In this lecture, we'll see how optimization can be used to construct sports schedules.

Specifically, we'll introduce the method of integer optimization.

Sports is a $300 billion industry.

This is twice as big as the automobile industry and seven times as big as the movie industry.

This includes tickets for games, team merchandise, salaries for players, etc.

Almost every single country participates in the sports industry.

For this industry to remain so large sports teams are very important.

They key revenue for sports teams comes from TV networks.

TV networks paid $513 million per year for English Premier League soccer, $766 million per year for the National Basketball Association, or NBA, and $3 billion per year for the National Football League, or NFL.

These TV networks are paying such large amounts to ensure that they will have a good schedule of sports games to convince fans to tune in and watch the games on their network.

In addition to the TV networks, good sports schedules are important for other reasons too.

One is that extensive traveling, caused by a poor schedule, can cause player fatigue, which can reflect badly on the team.

Also, ticket sales tend to be better on the weekends, so teams like to have games scheduled for weekends to increase revenue.

Additionally, it's better to play division teams, or direct competitors for playoff spots, near the end of the season since teams have more information.

For these reasons and many more, everyone in the sports industry is incentivized to have a good schedule of games.

All competitive sports require schedules defining which pairs of teams play each other and when.

Until recently, sports schedules were mostly constructed by hand.

This is incredibly time consuming.

With just 10 teams, there are over one trillion possible schedules, where every team plays every other team.

There are many constraints defined by the TV networks, teams, cities, and others.

TV networks want games to occur at prime times, like in the evening.

Teams want games on the weekends.

Cities want games that don't conflict with other major events, etc.

This requires looking through all trillion possible schedules to find one that satisfies all of the constraints.

For major league baseball, a husband and wife team constructed the schedules for 24 years.

They mostly built the schedule by hand and used a giant wall of magnets to schedule 2,430 games each year.

Not only is this approach time consuming, but it's very difficult to add new constraints.

If one new constraint is added that might make the schedule infeasible and the process would have to start all over again.

There have been many interesting constraints that have been added by interesting people.

In 2008, the owners and TV networks were not the only ones who cared about the schedule.

President Barack Obama and Senator John McCain complained about the schedule.

2008 was an election year and President Obama and Senator McCain were the leading presidential nominees.

The Democratic and Republican National Conventions conflicted with the game scheduling so the schedule had to be adjusted.

After that was settled, the Pope complained about the schedule.

The Pope visited New York on April 20, 2008.

He traditionally always holds mass in Yankee Stadium, but a game was scheduled that same day.

The schedule had to be readjusted to move the Yankee game.

These are just a couple examples of the wide variety of constraints that have to be accounted for when building a sports schedule.

Recognizing how difficult it was to construct sports schedules by hand, in 1996 a company called the Sports Scheduling Group was started.

The founders were Doug Bureman, a former baseball vice president, and three academics-- George Nemhauser, Michael Trick, and Kelly Easton.

Instead of generating sports schedules by hand, they use a computer.

They've been scheduling college sports since 1999 and major league baseball since 2005.

They rely on optimization to build the schedules, which can easily adapt when new constraints are added.

In this lecture, we'll introduce one of the techniques they use, called integer optimization, to construct a sports schedule.