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Jt Scratch Lesson 5A • Fall 2015 • slide 1

Scratch Programming

Lesson 5A: Loops

Revisiting Grading

- Demo: Grading

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Revisiting Grading

- Demo: Grading
- At the beginning the costume keeps switching back and forth.

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Revisiting Grading


- Demo: Grading
- At the beginning the costume keeps switching back and forth.



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Revisiting Grading

- Demo: Grading
- At the beginning the costume keeps switching back and forth.



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Revisiting Grading

- Demo: Grading
- At the beginning the costume keeps switching back and forth.



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Revisiting Grading

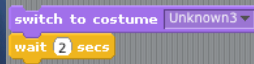
- Demo: Grading
- At the beginning the costume keeps switching back and forth.



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Revisiting Grading

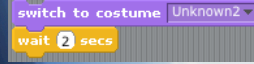
- Demo: Grading
- At the beginning the costume keeps switching back and forth.



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Revisiting Grading

- Demo: Grading
- At the beginning the costume keeps switching back and forth.



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Repeating Actions

- How can we cause actions to happen over and over in programming?

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Repeating Actions

- How can we cause actions to happen over and over in programming?
- Loops

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Three Types of Loops

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Three Types of Loops

- Continue Forever without Stopping

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Three Types of Loops

- Continue Forever without Stopping



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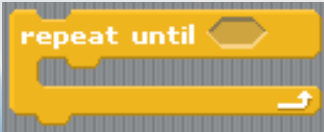
Three Types of Loops

- Continue Forever without Stopping
- Continue until a condition becomes True

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Three Types of Loops

- Continue Forever without Stopping
- Continue until a condition becomes True



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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



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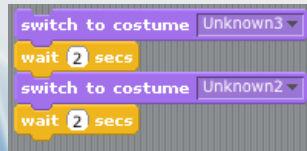
Continually Change Costume

- Show first costume, then second

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Continually Change Costume

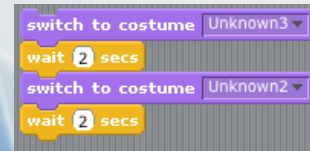
- Show first costume, then second



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Continually Change Costume

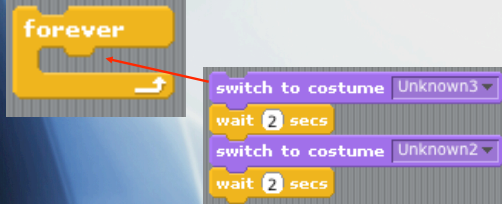
- Show first costume, then second
- Do this forever



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Continually Change Costume

- Show first costume, then second
- Do this forever



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Continually Change Costume

- Show first costume, then second
- Do this forever



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Continually Change Costume

- Show first costume, then second
- Do this forever
- Actually we do not want to do it forever -

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Continually Change Costume

- Show first costume, then second
- Do this forever
- Actually we do not want to do it forever - as we saw in the grading program, we eventually switched to another costume indicative of the grade given

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Continually Change Costume

- Show first costume, then second
- Do this forever
- Actually we do not want to do it forever - as we saw in the grading program, we eventually switched to another costume indicative of the grade given
- We will return to this later


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Looping for a while



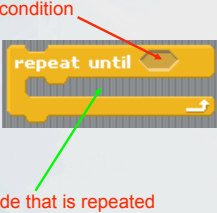
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Looping for a while



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Looping for a while



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Repeat Until

Keep repeating loop as long as the condition is FALSE



A diagram of a yellow Scratch 'repeat until' block. A red arrow points from the word 'condition' to the top of the block. A green arrow points from the text 'code that is repeated' to the main body of the block.

condition


code that is repeated

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Repeat Until

Keep repeating loop as long as the condition is FALSE

Stop loop when condition is TRUE



A diagram of a yellow Scratch 'repeat until' block. A red arrow points from the word 'condition' to the top of the block. A green arrow points from the text 'code that is repeated' to the main body of the block.

condition

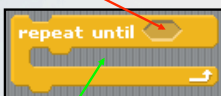
code that is repeated

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Repeat Until

Keep repeating loop as long as the condition is FALSE

Stop loop when condition is TRUE



A diagram of a yellow Scratch 'repeat until' block. A red arrow points from the word 'condition' to the top of the block. A green arrow points from the text 'code that is repeated' to the main body of the block.

condition

code that is repeated


Note: Each time through the loop, all code will be completed.

