

Tournament scheduling

Our first project will be to set up two “tournaments” and gather data to use in our course. We will encounter the three basic types of tournament in the course, a knockout tournament, a round robin tournament and a tournament where the contestants are ranked by a group or judges. In a **knockout tournament**, such as the NCAA playoffs, the winner of each match proceeds to the next round and the loser does not. In a **round robin tournament**, such as the Six Nations Rugby Cup, each player (or team) plays every other player (or team) exactly once (sometimes exactly twice or exactly 3 times etc...).

Scheduling a Round Robin Tournament: Scheduling of a round robin tournament requires attention to a number of details and is a very difficult problem when one is dealing with a large number of teams, constraints such as alternating home and away games and availability of venues. In addition non-professional tournaments have extra constraints on the availability of players. Sometimes the methods of graph theory or integer programming can be used to find a schedule, however, these methods require more time to learn than we have available, so we will satisfy ourselves with organizing and deciding a winner for a simple round robin tournament with no constraints.

Number of matches: The first thing to consider is the **number of games**, we will need to run. There is a simple formula for the number of games necessary when we have N players.

Example If we have $N = 6$ players and each must play each other exactly once. We place one X in the table below for each game that must be played so that the number of games is the number of X's.

Player	1	2	3	4	5	6
1	–	X	X	X	X	X
2	–	–	X	X	X	X
3	–	–	–	X	X	X
4	–	–	–	–	X	X
5	–	–	–	–	–	X
6	–	–	–	–	–	–

We see that the number of X's in the above table is half of the number of X's in the table below;

Player	1	2	3	4	5	6
1	–	X	X	X	X	X
2	X	–	X	X	X	X
3	X	X	–	X	X	X
4	X	X	X	–	X	X
5	X	X	X	X	–	X
6	X	X	X	X	X	–

There are 5 X's in each row in this table, thus the number of matches necessary for the tournament is

$$\frac{6 \cdot 5}{2} = 15 \text{ matches.}$$

Similarly, for N players in a round robin tournament, where every player plays every other player exactly once, we need to arrange

$$\frac{N \cdot (N - 1)}{2} \text{ games.}$$

Example If we wish to run a round robin tournament with 20 teams, where each team plays each of the other teams exactly once, how many games need to be played?

Scheduling the games We first consider the **case where N is odd**, let's say we have $N = 5$ players. Since at most two games can be played in each round and $10 = \frac{5 \cdot 4}{2}$ games must be played, we need at least five rounds. Since we have an odd number of teams, one team must get a bye in each round. For a small number of teams, we can usually fill out the schedule by experimentation.

We will fill in the schedule below by placing the number of the player who will play the row player in the given round. Note that all matches are duplicated in the schedule shown. If Player p is scheduled to play Player p in Round r , then that indicates that Player p gets a Bye in that round. The schedule we make should satisfy the following conditions:

1. Each row contains the numbers 1 through 5 and
2. Each row contains the numbers 1 through 5.
3. If Player i is scheduled to play Player j in Round r , then Player j must be scheduled to play Player i in Round r .

	Round 1	Round 2	Round 3	Round 4	Round 5
Player 1	1	2	3	4	5
Player 2					
Player 3					
Player 4					
Player 5					

Step 1: We start by putting the numbers 1 through 5 in row 1. This means that Player 1 gets the Bye in round 1.

Note that since each game is duplicated on the schedule, we can now fill in the players for those spots corresponding to the games already scheduled:

	Round 1	Round 2	Round 3	Round 4	Round 5
Player 1	1	2	3	4	5
Player 2		1			
Player 3			1		
Player 4				1	
Player 5					1

Step 2 We now schedule the games for Player 2. It seems that if we slide everything in row 1 over to the right by one place and wrap the row around to place a 5 in round 1, our schedule will remain consistent with everything previously scheduled and conditions 1, 2 and 3. Our new schedule looks like:

	Round 1	Round 2	Round 3	Round 4	Round 5
Player 1	1	2	3	4	5
Player 2	5	1	2	3	4
Player 3			1		
Player 4				1	
Player 5					1

Filling in the related games already scheduled, we get:

	Round 1	Round 2	Round 3	Round 4	Round 5
Player 1	1	2	3	4	5
Player 2	5	1	2	3	4
Player 3			1	2	
Player 4				1	2
Player 5	2				1

Steps 3, 4, 5 If we continue to slide the rows over by one place, wrapping them around as with player two, we get a complete and consistent schedule:

	Round 1	Round 2	Round 3	Round 4	Round 5
Player 1	1	2	3	4	5
Player 2	5	1	2	3	4
Player 3	4	5	1	2	3
Player 4	3	4	5	1	2
Player 5	2	3	4	5	1

Identifying the Bye's, we get the following schedule

	Round 1	Round 2	Round 3	Round 4	Round 5
Player 1	<i>Bye</i>	2	3	4	5
Player 2	5	1	<i>Bye</i>	3	4
Player 3	4	5	1	2	<i>Bye</i>
Player 4	3	<i>Bye</i>	5	1	2
Player 5	2	3	4	<i>Bye</i>	1

Schedule for 6 Teams: If we use our completed schedule for 5 teams, replacing the Bye's by 6's and filling in the games for Player 6 appropriately, we get a schedule satisfying conditions 1, 2 and 3 above. Note: we need only five rounds to complete the $\frac{6 \cdot 5}{2} = 15$ games.

