FunctionalObjectProperty	0
InverseFunctionalObjectProperty	0
TransitiveObjectProperty	0
SymmetricObjectProperty	0
AsymmetricObjectProperty	0
ReflexiveObjectProperty	0
IrreflexiveObjectProperty	0
ObjectPropertyDomain	3
ObjectPropertyRange	3

Data property axioms:

Axiom	Count
SubDataPropertyOf	0

Ontology imports: Ontology: Prefixes: General class axioms

Imported ontologies:

Direct imports:

- File: C:\Users\Natisha\Downloads\basketballNM_dump.ttl
- OntologyID(Anonymous-8)
- Location: C:\Users\Natisha\Downloads\basketballNM_dump.ttl
- File: C:\Users\Natisha\Downloads\basketball-20230430T234808Z-001\basketball.csv_dump.ttl
- OntologyID(Anonymous-14)
- Location: C:\Users\Natisha\Downloads\basketball-20230430T234808Z-001\basketball.csv_dump.ttl

Indirect imports:

The loaded instances can be seen as follow-

- ◆ Denver Nuggets
- ◆ Golden State Warriors
- ◆ Los Angeles Clippers
- ◆ Los Angeles Lakers
- ◆ Miami Heat
- ◆ Milwaukee Bucks
- ◆ Philadelphia 76ers
- ◆ Phoenix Suns
- ◆ Portland_Trail_Blazers

Class hierarchy: Team

Annotations: Team

Asserted

Annotations

Description: Team

- ◆ dbpedia:P.A.O.K. BC
- ◆ dbpedia:Philadelphia 76ers
- ◆ dbpedia:Phoenix Suns
- ◆ dbpedia:Portland Trail Blazers
- ◆ dbpedia:Riesen Ludwigsburg
- ◆ dbpedia:Rutgers Scarlet Knights
- ◆ dbpedia:Sacramento Kings
- ◆ dbpedia:San Antonio Spurs
- ◆ dbpedia:San Miguel Beermen
- ◆ dbpedia:Sigal Prishtina
- ◆ dbpedia:Stockton Kings
- ◆ dbpedia:Tasmania JackJumpers
- ◆ dbpedia:Terrafirma Dyto
- ◆ dbpedia:Texas Legends
- ◆ dbpedia:TNT Tropang Giga
- ◆ dbpedia:Türk Telekom B.K.
- ◆ dbpedia:UCF Knights men's basketball
- ◆ dbpedia:UST Growling Tigers
- ◆ dbpedia:Vancouver Bandits
- ◆ dbpedia:Washington Wizards
- ◆ dbpedia:Westchester Knicks
- ◆ dbpedia:Windsor Express
- ◆ dbpedia:Windy City Bulls
- ◆ dbpedia:Yesilgiresun Beledive
- ◆ Denver Nuggets
- ◆ Golden State Warriors
- ◆ Los Angeles Clippers
- ◆ Los Angeles Lakers
- ◆ Miami Heat
- ◆ Milwaukee Bucks
- ◆ Philadelphia 76ers
- ◆ Phoenix Suns
- ◆ Portland_Trail_Blazers

Bonus Query-

```
# Define the name of the BasketballPlayer you want to retrieve the position for
BasketballPlayer_name = 'Borgie Hermida'

# Define the SPARQL query to retrieve the player's team
query = prepareQuery(
    """
    SELECT ?player ?ShortPlayer
    WHERE {
        ?BasketballPlayer rdf:type fa:BasketballPlayer .
        ?BasketballPlayer fa:name ?name .
        ?player fa:height ?ShortPlayer .
        ?ShortPlayer rdf:type fa:ShortPlayer .
        FILTER (regex(?name, "%s", "i"))
    }
    """
    .format(BasketballPlayer_name),
    initNs=NAMESPACE
)

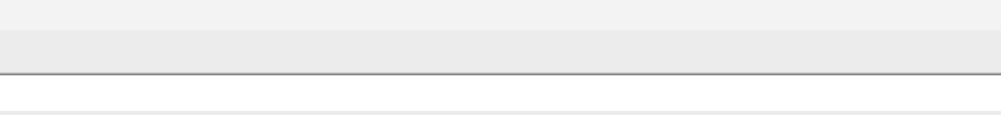
# Execute the SPARQL query and print the results
for result in g.query(query):
    player = result.player.split('#')[-1]
    ShortPlayer = result.ShortPlayer
    print(f'{BasketballPlayer_name} has height {ShortPlayer} and is a Short Player')
```