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Repeat Until

Keep repeating loop as long as the condition is FALSE

Stop loop when condition is TRUE



A diagram of a yellow Scratch 'repeat until' block. A red arrow points from the word 'condition' to the top of the block. A green arrow points from the text 'code that is repeated' to the main body of the block. A second red arrow points from the text 'Note: This does not have to be last structure in the script - other code can be attached.' to the bottom of the block.

condition

code that is repeated

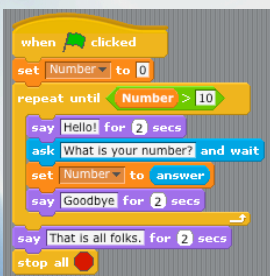
Note: This does not have to be last structure in the script - other code can be attached.

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Repeat Until Example

Keep repeating loop as long as the condition is FALSE

Stop loop when condition is TRUE



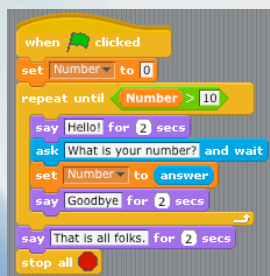
A Scratch script starting with a 'when clicked' block, followed by 'set Number to 0', a 'repeat until Number > 10' loop containing 'say Hello!', 'ask What is your number?', 'set Number to answer', and 'say Goodbye!', and finally 'say That is all folks.' and 'stop all'.

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Repeat Until Example

Keep repeating loop as long as the condition is FALSE

Stop loop when condition is TRUE



A Scratch script identical to the one on slide 35.

Demo: Loop 2

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Problem

- Allow people on to an elevator as long as their total weight does not yet exceed the specified weight limit.

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Problem

- Allow people on to an elevator as long as their total weight does not yet exceed the specified weight limit. Once a person gets on who brings the weight over the limit, close the doors and let no one else on.

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Problem

- Allow people on to an elevator as long as their total weight does not yet exceed the specified weight limit. Once a person gets on who brings the weight over the limit, close the doors and let no one else on. (Don't worry - yes the weight will be over the limit - but the elevator can actually support twice the limit.)

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Overall Approach

- Ask for weight limit

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Overall Approach

- Ask for weight limit
- Track how much weight is on the elevator at any time

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Overall Approach

- Ask for weight limit
- Track how much weight is on the elevator at any time - start this at zero

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Overall Approach

- Ask for weight limit
- Track how much weight is on the elevator at any time - start this at zero
- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far

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Overall Approach

- Ask for weight limit
- Track how much weight is on the elevator at any time - start this at zero
- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far
- Keep letting another person on as long as total weight is under the limit

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Variables

- MaxWeight - limit of how much weight is allowed on the elevator (pounds)

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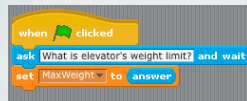
Variables

- MaxWeight - limit of how much weight is allowed on the elevator (pounds)
- TotalWeight - weight of everyone currently on the elevator

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Start

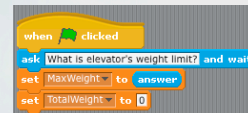
- Ask for weight limit



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Start

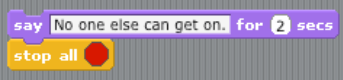
- Ask for weight limit
- Track how much weight is on the elevator at any time - start this at zero



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End

- Make it clear no one else can get on the elevator



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Handle one person

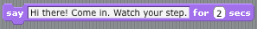
- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far

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Handle one person

We do not have to, but lets welcome them:

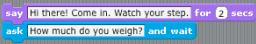
- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far



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Handle one person

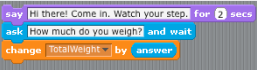
- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far



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Handle one person

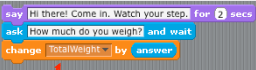
- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far




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Handle one person

- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far



Another way to add the person's weight (answer) on to the TotalWeight



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Handle one person

- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far

Or to increase TotalWeight by the person's weight (answer)

