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Scratch Programming
Lesson 5A: Loops

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?

Repeating Actions

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

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

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

Continually Change Costume

- Show first costume, then second
- Do this forever
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
Repeat Until

Keep repeating loop as long as the condition is FALSE
Stop loop when condition is TRUE

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

Repeat Until Example

Keep repeating loop as long as the condition is FALSE
Stop loop when condition is TRUE
Problem

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

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.)

Overall Approach

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

Overall Approach

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

Variables

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

Start

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

Variables

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

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

Handle one person

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

Handle one person

We do not have to, but let’s welcome them:

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

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
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):

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

Handle one person

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

Keep letting people on

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

Complete Code

```
repeat until TotalWeight > MaxWeight
  say Hi there! Come in. Watch your step. For 2 secs
  ask How much do you weigh? and wait
  change TotalWeight by answer
  say Join TotalWeight currently at: join TotalWeight 0.044lbs. For 2 secs
end
```

Dem. Elevator 1

```
when clicked
  ask What is elevator's weight limit and wait
  ask Maximum: the answer
  change MaxWeight to answer
repeat until TotalWeight > MaxWeight
  say Hi there! Come in. Watch your step. For 2 secs
  ask How much do you weigh? and wait
  change TotalWeight by answer
  say Join TotalWeight currently at: join TotalWeight 0.044lbs. For 2 secs
end
say You can't get on. For 2 secs
stop all
```

A Little Multimedia

- Bellhop Sprite

- Stage Sounds
A Little Multimedia

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

A Little Multimedia

- Stage Sounds
- Stage Costumes

A Little Multimedia

- Stage Sounds
- Stage Costumes

Stage Scripts

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

Stage Scripts

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

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

```
say No one else can get on. for 2 secs
broadcast CloseDoors
stop all
```

Complete Multimedia Code

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

A Little More Multimedia

- Some costumes:
A Little More Multimedia

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

Useful statement:

- Next background

A Little More Multimedia

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

Useful statement:

- Next background

A Little More Multimedia

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

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

  ![Bellhop script](image1.jpg)

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

  ![Broadcast message](image2.jpg)

Small Issue

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

  ![Costumes](image3.jpg)

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

  ![Additional costumes](image4.jpg)

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?

  ![Redesigned code](image5.jpg)

- In other words, use an boolean condition in the loop.
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.

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.

New variable

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.

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 for loop to continue.
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 a boolean condition in the loop.

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

Small Issue

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

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

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.
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

New Version of Script

Let all people on
New Version of Script

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

Let all people on

New Version of Script

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

Let all people on

New Version of Script

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

Let all people on

Interesting Twist

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

Demo: Elevator

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
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

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

We can not know which beforehand

This is useful for computer games or simulations
New Operation

- Pick Random operator examples:

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

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

New Operation

- Pick Random operator examples:

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

Elevator Simulation

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

Simulation Script

```
let PersonsWeight to pick random 65 to 250
```

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

Simulation Script

```
let PersonsWeight to pick random 65 to 250
```
Simulation Script

Let all people on
The only change - set person's weight randomly rather than asking for it

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?

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
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.

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Grading Again

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

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

  Nice use of a repeat until loop

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

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