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Jt Scratch Lesson 6 • Fall 2015 • slide 1

Scratch Programming

Lesson 6: Counted Loops

Three Types of Loops

- Continue Forever without Stopping
- Continue until a condition becomes True
- Loop a given amount of times

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Three Types of Loops

Seen These Two

- Continue Forever without Stopping
- Continue until a condition becomes True
- Loop a given amount of times

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Three Types of Loops

- Continue Forever without Stopping
- Continue until a condition becomes True
- Loop a given amount of times

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Three Types of Loops

- Continue Forever without Stopping
- Continue until a condition becomes True
- Loop a given amount of times

This is called a "Counted Loop"

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Situations For Counted Loops

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students
- Display a separate dinner menu for each day during December

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students
- Display a separate dinner menu for each day during December - 31 days

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students
- Display a separate dinner menu for each day during December - 31 days
- Find out who is the oldest person working in an office building with 325 workers

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students
- Display a separate dinner menu for each day during December - 31 days
- Find out who is the oldest person working in an office building with 325 workers

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students
- Display a separate dinner menu for each day during December - 31 days
- Find out who is the oldest person working in an office building with 325 workers
- Keep track of the score during a baseball game

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Situations For Counted Loops

- Figure out the grade of each person in a class of 100 students
- Display a separate dinner menu for each day during December - 31 days
- Find out who is the oldest person working in an office building with 325 workers
- Keep track of the score during a baseball game - 9 innings

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Baseball Scoring

- Lets write a script to keep track of the score during a baseball game

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Baseball Scoring

- Lets write a script to keep track of the score during a baseball game
- 9 inning game

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Baseball Scoring

- Lets write a script to keep track of the score during a baseball game
- 9 inning game
- In each inning, the “visiting” team is “up” first during the “top” half of the inning

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Baseball Scoring

- Lets write a script to keep track of the score during a baseball game
- 9 inning game
- In each inning, the “visiting” team is “up” first during the “top” half of the inning
- Also, in each inning, the “home” team is up in the “bottom” half of the inning

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Baseball Scoring

- Lets write a script to keep track of the score during a baseball game
- 9 inning game
- In each inning, the “visiting” team is “up” first during the “top” half of the inning
- Also, in each inning, the “home” team is up in the “bottom” half of the inning
- A whole inning consist of both teams being up in this order.

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Baseball Scoring

- During their part of an inning, a team can earn zero or more “runs”

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Baseball Scoring

- During their part of an inning, a team can earn zero or more “runs”
- Runs accumulate - so if you have 2 in the first inning, and later on 3 more in the fourth inning, your score will 5

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Baseball Scoring

- During their part of an inning, a team can earn zero or more “runs”
- Runs accumulate - so if you have 2 in the first inning, and later on 3 more in the fourth inning, your score will 5
- The team that has the most runs at any point in the game is “winning”

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Baseball Scoring

- During their part of an inning, a team can earn zero or more “runs”
- Runs accumulate - so if you have 2 in the first inning, and later on 3 more in the fourth inning, your score will 5
- The team that has the most runs at any point in the game is “winning”
- If neither team has more, it is a “tie” game

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Baseball Scoring

- After the last inning - the 9th - ends, the game is over and the team with the most runs wins the game

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Baseball Scoring

- Our script will keep track of the score

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Baseball Scoring

- Our script will keep track of the score
- After each half inning, it will announce which team is leading (has the most runs so far)

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Baseball Scoring

- Our script will keep track of the score
- After each half inning, it will announce which team is leading (has the most runs so far)
- Or, if neither then it will say it is a tie

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Baseball Scoring

- Because this is one of the most well-known rivalries in all of sports, in our script we will make the visiting team be the "Boston Red Sox" and the home team be the "NY Yankees."

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Baseball Scoring

- Because this is one of the most well-known rivalries in all of sports, in our script we will make the visiting team be the "Boston Red Sox" and the home team be the "NY Yankees."