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Handle one person

- For each person who gets on the elevator, get person's weight and calculate total weight on elevator so far

By the way, we could have used another variable here such as PersonsWeight

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Handle one person

- Not necessary but we can announce the total weight if we want

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Keep letting people on

- Keep letting another person on as long as total weight is under the limit

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Keep letting people on

- Keep letting another person on as long as total weight is under the limit

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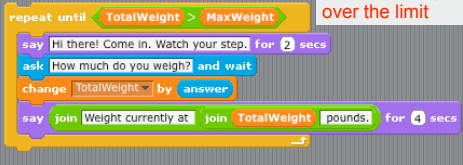
Keep letting people on

- Keep letting another person on as long as total weight is under the limit

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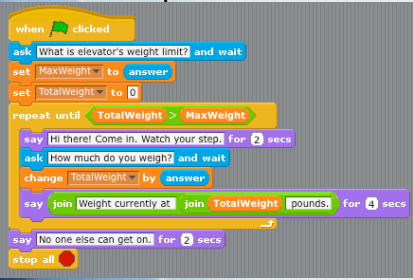
Keep letting people on

- Keep letting another person on as long as total weight is under the limit *Or said another way until total weight is over the limit*



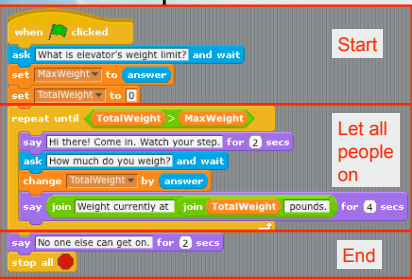
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Complete Code



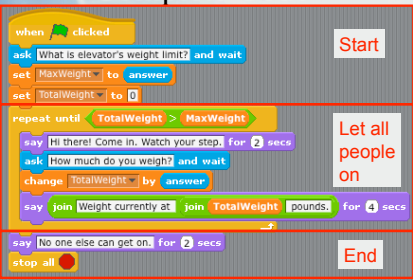
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Complete Code



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Complete Code



Demo: Elevator 1

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A Little Multimedia

- Bellhop Sprite



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A Little Multimedia

- Stage Sounds

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A Little Multimedia

- Stage Sounds
 - Elevator bell
 - Door closing
 - Elevator music



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A Little Multimedia

- Stage Sounds
- Stage Costumes

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A Little Multimedia

- Stage Sounds
- Stage Costumes
 - Closed doors
 - Open and Empty




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Stage Scripts

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Stage Scripts

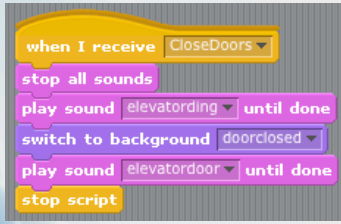
- At start, show doors open and begin playing elevator music



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Stage Scripts

- When closeddoor message is sent (from bellhop script) stop elevator music, play ding and door closing sound and show doors closed



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Change to Bellhop script

- Of course, in the bellhop script, we now have to send (broadcast) the closeddoor message to trigger the final stage script

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Complete Multimedia Code

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Complete Multimedia Code

Demo:
Elevator 2

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A Little More Multimedia

- It would be interesting to show people getting on the elevator

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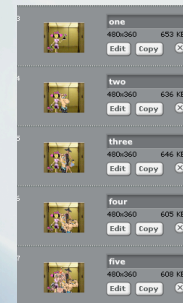
A Little More Multimedia

- It would be interesting to show people getting on the elevator
- This can be accomplished by having multiple costumes for the stage, each showing the elevator a little more crowded

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A Little More Multimedia

- Some costumes:



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A Little More Multimedia

- Some costumes:
- Set the names to how many people are on elevator



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A Little More Multimedia

- Some costumes:
- Set the names to how many people are on elevator
- Useful statement:



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A Little More Multimedia

- Some costumes:
- Set the names to how many people are on elevator
- Useful statement:




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A Little More Multimedia

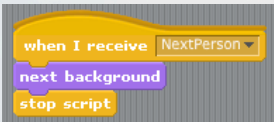
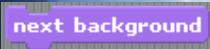
- Since costumes are in order, we can write a simple stage script to show one more person:
- Useful statement:



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A Little More Multimedia

- Since costumes are in order, we can write a simple stage script to show one more person:
- Useful statement:

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A Little More Multimedia

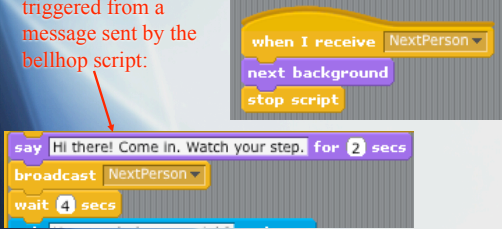
- We set it up to be triggered from a message sent by the bellhop script:



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A Little More Multimedia

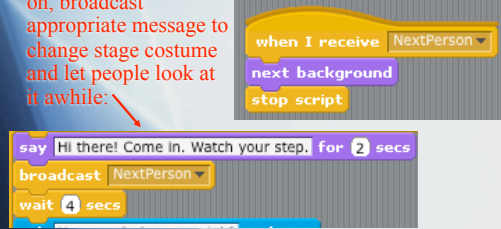
- We set it up to be triggered from a message sent by the bellhop script:



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A Little More Multimedia

- As soon as person gets on, broadcast appropriate message to change stage costume and let people look at it awhile:



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Small Issue

- We made ten more costumes to show up to ten people in elevator

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Small Issue

- We made ten more costumes to show up to ten people in elevator - what if more than ten people get on?

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Small Issue

- We made ten more costumes to show up to ten people in elevator - what if more than ten people get on?
- How about just redesigning the code to let people on as long as the weight is under the limit and as long as ten people are not on yet?

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Small Issue

- We made ten more costumes to show up to ten people in elevator - what if more than ten people get on?
- How about just redesigning the code to let people on as long as the weight is under the limit and as long as ten people are not on yet?
- In other words, use an boolean condition in the loop.

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Small Issue

- ... let people on as long as the weight is under the limit and as long as ten people are not on yet - use an boolean condition in the loop.

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Small Issue

- ... let people on as long as the weight is under the limit and as long as ten people are not on yet - use an boolean condition in the loop.

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Small Issue

- ... let people on as long as the weight is under the limit and as long as ten people are not on yet - use an boolean condition in the loop.

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Small Issue

- ... let people on as long as the weight is under the limit and as long as ten people are not on yet - use an boolean condition in the loop.

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Small Issue

- ... let people on as long as the weight is under the limit and as long as ten people are not on yet - use an boolean condition in the loop.

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Small Issue

- ... let people on as long as the weight is under the limit and as long as ten people are not on yet - use an boolean condition in the loop.

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Small Issue

- ... let people on as long as the weight is under the limit and as long as ten people are not on yet - **use an boolean condition in the loop.**



Why an OR? Think about it.
Only one part has to be true to let another person on.

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Small Issue

- Of course we have to track NumberOfPeople properly:

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Small Issue

- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on

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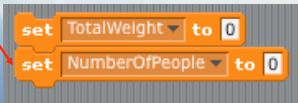
Small Issue

- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on - once right before loop starts

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Small Issue

- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on - once right before loop starts



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Small Issue

- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on - once right before loop starts
 - Increase it by one (increment it) each time a person gets on

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Small Issue

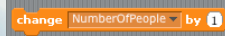
- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on - once right before loop starts
 - Increase it by one (increment it) each time a person gets on



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Small Issue



- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on - once right before loop starts
 - Increase it by one (increment it) each time a person gets on - that is, in the loop



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Small Issue



- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on - once right before loop starts
 - Increase it by one (increment it) each time a person gets on - that is, in the loop

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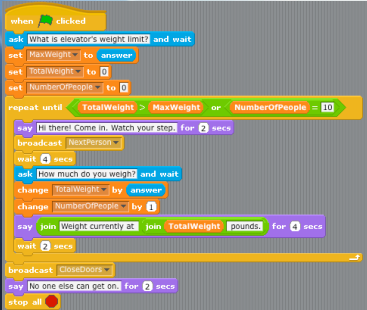
Small Issue