Borgie Hermida has height 1.7272 and is a Short Player

BONUS TASK 2: Description Logics to define SWRL rules

TallPlayer: The following logic is created to find all the Tall Players from the A-Box

Any player with height > 1.8 meters would be inferred as a tall player.



The screenshot shows the 'Edit' dialog box in the JBoss IDE. The dialog has a title bar with a close button. It contains four input fields: 'Name' with the value 'S1', 'Comment' with the value 'Tall Player', 'Status' with the value 'Ok', and a large text area for the rule definition. The rule definition text is: 'BasketballPlayer(?p) ^ height(?p, ?h) ^ swrlb:greaterThan(?h, "1.8"^^xsd:integer) -> TallPlayer(?p)'. At the bottom of the dialog are 'Cancel' and 'Ok' buttons.

Field	Value
Name	S1
Comment	Tall Player
Status	Ok
Rule Definition	BasketballPlayer(?p) ^ height(?p, ?h) ^ swrlb:greaterThan(?h, "1.8"^^xsd:integer) -> TallPlayer(?p)

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< > basketbalNM (<http://www.semanticweb.org/natishamallick/ontologies/2023/basketbalNM/>) Search...

Active Ontology: x Entities x Classes x Object Properties x Data Properties x Individuals by class x SWRLTab x

Class hierarchy: Class hierarchy (inferred)

Class hierarchy: TallPlayer Annotations: Usage Annotations: TallPlayer

owl:Thing Asserted Annotations

- ShortPlayer
- TallPlayer
- BasketballPlayer
- League
- Position
- Team

Description: TallPlayer

- 'dbpedia:Bill Jones (basketball, born 1966)'
- 'dbpedia:Brandon Williams (basketball, born 1975)'
- 'dbpedia:David McClure (basketball)'
- 'dbpedia:Johnny Taylor (basketball)'
- 'dbpedia:Jordan Brady (basketball)'
- 'dbpedia:José Calderón (basketball)'
- 'dbpedia:Roy Rogers (basketball)'
- Anthony Davis
- Chris Paul
- Damian Lillard
- dbpedia:Beno Udrih
- dbpedia:Bičov Ravanes
- dbpedia:Billy Donovan
- dbpedia:Blasota Sekulić
- dbpedia:Blake Ahearn
- dbpedia:Blerim Mazreku
- dbpedia:Bob Love
- dbpedia:Bobby Frasor
- dbpedia:Bobby Hurley
- dbpedia:Bobby Jackson
- dbpedia:Bonq Ravena
- dbpedia:Boris Diaw
- dbpedia:Boštjan Nachbar
- dbpedia:Bradley Beal
- dbpedia:Brandin Knight
- dbpedia:Brent Barry
- dbpedia:Brian Shaw
- dbpedia:Calbert Cheaney
- dbpedia:Calvin Booth
- dbpedia:Can Akın
- dbpedia:Cano Osman
- dbpedia:Carlos Jiménez
- dbpedia:Caron Butler
- dbpedia:Dave Cowens
- dbpedia:David McCrav
- dbpedia:David Noel
- dbpedia:Delvidas Dulkys
- dbpedia:Dejan Milojević
- dbpedia:Delisha Milton-Jones
- dbpedia:Dell Demos

To use the reasoner click Reasoner > Start reasoner Show Inferences

The SWRL rule would also show up in the player Description-

File Edit View Reasoner Tools Refactor Window Help

<> * basketballNM (http://www.semanticweb.org/natishamalic/ontologies/2023/basketballNM)

