

## MAT 3503 Tournaments

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### Best of $2n + 1$ Tournaments

Two teams play up to  $2n + 1$  games until one team wins  $n + 1$ . Typical formats are best of 3, best of 5, or best of 7.

1. What is the least number of games that can be played? The most?
2. What is the most games won by the losing team?

### Single Elimination Tournaments

This is the format of the March Madness NCAA Basketball Tournament. Teams are paired and can keep playing until they lose. A single elimination tournament usually starts with  $m = 2^n$  teams so that every team will have an opponent in each round. In the first round all teams play. In the second round only the winners from the first round play. In the third round only the winners of the second round play, *etc.*

1. How many rounds are played?
2. How many games are played in each round?
3. How many games are played in a single elimination tournament? Think of two ways to show this.
4. How many games does the winner play?

### Double Elimination Tournaments

Teams play until they lose twice, usually structured into two brackets. All teams start in the Winners Bracket and stay there until they lose. Once a team loses, it moves to the Losers Bracket where they play other one loss teams. A double elimination tournament usually starts with  $m = 2^n$  teams so that every team in the Winners' Bracket will have an opponent in each round. In the final round, the winner of the Winners Bracket plays the winner of the Losers Bracket, twice if necessary.

1. How many games are played in the Winners Bracket?
2. How many games are played in the Losers Bracket?
3. How many games are played in a double elimination tournament?
4. How many games does the winner play, if the winner never loses?
5. Suppose a team loses the first game, but goes on to win the tournament. How many games does the winner play?

### Round Robin Tournaments

Any number  $m$  of teams can play. Each team is scheduled to play each of the other teams. The winner is decided by the best record, with ties being decided by face-to-face competition.

1. How many games does each team play?
2. How many games are played in a round robin tournament?
3. Can a team lose one game, yet win a round robin tournament?
4. Can a round robin have a two way tie?
5. Can a round robin have a three way tie?
6. Can a team lose two games, yet win a round robin?

### Triple Elimination Tournaments

Teams play until they lose three times. Usually structured into three brackets. Winners, Loser1 and Loser2. The winners of the two losers brackets play each other, twice if necessary, and that winner then plays the winner of the Winners Bracket.

1. How many games are played in the Winners Bracket?
2. How many games are played in Loser1?
3. How many games are played in Loser2?
4. How many games are played in a triple elimination tournament?
5. If the winner, never loses, how many games does the winner play?
6. If the winner loses the first game, how many games does the winner play?
7. If the winner loses the first two games, how many games does the winner play?

### Three Game Guarantee Tournaments

Like double elimination except that any team which loses the first two games is given a third consolation game in the Losers Bracket. This third game is of no consequence to the tournament. The number of participating teams is  $m = 2^n$ .

1. How many teams lose the first two games?
2. How many consolation third games are played?
3. How many total games are played?

## NCAA Post Season Baseball Tournament

This tournament starts with 64 teams and is played in three stages. In the first stage, the Regionals, the 64 teams are sent to 16 sites in groups of 4 to play a double elimination. In the second stage, the Super Regionals, the 16 winners from the Regionals are sent to 8 sites in groups of 2 to play a best of 3 round. The 8 winners go to the College World Series in Omaha. The 8 teams are broken into two divisions of 4 to play full double elimination. The winners of the two divisions play a best of three.

1. How many total games are played in the Regionals?
2. How many total games are played in the Super Regionals?
3. How many games are played in the College World Series?
4. How many total games are played in the Tournament?
5. How many games does the winner win?
6. What is the most games the winner can lose?

## FIFA World Cup

The current final tournament features 32 national teams. There are two stages: the group stage followed by the knockout stage. In the *group stage* the teams are divided into 8 groups of 4 teams. Each group plays a round robin. The top two teams from each group go to the *knockout stage* comprising 16 teams. The knockout stage is a single-elimination tournament. A third-place match is included between the losers of the semi-final matches.

1. How many games are played in the group stage?
2. How many games are played in the knockout stage?
3. How many total games are played?
4. How many games does the winner play?
5. How many games does the third place team play?