(Apologies to fans of other teams, the code can be modified to work with any two teams)

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Baseball Scoring - Variables

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Baseball Scoring - Variables

- **HomeTeamRuns** - score of the home team, this starts at zero

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Baseball Scoring - Variables

- HomeTeamRuns - score of the home team, this starts at zero
- **VisitingTeamRuns** - score of the visiting team, this starts at zero

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Baseball Scoring - Variables

- HomeTeamRuns - score of the home team, this starts at zero
- VisitingTeamRuns - score of the visiting team, this starts at zero
- **Inning** - the current inning of the game - this starts at 1 and goes up to 9

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Baseball Scoring - Variables

- HomeTeamRuns - score of the home team, this starts at zero
- VisitingTeamRuns - score of the visiting team, this starts at zero
- Inning - the current inning of the game - this starts at 1 and goes up to 9

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Handling an Inning

- As usual, it is wise to tackle a complicated problem by working on simpler parts first

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Handling an Inning

- As usual, it is wise to tackle a complicated problem by working on simpler parts first
- So lets forget about 9 innings, and see if we can handle one inning

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Handling an Inning

The Approach

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Handling an Inning

The Approach

- Find out how many runs the visiting team got

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Handling an Inning

The Approach

- Find out how many runs the visiting team got
- Adjust visiting team's score

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Handling an Inning

The Approach

- Find out how many runs the visiting team got
- Adjust visiting team's score
- Say who is winning so far or announce a tie

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Handling an Inning

The Approach

- Find out how many runs the visiting team got
- Adjust visiting team's score
- Say who is winning so far or announce a tie
- Find out how many runs the home team got

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Handling an Inning

The Approach

- Find out how many runs the visiting team got
- Adjust visiting team's score
- Say who is winning so far or announce a tie
- Find out how many runs the home team got
- Adjust home team's score

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Handling an Inning

The Approach

- Find out how many runs the visiting team got
- Adjust visiting team's score
- Say who is winning so far or announce a tie
- Find out how many runs the home team got
- Adjust home team's score
- Say who is winning so far or announce a tie

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Handling an Inning

The Approach

- Ask for # visiting runs
- Adjust VisitingTeamRuns
- State leader or tie
- Ask for # home runs
- Adjust HomeTeamRuns
- State leader or tie

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Handling an Inning

The Approach

- Ask for # visiting runs

ask How many runs does visiting team get in top of inning and wait

- State leader or tie
- Ask for # home runs
- Adjust HomeTeamRuns
- State leader or tie

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Handling an Inning

The Approach

- Ask for # visiting runs
- Adjust VisitingTeamRuns

change VisitingTeamRuns by answer

- Adjust HomeTeamRuns
- State leader or tie

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Handling an Inning

The Approach

- Ask for # visiting runs
- Adjust VisitingTeamRuns
- State leader or tie
- Ask for # home runs

ask How many runs does home team get in bottom of inning and wait

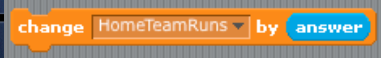
- State leader or tie

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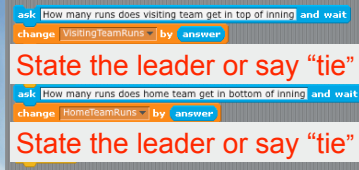
Handling an Inning

The Approach

- Ask for # visiting runs
- Adjust VisitingTeamRuns
- State leader or tie
- Ask for # home runs
- **Adjust HomeTeamRuns**



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The Approach

- Ask for # visiting runs
- Adjust VisitingTeamRuns
- State leader or tie
- Ask for # home runs
- Adjust HomeTeamRuns
- State leader or tie

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Announce Leader

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Announce Leader

- Have to decide who is leading

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Announce Leader

- Have to **decide** who is leading

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Announce Leader

- Have to **decide** who is leading
- How many choices?

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Announce Leader

- Have to **decide** who is leading
- How many choices?
 - Home team is winning

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Announce Leader

- Have to **decide** who is leading
- How many choices?
 - Home team is winning
 - Visiting team is winning

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Announce Leader

- Have to **decide** who is leading
- How many choices?
 - Home team is winning
 - Visiting team is winning
 - Its a tie

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Announce Leader

- Have to **decide** who is leading
- How many choices?
 - Home team is winning
 - Visiting team is winning
 - Its a tie
- Three choices

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Announce Leader

- Have to **decide** who is leading
- How many choices?
 - Home team is winning
 - Visiting team is winning
 - Its a tie
- Three choices
- What do you use to make a three-way decision?