- Of course we have to track NumberOfPeople properly:
 - Set it to zero before anyone has been let on - once right before loop starts
 - Increase it by one (increment it) each time a person gets on - that is, in the loop

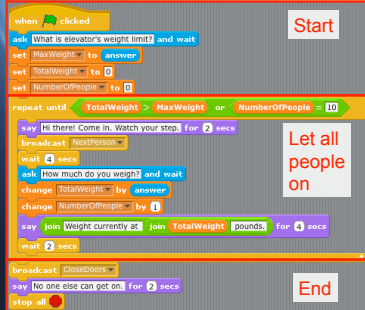
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New Version of Script



Jt Scratch Lesson 5A • Fall 2015 • slide 107

New Version of Script



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New Version of Script

Start

Initialize number of people to zero BEFORE loop (before letting people on)

Let all people on

End

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New Version of Script

Start

Also stop loop (let no one else on) if ten people are already on

Let all people on

End

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New Version of Script

Start

Let all people on

Each time person is allowed on (in loop), increment counter to reflect new number of people

End

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New Version of Script

Start

Let all people on

Demo: Elevator

End

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Interesting Twist

- Instead of asking for people's weight, why don't we just turn this into a computer simulation

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Interesting Twist

- Instead of asking for people's weight, why don't we just turn this into a computer simulation - that is why don't we just allow the computer to assign arbitrary weights to people who enter

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Interesting Twist

- Instead of asking for people's weight, why don't we just turn this into a computer simulation - that is why don't we just allow the computer to assign arbitrary weights to people who enter - **let's have it just create its own elevator world**

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Interesting Twist

- the computer assigns arbitrary weights to people who enter - let's have it just create its own elevator world - **each time the script runs, different weights are assigned by the computer - not us - and it is all unpredictable**

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New Operation

- How can you have the computer pick arbitrary weights?

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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?

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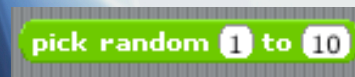
New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- **Answer: Use the Pick Random operator**

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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- **Answer: Use the Pick Random operator**



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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- Answer: Use the Pick Random operator



Maybe it picks 4

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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- Answer: Use the Pick Random operator




Maybe it picks 4 - or 8

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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- Answer: Use the Pick Random operator




Maybe it picks 4 - or 8 - or 1

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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- Answer: Use the Pick Random operator



we can not know which beforehand

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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- Answer: Use the Pick Random operator




This is useful for computer games

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New Operation

- How can you have the computer pick arbitrary weights?
- Or more generally, arbitrary numbers?
- Answer: Use the Pick Random operator



This is useful for computer games or simulations

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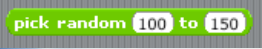
New Operation

- Pick Random operator examples:

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New Operation

- Pick Random operator examples:




Picks some whole number between 100 and 150 (including end points)

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New Operation

- Pick Random operator examples:






Even negatives okay - picks whole number from -5 to 10

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New Operation

- Pick Random operator examples:



Decimals too - picks decimal number from .3 to .7 - for example maybe .59174523

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New Operation

- Pick Random operator examples:



Can even use variables - so if Begin was 15 and Last was 22, this might pick 19

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Elevator Simulation

- Lets have the computer pick the weights of the people getting on, rather than asking

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Elevator Simulation

- Lets have the computer pick the weights of the people getting on, rather than asking
- Lets say from 65 pounds to 250 pounds

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Elevator Simulation

- Lets have the computer pick the weights of the people getting on, rather than asking
- Lets say from 65 pounds to 250 pounds
- Lets place this into a new variable called PersonsWeight

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Elevator Simulation

- Lets have the computer pick the weights of the people getting on, rather than asking
- Lets say from 65 pounds to 250 pounds
- Lets place this into a new variable called PersonsWeight

```
set PersonsWeight to pick random 65 to 250
```

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Elevator Simulation

- Lets have the computer pick the weights of the people getting on, rather than asking
- Lets say from 65 pounds to 250 pounds
- Lets place this into a new variable called PersonsWeight and announce it

```
set PersonsWeight to pick random 65 to 250
say join join A person of PersonsWeight pounds just entered the elevator. for 4 secs
```