	Round 1	Round 2	Round 3	Round 4	Round 5
Player 1	6	2	3	4	5
Player 2	5	1	6	3	4
Player 3	4	5	1	2	6
Player 4	3	6	5	1	2
Player 5	2	3	4	6	1
Player 6	1	4	2	5	3

To schedule a round robin tournament with N players (teams) where each player (team) plays each other player(team) exactly once;

The **Number of Rounds necessary** is $\begin{cases} N & \text{if } N \text{ is odd} \\ N - 1 & \text{if } N \text{ is even.} \end{cases}$

We let $T(p, r)$ denote the number of the player (team) who is scheduled to play Player p (Team p) in Round r .

For N odd we let

$$\text{If } N \text{ is odd: } T(p, r) = \begin{cases} r - p + 1 & \text{if } r - p + 1 > 0 \\ r - p + 1 + N & \text{if } r - p + 1 \leq 0 \end{cases}$$

If $T(p, r) = p$, we assign a Bye to Player p in Round r .

For N even we make a schedule as above for the first $N - 1$ teams and then replace the Bye's on the schedule by a match between that team and Team N .

Pong Tournament (Round Robin)

Next Day, we will run a round robin Pong tournament with 6 players. As we saw above, we will need 5 rounds, with a total of 15 games. Each match will be conducted according to the following rules:

- Both players will receive 5 ping pong balls.
- Each player will stand behind a marker (tape on floor) 5 feet from an 18 oz cup with 2.5 oz of water in the cup.
- The players will stand a distance of 3 feet apart and their cups will also be 5 feet apart.
- If the cup is knocked out of place or turned over, the referee will restore it to its original position and refill the water to 2.5 oz.
- Each player will try to get as many ping pong balls into the cup as possible, scoring one point for each ping pong ball they get into the cup.
- Each match will last a maximum of 2.5 minutes.

We will need 6 players, 3 referees, 3 time keepers, 6 people to set up the rings, One record keeper and one person in each ring who will report the score to the record keeper.

Schedule

Players	Round 1	Round 2	Round 3	Round 4	Round 5
1.	6.	2.	3.	4.	5.
2.	5.	1.	6.	3.	4.
3.	4.	5.	1.	2.	6.
4.	3.	6.	5.	1.	2.
5.	2.	3.	4.	6.	1.
6.	1.	4.	2.	5.	3.

Games marked in **red** are played in Ring 1.

Games marked in **blue** are played in Ring 2.

Games marked in **green** are played in Ring 3.

Overall Scorekeeper: _____

Ring 1 :

Set Up: _____ and _____

Referee: _____

Timekeeper: _____

Scorekeeper/reporter: _____

Ring 2 :

Set Up: _____ and _____

Referee: _____

Timekeeper: _____

Scorekeeper/reporter: _____

Ring 3 :

Set Up: _____ and _____

Referee: _____

Timekeeper: _____

Scorekeeper/reporter: _____

Scoresheet **Ring 1**

Scorekeeper: _____

Round 1

Player 1 Name: _____ vs. Player 6 Name: _____

Score: _____

Score: _____

Round 2.

Player 5 Name: _____ vs. Player 3 Name: _____

Score: _____

Score: _____

Round 3.

Player 6 Name: _____ vs. Player 2 Name: _____

Score: _____

Score: _____

Round 4.

Player 4 Name: _____ vs. Player 1 Name: _____

Score: _____

Score: _____

Round 5.

Player 6 Name: _____ vs. Player 3 Name: _____

Score: _____

Score: _____

Scoresheet [Ring 2](#)

Scorekeeper: _____

Round 1

Player 5 Name: _____ vs. Player 2 Name: _____

Score: _____

Score: _____

Round 2.

Player 2 Name: _____ vs. Player 1 Name: _____

Score: _____

Score: _____

Round 3.

Player 5 Name: _____ vs. Player 4 Name: _____

Score: _____

Score: _____

Round 4.

Player 3 Name: _____ vs. Player 2 Name: _____

Score: _____

Score: _____

Round 5.

Player 5 Name: _____ vs. Player 1 Name: _____

Score: _____

Score: _____

Scoresheet **Ring 3**

Scorekeeper: _____

Round 1

Player 3 Name: _____ vs. Player 4 Name: _____

Score: _____

Score: _____

Round 2.

Player 6 Name: _____ vs. Player 4 Name: _____

Score: _____

Score: _____

Round 3.

Player 3 Name: _____ vs. Player 1 Name: _____

Score: _____

Score: _____

Round 4.

Player 6 Name: _____ vs. Player 5 Name: _____

Score: _____

Score: _____

Round 5.

Player 4 Name: _____ vs. Player 2 Name: _____

Score: _____

Score: _____

Overall Scoresheet (row player's score first, column player's score second).

Initials	1	2	3	4	5	6	Point Diff.
Player 1							
2							
3							
4							
5							
6							

Player	Name	W = Wins	L = Losses	W-L
1				
2				
3				
4				
5				
6				

Music Video Competition

Need 5 music videos and **5 people who will choose the videos.**

In Charge of Choosing Videos and sending me the link. These people will send me a link to their music video.

Video Promoter 1: _____ Video url:

Video Promoter 2: _____ Video url:

Video Promoter 3: _____ Video url:

Video Promoter 4: _____ Video url:

Video Promoter 5: _____ Video url:

Need **10 judges who will rank the videos 1 through 5.**

Judge 1: _____

Judge 2: _____

Judge 3: _____

Judge 4: _____

Judge 5: _____

Judge 6: _____

Judge 7: _____

Judge 8: _____

Judge 9: _____

Judge 10: _____

Vote Collector: _____

Each Judge ail print this Voting Sheet and bring it to class:

- The judges will watch the videos in class (bring your computer to class if you can).
- Each judge will rank the videos 1 through 5 (secret ballot).
- Each Judge will then give their voting sheet to the Vote Collector.

Judge's Name: _____

VideoNumber	Name	Rank
1.		
2.		
3.		
4.		
5.		