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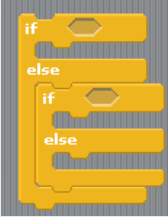
Announce Leader

- Have to **decide** who is leading
- How many choices?
 - Home team is winning
 - Visiting team is winning
 - Its a tie
- Three choices
- What do you use to make a three-way decision? **A Nested IF**

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Announce Leader

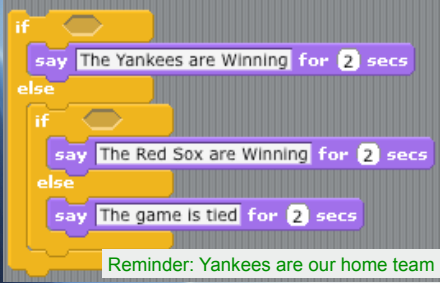
- Have to **decide** who is leading
- How many choices?
 - Home team is winning
 - Visiting team is winning
 - Its a tie
- Three choices
- What do you use to make a three-way decision? **A Nested IF**



A Nested IF

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Announce Leader



Reminder: Yankees are our home team

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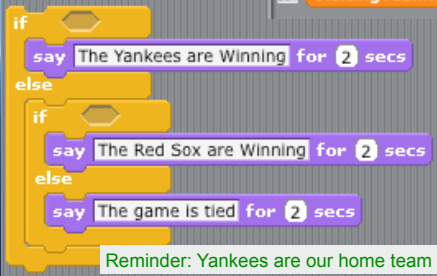
Announce L

Our Variables

HomeTeamRuns

Inning

VisitingTeamRuns



Reminder: Yankees are our home team

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Announce L

Our Variables

HomeTeamRuns

Inning

VisitingTeamRuns

What condition goes here?




Reminder: Yankees are our home team

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Announce Leader

What condition goes here?




Reminder: Yankees are our home team

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Announce Leader

What condition goes here?



Reminder: Yankees are our home team

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Announce Leader

```

if HomeTeamRuns > VisitingTeamRuns
  say The Yankees are Winning for 2 secs
else
  if HomeTeamRuns < VisitingTeamRuns
    say The Red Sox are Winning for 2 secs
  else
    say The game is tied for 2 secs
  
```

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Handling an Inning

The Approach

- Ask for # visiting runs
- Adjust VisitingTeamRuns
- State leader or tie
- Ask for # home runs
- Adjust HomeTeamRuns
- State leader or tie

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```

ask How many runs does visiting team get in top of inning and wait
change VisitingTeamRuns by answer
State the leader or say "tie"
ask How many runs does home team get in bottom of inning and wait
change HomeTeamRuns by answer
State the leader or say "tie"
  
```

The Approach

- Ask for # visiting runs
- Adjust VisitingTeamRuns
- State leader or tie
- Ask for # home runs
- Adjust HomeTeamRuns
- State leader or tie

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Handling an Inning

```

ask How many runs does visiting team get in top of inning and wait
change VisitingTeamRuns by answer
State the leader or say "tie"
ask How many runs does home team get in bottom of inning and wait
change HomeTeamRuns by answer
State the leader or say "tie"
  
```

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Handling an Inning

```

ask How many runs does visiting team get in top of inning and wait
change VisitingTeamRuns by answer
if HomeTeamRuns > VisitingTeamRuns
  say The Yankees are Winning for 2 secs
else
  if HomeTeamRuns < VisitingTeamRuns
    say The Red Sox are Winning for 2 secs
  else
    say The game is tied for 2 secs
  ask How many runs does home team get in bottom of inning and wait
  change HomeTeamRuns by answer
  if HomeTeamRuns > VisitingTeamRuns
    say The Yankees are Winning for 2 secs
  else
    if HomeTeamRuns < VisitingTeamRuns
      say The Red Sox are Winning for 2 secs
    else
      say The game is tied for 2 secs
  
```

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Handling an Inning