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Simulation Script

```
when clicked
ask What is elevator's weight limit? and wait
set TotalWeight to elevator
set PersonsWeight to 0
set NumberOfPeople to 0
repeat until TotalWeight > MaxWeight or NumberOfPeople = 10
say Oh there come in, watch your step. for 2 secs
broadcast broadcast
wait 4 secs
set PersonsWeight to pick random 65 to 250
say join join A person of PersonsWeight pounds just entered the elevator. for 4 secs
change TotalWeight by PersonsWeight
change NumberOfPeople by 1
say join Weight currently at join TotalWeight pounds for 4 secs
wait 2 secs
broadcast broadcast
say You're close can get on! for 2 secs
stop all
```

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Simulation Script

```
when clicked
ask What is elevator's weight limit? and wait
set TotalWeight to elevator
set PersonsWeight to 0
set NumberOfPeople to 0
repeat until TotalWeight > MaxWeight or NumberOfPeople = 10
say Oh there come in, watch your step. for 2 secs
broadcast broadcast
wait 4 secs
set PersonsWeight to pick random 65 to 250
say join join A person of PersonsWeight pounds just entered the elevator. for 4 secs
change TotalWeight by PersonsWeight
change NumberOfPeople by 1
say join Weight currently at join TotalWeight pounds for 4 secs
wait 2 secs
broadcast broadcast
say You're close can get on! for 2 secs
stop all
```

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Simulation Script

Start

End

The only change - set person's weight randomly rather than asking for it

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Simulation Script

Start

End

Demo:
Elevator
Simulation

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Grading Again

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Grading Again

- Instead of using a forever loop, how did we get the grading costume to change back and forth until the score was entered?

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Grading Again

- Instead of using a forever loop, how did we get the grading costume to change back and forth until the score was entered?
- Answer: we used a variable and set it appropriately only once the score was entered - and we used a repeat until loop which kept going as long as the variable didn't have the special value yet

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Grading Again

- Answer: we used a variable and set it appropriately only once the score was entered - and we used a repeat until loop which kept going as long as the variable didn't have the special value yet

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Grading Again

- Answer: we used a variable and set it appropriately only once the score was entered - then we used a repeat until loop which kept going as long as the variable didn't have the special value yet

```

when clicked
  set GradeSet to No
  
```

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Grading Again

- Answer: we used a variable and set it appropriately only once the score was entered - then we used a repeat until loop which kept going as long as the variable didn't have the special value yet

```

when clicked
  ask 'What was your numeric score?' and wait
  set Score to answer
  set GradeSet to Yes
  
```

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Grading Again

- Answer: we used a variable and set it appropriately only once the score was entered - then we used a repeat until loop which kept going as long as the variable didn't have the special value yet

```

repeat until GradeSet = Yes
  
```

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Grading Again

- Answer: we used a variable and set it appropriately only once the score was entered - then we used a repeat until loop which kept going as long as the variable didn't have the special value yet

```

repeat until GradeSet = Yes
  switch to costume Unknown3
  wait 2 secs
  switch to costume Unknown2
  wait 2 secs
  
```

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Grading Again

- Little script used to keep changing grade until score was entered:

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Grading Again

- Little script used to keep changing grade until score was entered:

```

when clicked
  set GradeSet to No
  repeat until GradeSet = Yes
    switch to costume Unknown3
    wait 2 secs
    switch to costume Unknown2
    wait 2 secs
  stop script
  
```

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Grading Again

- Little script used to keep changing grade until score was entered:

```

when clicked
  set GradeSet to No
  repeat until GradeSet = Yes
    switch to costume Unknown3
    wait 2 secs
    switch to costume Unknown2
    wait 2 secs
  stop script
  
```

Nice use of a repeat until loop

Grading Again

- Little script used to keep changing grade until score was entered:

```

when clicked
  set GradeSet to No
  repeat until GradeSet = Yes
    switch to costume Unknown3
    wait 2 secs
    switch to costume Unknown2
    wait 2 secs
  stop script
  
```

There is a tiny flaw that I will leave it to the dedicated experimenter to discover....

Availability of Slides

Go to

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