Active Ontology >

Entities >

Classes >

Object Properties >

Data Properties >

Individuals by class >

SWRLTab >

Annotations properties >

Classes >

Object properties >

Data properties >

Individuals >

Annotations >

Annotations: dbpedia:Primoz_Brezec

Annotations

birthPlace

<http://dbpedia.org/resource/Postojna>

birthPlace

http://dbpedia.org/resource/SFR_Yugoslavia

birthPlace

http://dbpedia.org/resource/SR_Slovenia

Descriptions: dbpedia:Primoz_Brezec

Taxes

BasketballPlayer

TallPlayer

Some individual As

Different individuals

Property assertions: dbpedia:Primoz_Brezec

Object property assertions

hasPosition 'dbpedia:Center_(basketball)'

playsFor dbpedia:Cleveland_Cavaliers

Data property assertions

weight 115668.0

name "Primoz Brezec"

careerStart "1996-01-01"^^xsd:date

height 2.159


careerEnd "2017-01-01"^^xsd:date

birthDate "1979-10-02"^^xsd:date

Negative object property assertions

Negative data property assertions

ShortPlayer: The following logic is created to find all the Short Players from the A-Box
Any player with height < 1.8 meters would be inferred as a short player

 Edit ✕

Name

S2

Comment

Short Player

Status

Ok

BasketballPlayer(?p) ^ height(?p, ?h) ^ swrlb:lessThan(?h, "1.8"^^xsd:integer) -> ShortPlayer(?p)

Cancel

Ok

Active Ontology: [basketballNM](http://www.semanticweb.org/natishamallick/ontologies/2023/basketballNM) Search...

Class Hierarchy: ShortPlayer

owl:Thing

ShortPlayer

TallPlayer

BasketballPlayer

League

Position

Team

Annotations: ShortPlayer

Description: ShortPlayer

Equivalent To

Sub-Class Of

General class axioms

Sub-Class Of (Anonymous Ancestor)

Instances

Target for key

Disjoint With

Disjoint Union Of

dbpedia:Becky_Hammon

dbpedia:Borile_Hermida

dbpedia:Carla_Cortio

dbpedia:Johnny_Abarrientos

dbpedia:Rodney_Billups

dbpedia:Ronnie_Maclean

dbpedia:Sandy_Brondello

The SWRL rule would also show up in the player Description-

File Edit View Reasoner Tools Refactor Window Help

Active Ontology: [basketballNM](http://www.semanticweb.org/natishamallick/ontologies/2023/basketballNM) Search...

Annotation properties

Classes

Object properties

Data types

Data properties

Individuals by class

SWRLTab

Annotations: dbpedia:Rodney_Billups

Description: dbpedia:Rodney_Billups

Types

Same individual as

Different individuals

Property assertions: dbpedia:Rodney_Billups

Object property assertions

Data property assertions

Negative object property assertions

Negative data property assertions

Files included along with the report:

Folder Name: BasicTask

1. T-Box : BasketballNM.owl
2. A-Box: BasketballNM_basic.owl
3. Pyscript: Basketball-basic.py
4. TurtleFile: BasketballNM_dbpedia_dump.ttl
5. Query: Basketball_basic_query.py



basketball_basic



basketball_basic_query



BasketBallNM



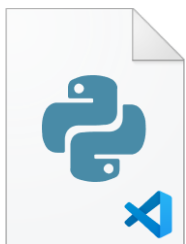
BasketballNM_basic



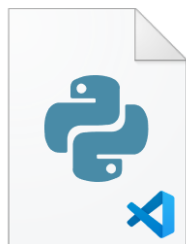
basketballNM_dbpedia_dump

Folder Name: BonusTasks_1_2

1. A Box: BasketballNM_bonus.owl (Data populated from both Basic & Bonus 1&2 Tasks)
2. Pyscript: Basketball_bonus.py
3. CSV File: team.csv
4. TurtleFile: Basketballcsv_dump.ttl
5. Query: Basketball_bonus_query.py



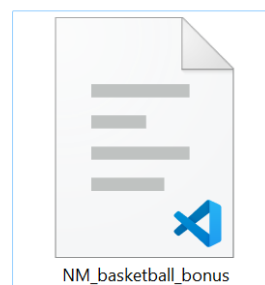
basketball_bonus_query



basketballcsv_dump



Basketballcsv_dump



NM_basketball_bonus



team