```

ask How many runs does visiting team get in top of inning and wait
change VisitingTeamRuns by answer
if HomeTeamRuns > VisitingTeamRuns
  say The Yankees are Winning for 2 secs
else
  if HomeTeamRuns < VisitingTeamRuns
    say The Red Sox are Winning for 2 secs
  else
    say The game is tied for 2 secs
  ask How many runs does home team get in bottom of inning and wait
  change HomeTeamRuns by answer
  if HomeTeamRuns > VisitingTeamRuns
    say The Yankees are Winning for 2 secs
  else
    if HomeTeamRuns < VisitingTeamRuns
      say The Red Sox are Winning for 2 secs
    else
      say The game is tied for 2 secs
  
```

Handle Visitors

Say who is winning or "tie"

Handle Home Team

Say who is winning or "tie"

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Handling an Inning

Demo: Baseball Scoring 1

Handle Visitors

Handle Home Team

Say who is winning or "tie"

Say who is winning or "tie"

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Handling The Whole Game

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Handling The Whole Game

- Start when green flag clicked

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Handling The Whole Game

- Start when green flag clicked
- Announce game

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Handling The Whole Game

- Start when green flag clicked
- Announce game
- Set score to 0 - 0

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Handling The Whole Game

- Start when green flag clicked
- Announce game
- Set score to 0 - 0
- 9 Times:

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Handling The Whole Game

- Start when green flag clicked
- Announce game
- Set score to 0 - 0
- 9 Times:
 - Handle an Inning

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Handling The Whole Game

- Start when green flag clicked
- Announce game
- Set score to 0 - 0
- 9 Times:
 - Handle an Inning
 - End

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Handling The Whole Game

- Start when green flag clicked
- Announce game
- Set score to 0 - 0



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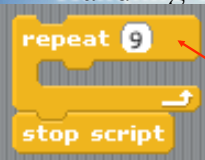
Handling The Whole Game



- 9 Times:
 - Handle an Inning
 - End

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Handling The Whole Game

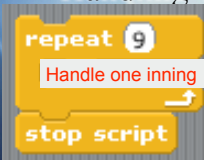


Finally, we use the counted loop !

- 9 Times:
 - Handle an Inning
 - End

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Handling The Whole Game



- 9 Times:
 - Handle an Inning
 - End

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Handling The Whole Game

- 9 Times: Handle an Inning
- End

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Handling The Whole Game

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Handling The Whole Game

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Handling The Whole Game

The Counted Loop [Repeat]

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Handling The Whole Game

9 times (9 innings)
The Counted Loop [Repeat]

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Handling The Whole Game

9 times (9 innings)
The Counted Loop [Repeat]

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Handling The Whole Game

9 times (9 innings)
The Counted Loop
[Repeat]

Demo: Baseball Scoring 2

The image shows a Scratch script titled "Before Game Starts" and "One inning". The "Before Game Starts" block includes: "when green flag is clicked", "say 'The Yankees are playing Boston in Yankee Stadium' for 2 secs", "set HomeTeamRuns to 0", and "set VisitingTeamRuns to 0". The "One inning" block is a "repeat" loop that runs 9 times. Inside the loop, it asks "How many runs does visiting team get in top of inning?", changes VisitingTeamRuns by the answer, checks if HomeTeamRuns > VisitingTeamRuns, and says "The Yankees are Winning!" for 2 secs. It then asks "How many runs does home team get in bottom of inning?" and changes HomeTeamRuns by the answer. It checks if HomeTeamRuns < VisitingTeamRuns and says "The Red Sox are Winning!" for 2 secs, or if HomeTeamRuns = VisitingTeamRuns and says "The game is tied!" for 2 secs. The script ends with "stop script".

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Multimedia Version

- Demo: Baseball Scoring

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Multimedia Version

- Stage:

A 3D rendering of a baseball stadium, showing the field, seating, and lights.

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Multimedia Version

- Script Sounds:

The image shows the Scratch Sounds panel with three sounds listed:

1	Boop	0:00:07	158 KB	When home team losing
2	Cheer	0:00:04	67 KB	When home team winning
3	Encouragement	0:00:07	285 KB	When it's a tie game

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Multimedia Version

- Costumes

The image shows the Scratch Costumes panel with three costumes listed:

1	HomeTeam	116430	48 KB	When home team winning
2	VisitingTeam	120420	58 KB	When home team losing
3	Tie	95489	2 KB	When it's a tie game

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Multimedia Version

- A second sprite
- This is not necessary but it will allow us to change multiple objects on the screen at the same time - so makes a more interesting multimedia presentation

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Multimedia Version

- A second sprite
- Two Costumes

CurrentInning Costume

GameOver Costume

OR

INNING

GAME OVER

CURRENT LEADER

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Multimedia Version

- A second sprite
- Some scripts for this sprite

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Multimedia Version

- A second sprite
- Some scripts for this sprite

At start, set Inning variable to zero, put sound at low volume & be wearing CurrentInning costume

when clicked

set Inning to 0

set volume to 10 %

