How can computation... help visualize data?

For data to solve problems, what do we need to do?

- Capture
  - Collect or obtain

- Store
  - Where? what if it gets lost?

- Share
  - Who should have access? Anonymize for privacy

- Organize
  - Sort it? put in categories?

- Process it
  - Search through it, analyze it, mine it for correlations

- Visualize it
  - What is useful for humans to look at?

Use results to inform our decision

Data Visualization

TED talk (Technology, Entertainment, Design)

"Demo: Stunning data visualization in the AlloSphere"

- See, hear and interpret scientific data
- Dive into the brain, feel electron spin, hear the music of the elements
- 6 minutes

http://www.ted.com/talks/joann_kuchera_marin_tours_the_allosphere.html

Data Visualization

TED talk

Hans Rosling: "Let my dataset change your mindset"

- Visualizing time-series data sets can give new insights
- Data-bubble software bursts myths about the developing world (health, wealth)
- 20 minutes

http://www.ted.com/talks/hans_rosling_at_state.html#
Data Visualization

Steps towards Visualization in Scratch

What is result of running Scripts?

How to draw a function?

Forever

• Goto random location on grid
• Stamp random shade of blue
• Random size within space

Forever

• Goto random location on grid
• Random size within space
• Stamp random shade of blue

Use pen and go to all (X,Y) coordinates such that Y = absolute (X)

Y = absolute (X)

Initialize X, Y (-240, 240)
Put pen down
Repeat until X = 240
• Set Y to abs (X)
• Goto X,Y
• Change X by 1
How to draw a function?

What if don't set Y in repeat loop?
What if change from abs to mod?
What if don't set Y in repeat loop?
How to make function draw faster?

What if want to plot non-mathematical data set?

Have data set you care about
- Example: population in some small village over time
- Data for every year for 100 years
- One value for each year (100 data points)

How can we store this in Scratch?

Lists

Lists are common data structure
- List of items to buy at grocery store
- List of high scores for game
- List of student names in class
- List of account balances at bank
- List of cities in Wisconsin

Name the List as a whole
- Index into List to access individual items, elements

Lists in Scratch: How to Create?
Example List in Scratch

- Name: Valuable Numbers
- List of N elements: Element1, Element2, ..., ElementN
- N=100 for Valuable Numbers
  - What value is at element 1?
  - element 10?
  - At what location (or element or index) is value 73?

Lists: How to Look at Contents?

- Click the checkbox (next to the block) to show the monitor on the stage.
- For individual items, use this block.

Lists: How to Change the Contents?

- Use this block if you want to add an item to the end of a list.
  - Make a list
  - Add name to my list
  - Add name to my list
  - Say all of my list for 3 secs
- Say one of the items in the list
- Can’t find the list block? You need to first make a list.
  - Make a list

When the lamp sprite is clicked insert the item "laptop" at the first place in the list.

You can indicate where in the list you want to add an item.
- Insert index at of my list inserts item at the specified place in the list
- Insert index at of my list inserts item at a random place in the list

Lists: How to Change the Contents?
**Lists: How to Change the Contents?**

Replace item 2 of list with item 1 replaces item 1 in the list with the current score.

Before: scoreboard

1
2

After: scoreboard

1
2

You can choose where in the list to put an item. For example:
- Replace item 2 of list with item 1 replaces item 2 in the list.
- Replace item last of list with item 1 replaces last item in the list.

**Lists: How to Remove Items?**

Delete item 2 of list says the first item from the list.

Before: supplies

1. water
2. piece of fruit
3. biscuits

After: supplies

1. piece of fruit
2. biscuits

You can specify the number of the item you want to delete. For example:
- Delete item 2 of list deletes item 2 from the list.
- To delete the last item in the list, choose "last" from the pull-down menu:
  - Delete last of list deletes last item in the list.
- You can also choose to delete everything in the list:
  - Delete all of list deletes all items in the list.

**Lists: How to Look at the Contents?**

Say item 2 of list for 2 seconds says one of the items from a list of phrases.

If the current score is greater than item 1 on a top score list:
- Play sound for 1.

The item block reports the value of the item at the specified place on a list.
- Item block reports the value of the item at the specified place on a list.
- You can fit an item block into other blocks, for example:
  - Say, switch to costume, play sound, or broadcast.
Lists:
How to Look at the Contents?

- set the counter value to 1
- repeat for the number of items in the list
- say this item at that place in the list
- increase the counter by 1

This block reports how many items are currently in a list.

- The number is the same as the length shown at the bottom of the list monitor.

How to Make List with 100 Random Numbers?

New script: Create Valuable Numbers
- Puts result in List: Valuable Numbers
  - Contains 100 elements
  - Each element: Integer between 1 and 1000

Lists:
How to Delete Entire List?

Note: When a list is deleted, any of its blocks used in scripts will remain, but the scripts will not function properly.

Lists:
How to plot contents of List?

- Same approach as drawing function for y
- Just grab next value of y from list instead
Check-Up

How many items can you put in a list?

How do you find the number of items in a list?

What is the difference:

For the given list, what would this code do?

Today’s Summary

Today’s topic
- Visualizing data can help everyone better understand the world we live in

“Reading”
- TED talks linked on Course Schedule page

Announcements
- Exam 1 graded, returned
- Homework 5 available – compose music w/ lists, visualization