

# Solution to Midterm Exam

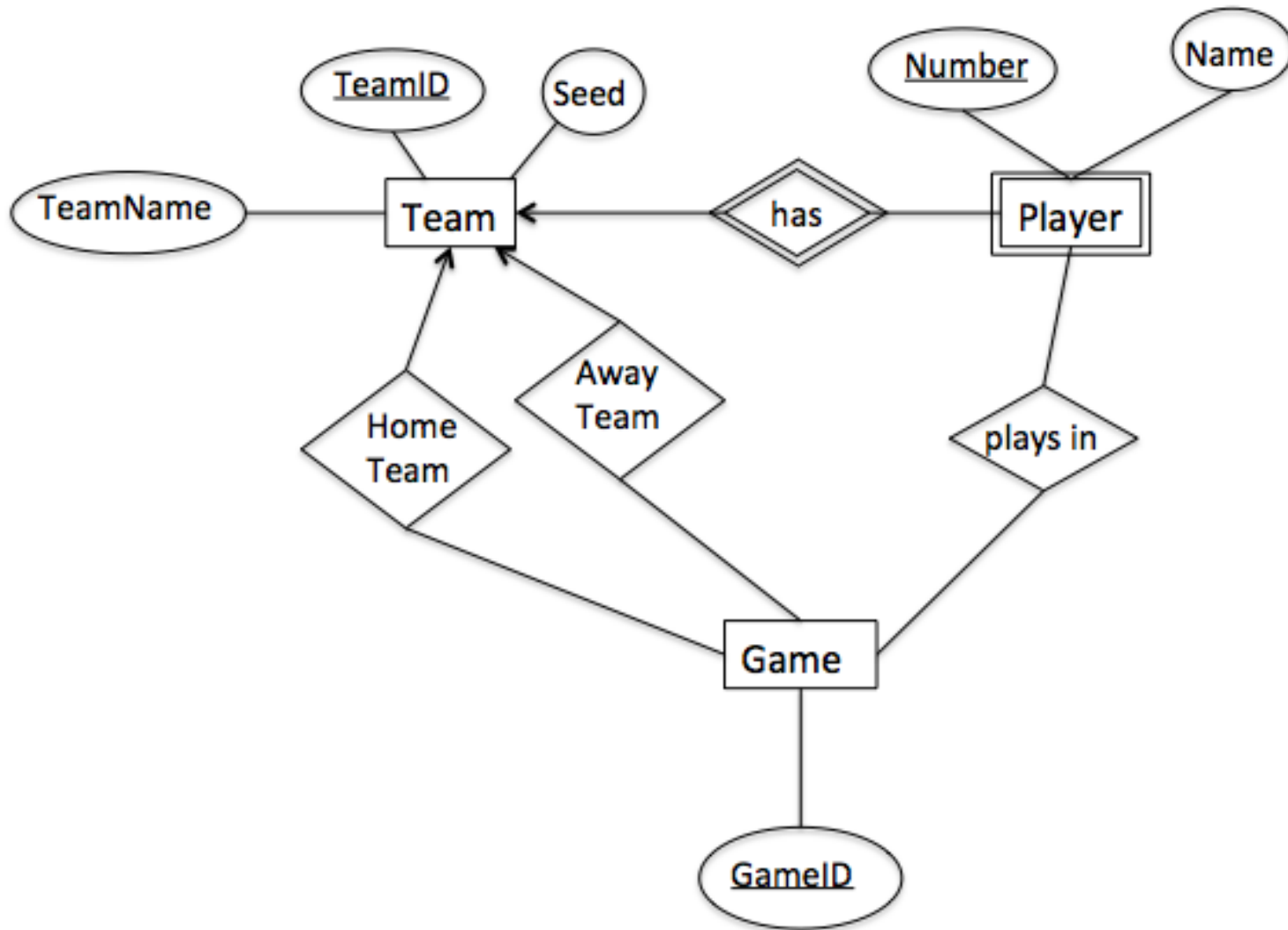
Spring 2018

# Question 1 (25 points)

Draw an E-R diagram for the design of a database system for college basketball teams, with the following constraints. Include all relevant integrity constraints in your E-R diagram, including key and participation constraints. You may use a weak entity type if your design calls for one.

- a. Each Team has a unique TeamID, a TeamName, and a Seed.
- b. Each Player has a unique Number, a Name, and belongs to exactly one Team. It is impossible for a player to not belong to a Team.
- c. The Number of a Player is unique within a Team, but is not unique across Teams. In other words, it is not possible that two Players on the same Team both have the Number 30. However, it is possible that two players on different Teams both have the Number 30.
- d. Teams play with each other in Games. Each Game consists of exactly two Teams, a Home Team and an Away Team.
- e. Players play in Games - over the course of the tournament a Player might play in one, many, or no Games. Each Game will have several Players playing.
- f. Each Game has a unique GameID.

# Answer 1



## Question 2 (20 points)

- Design a relational database corresponding to the E-R diagram you provided as the answer to the first question of this exam. Your design should be given in terms of the SQL statements needed to create the relations in your database, including any applicable primary and foreign key integrity constraints.