switch to costume CurrentInning

stop script

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Multimedia Version

- A second sprite
- Some scripts for this sprite

Each new inning, increment Inning variable, say the Inning & increase volume (so crowd sounds noisier)

when I receive NewInning

change Inning by 1

say Inning

change volume by 10

stop script

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Multimedia Version

- A second sprite
- Some scripts for this sprite

When told that game is over, switch to that final costume

when I receive GameOver

switch to costume GameOver

stop all

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Multimedia Version

- Some changes to script for main sprite

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Multimedia Version

- Some changes to script for main sprite




When game starts, show Tie Game costume

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Multimedia Version

- Some changes to script for main sprite



In each nested-IF, instead of saying who is leading or that the game is tied, just switch to appropriate costume and play associated sound effect

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Multimedia Version

- Some changes to script for main sprite



As each inning begins (start of each time around loop), send message to second sprite so it handles new Inning in manner previously discussed

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Multimedia Version

- Some changes to script for main sprite



Right before game is over (script stops) send message to second sprite so it changes to GameOver costume (screen message) as previously discussed

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Final Issue

- In baseball, if nine innings are over and no team has won the game (has more runs), the game goes into “extra innings.”

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Final Issue

- In baseball, if nine innings are over and no team has won the game (has more runs), the game goes into “extra innings.”
- That is, one whole inning at a time (top and bottom) is played until eventually (hopefully) at the end of the inning it is no longer tied - and some team has more runs. Then the game ends.

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Final Issue

- In baseball, if nine innings are over and no team has won the game (has more runs), the game goes into “extra innings.”
- That is, one whole inning at a time (top and bottom) is played **until** eventually (hopefully) at the end of the inning it is no longer tied - and some team has more runs. Then the game ends.

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Final Issue

- That is, one whole inning at a time (top and bottom) is played **until** eventually (hopefully) at the end of the inning it is no longer tied - and some team has more runs. Then the game ends.

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Final Issue

- That is, one whole inning at a time (top and bottom) is played **until** eventually (hopefully) at the end of the inning it is no longer tied - and some team has more runs. Then the game ends.
- No longer do we repeat innings a set amount of times, but rather we do innings over and over **UNTIL** the game is over

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Final Issue

- No longer do we repeat innings a set amount of times, but rather we do innings over and over **UNTIL** the game is over

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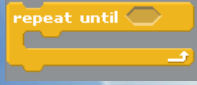
Final Issue

- No longer do we repeat innings a set amount of times, but rather we do innings over and over **UNTIL** the game is over
- What structure do we use in Scratch if we need to do something over and over until something special happens?

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Final Issue

- No longer do we repeat innings a set amount of times, but rather we do innings over and over **UNTIL** the game is over
- What structure do we use in Scratch if we need to do something over and over until something special happens?

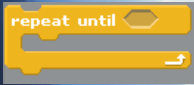


The image shows a yellow Scratch 'repeat until' block. It has a small grey box on the left for a loop count, a small grey box on the right for a condition, and a right-pointing arrow at the bottom right.

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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

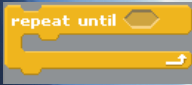


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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

What condition means we should have extra innings? (That is we should loop?)

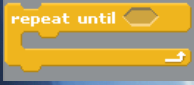



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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

What condition means we should have extra innings? (That is we should loop?)

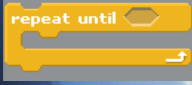




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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

So, what condition means we should no longer have extra innings? (That is no longer should loop?)

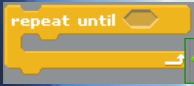




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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

So, what condition means we should no longer have extra innings? (That is no longer should loop?)

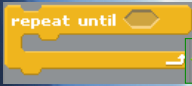

The exact opposite condition

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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

When this is true, we should have no more innings - the loop should stop

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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

When this is true, we should have no more innings - the loop should stop

```
repeat until [not HomeTeamRuns = VisitingTeamRuns]
```

So its the condition we need here

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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

```
repeat until [not HomeTeamRuns = VisitingTeamRuns]
broadcast [GameOver]
stop script
```

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Final Issue

- After nine innings are over, have loop for extra innings, which might happen zero times

Handle one inning

```
repeat 1
  ask [How many runs does visiting team get in top of inning?] and wait
  change [HomeTeamRuns] by [answer]
  if [HomeTeamRuns < VisitingTeamRuns]
    switch to costume [HomeTeam]
    play sound [Home]
  else
    switch to costume [VisitingTeam]
    play sound [Visiting]
  ask [How many runs does home team get in bottom of inning?] and wait
  change [VisitingTeamRuns] by [answer]
  if [HomeTeamRuns < VisitingTeamRuns]
    switch to costume [HomeTeam]
    play sound [Home]
  else
    switch to costume [VisitingTeam]
    play sound [Visiting]
```

```
repeat until [not HomeTeamRuns = VisitingTeamRuns]
broadcast [GameOver]
stop script
```

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A lot of code

```
when clicked
say [The Yankees are playing Boston in Yankee Stadium] for 2 secs
set [HomeTeamRuns] to 0
set [VisitingTeamRuns] to 0
switch to costume [Title]
```

Before game begins

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A lot of code

Handle regular nine innings (using repeat loop)

```
repeat 9
  broadcast [NextInning]
  ask [How many runs does visiting team get in top of inning?] and wait
  change [HomeTeamRuns] by [answer]
  if [HomeTeamRuns < VisitingTeamRuns]
    switch to costume [HomeTeam]
    play sound [Home]
  else
    switch to costume [VisitingTeam]
    play sound [Visiting]
  ask [How many runs does home team get in bottom of inning?] and wait
  change [VisitingTeamRuns] by [answer]
  if [HomeTeamRuns < VisitingTeamRuns]
    switch to costume [HomeTeam]
    play sound [Home]
  else
    switch to costume [VisitingTeam]
    play sound [Visiting]
```

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A lot of code

Handle extra innings if necessary (using Repeat Until loop)

```
repeat until [not HomeTeamRuns = VisitingTeamRuns]
  broadcast [NextInning]
  ask [How many runs does visiting team get in top of inning?] and wait
  change [HomeTeamRuns] by [answer]
  if [HomeTeamRuns < VisitingTeamRuns]
    switch to costume [HomeTeam]
    play sound [Home]
  else
    switch to costume [VisitingTeam]
    play sound [Visiting]
  ask [How many runs does home team get in bottom of inning?] and wait
  change [VisitingTeamRuns] by [answer]
  if [HomeTeamRuns < VisitingTeamRuns]
    switch to costume [HomeTeam]
    play sound [Home]
  else
    switch to costume [VisitingTeam]
    play sound [Visiting]
```

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A lot of code



Once past extra inning loop (which often happens zero times but sometime happens a while), the game is no longer tied and is thus over, so handle game ending

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A lot of code



Regular 9 innings

Extra innings when necessary


broadcast GameOver

stop script

Game ending

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A lot of code



Regular 9 innings 1.

Extra innings when necessary 2.

Although buried in different types of loops, these two blocks of code are exactly the same - "handle one inning"


broadcast GameOver

stop script

Game ending

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A lot of code



Regular 9 innings

Extra innings when necessary

broadcast GameOver

stop script

Game ending

Demo: Baseball Scoring 3

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Availability of Slides

Go to:

nbc.rutgers.edu/~jt

to see the powerpoint slides and/or podcasts for this lecture

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