## Answer 2

- `Team (TeamID, TeamName, Seed) ;`
- `Player (Number, TeamID, Name) ;`
- `Game (GameID, Team1ID, Team2ID) ;`
- `PlaysIn (GameID, Number, TeamID) ;`

# Question 3 (30 points)

In professional and college sports, countless statistics are kept on players, teams, and leagues. Sports analysts need quick and easy ways to store and search these statistics. Consider a small version of a college sports statistics database given by the following three relations:

- `Player(PLAYERID, Name, Number, TeamID, Position)`, which lists individual information about specific players.
- `Team(TeamID, School, Mascot, Colors)`, which lists the information about specific schools.
- `Stats(Year, PlayerID, Points, FieldGoalPercent, 3PntFGP, Rebounds, Turnovers)`, which lists yearly stats for players.
- For `Player` and `Team`, `PlayerID` and `TeamID` are the keys, while for `Stats`, `Year` and `PlayerID` form a joint key.

# Question 3 (Cont.)

A small instance of this database is as follows:

PlayerID	Name	Number	TeamID	Position
DM1	Demetri McCamey	32	UIUC	Guard
JS1	Jared Sullinger	0	OSU	Forward
EM1	E'Twaun Moore	33	PU	Guard
DG1	Drawmond Green	23	MSU	Forward

TeamID	School	Mascot	Colors
UIUC	University of Illinois	Fighting Illini	Orange and Blue
OSU	Ohio State University	Buckeyes	Red and Black
PU	Purdue University	Boilermakers	Gold and Black
MSU	Michigan State University	Spartans	Green and White

# Question 3 (Cont.)

Year	PlayerID	Points	FieldGoalPercent	3PntFGP	Rebounds	Turnovers
2011	DM1	443	45.1	46.8	102	88
2010	DM1	542	45.4	34.1	129	123
2011	JS1	514	55.6	27.3	394	47
2011	EM1	555	45.0	41.6	159	51
2010	EM1	575	44.5	34.9	134	73
2011	DG1	359	44.6	39.7	243	67

Answer the following queries using relational algebra. Your answer should work for any instance of the database, not just this one.



# Answer 3

(a) List the School of Drawmond Green (who is a player)

$$\pi_{School}(\sigma_{Name='Drawmond Green'}(Player \bowtie_{Player.Team\_ID=Team.Team\_ID} Team))$$

(b) List the names of all players who are not Guards

$$\pi_{Name}(\sigma_{Position \neq Guard} Player)$$

# Answer 3 (Cont.)

(c) List the Rebounds made by the player (or players) who had the highest Field Goal Percent in 2011

**Solution 1:**

$$\pi_{Rebound}(\sigma_{Year='2011'} Stats1) - \pi_{Stats1.Rebound}(Stats1 \bowtie_C Stats2)$$

Where

C = (Stats1.Year = '2011') and (Stats2.Year = '2011') and (Stats1.FieldGoalPercent < Stats2.FieldGoalPercent)

**Solution 2:**

$$\pi_{Rebound}(\sigma_{Year='2011'} Stats1) - \pi_{Stats1.Rebound}(Stats1 \bowtie_C Stats2)$$

Where

C = (Stats1.Year = '2011')

and (Stats1.FieldGoalPercent < Stats2.FieldGoalPercent) and (Stats1.PlayerID <> Stats2.PlayerID)

**Solution 3:**

$$\pi_{Stats1.Rebound}(Stats1 \bowtie_C Stats2)$$

Where

C = (Stats1.Year = '2011') and (Stats2.Year = '2011') and (Stats1.FieldGoalPercent >= Stats2.FieldGoalPercent) and (Stats1.PlayerID <> Stats2.PlayerID)

## Question 4 (25 points)

Using the same schema as in Question 3, write the following queries in SQL. Your statements should work for any instance of the database, and not just the instance of data given above.

(a) List the name and number of players who had, in the year 2011, more points than every guard (i.e., a player who plays the guard position), or fewer than 50 turnovers.

## Answer 4(a)

```
SELECT P.Name, P.Number
FROM Player P, Stats S
WHERE S.Year = 2011
AND (S.Turnovers < 50
      OR
      S.Points > ALL (SELECT T.Points
                       FROM Player Q
                       WHERE
                        Q.Position = 'Guard'
                        AND T.PlayerID = Q.PlayerID)
AND S.PlayerID = P.PlayerID;
```

## Question 4 (Cont.)

(b) I once saw a player put up some amazing stats one year, but I can't remember his name. The only thing I remember was that he had more than 500 points that year, had more than 300 rebounds, and he had the color red on his uniform.

Write an SQL query to give me a list of players that could potentially be the one I am thinking of. I want to know the player's name, what school he played for, and what year it happened

## Answer 4(b)

```
SELECT Name, School, Year FROM  
Player AS P, Team AS T, Stats AS S  
WHERE S.Points > 500  
      AND S.Rebounds > 300  
      AND S.PlayerID = P.PlayerID  
      AND P.TeamID = T.TeamID  
      AND T.Colors LIKE "%Black%";
```