Parallel Programming with Pictures

Wu FENG
Virginia Tech

Let's Code Blacksburg
August 7, 2017

Find the Highest Temperature
from Around the World

First Try …   SERIAL
- Correct answer?
- How fast?

Second Try …
- Correct answer?   PARALLEL
- How fast?

Schedule

- Wu Feng (Hour 1)
  - Module 1: Creating a Serial Program

- Annette Feng (Hour 2)
  - Module 2: Creating a Parallel Program

- Spencer Martin (Hour 3)
  - Module 3: Applying Parallelism to Gaming → Missile Command

Module 1: Creating a Serial Program
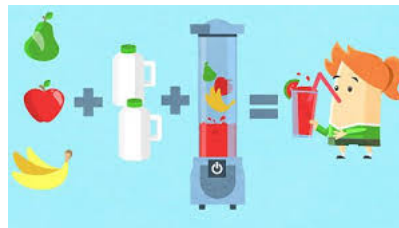
Wu FENG

What is a Program?

A program is an algorithm that runs on a computer.

What is an Algorithm?

An algorithm is a set of instructions that explains step by step how to do a task or solve a problem.

It's like a recipe:

Algorithm: PEMDAS

1. Parentheses
2. Exponents
3. Multiplication & Division
4. Addition & Subtraction

Solve:

$$4 + 5(3 - 1)^2$$
$$4 + 5(2)^2$$
$$4 + 5 \bullet 4$$
$$4 + 20$$
$$\boxed{24}$$

Algorithm: Find Maximum Number in a List
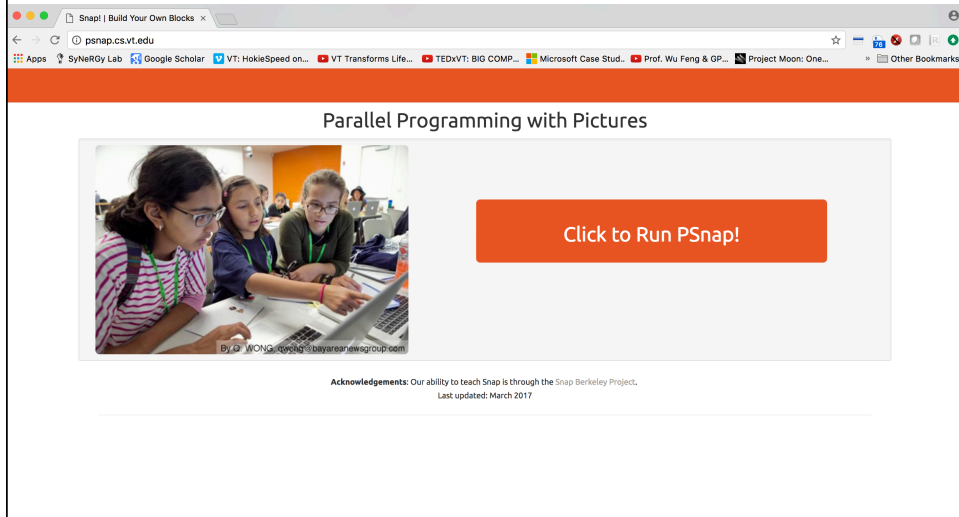
English / Pseudocode:

1. Set *max* to 0
2. For each number *x* in List
3. Compare *x* to *max*
4. If *x > max*,
5.   Set *max* to *x*
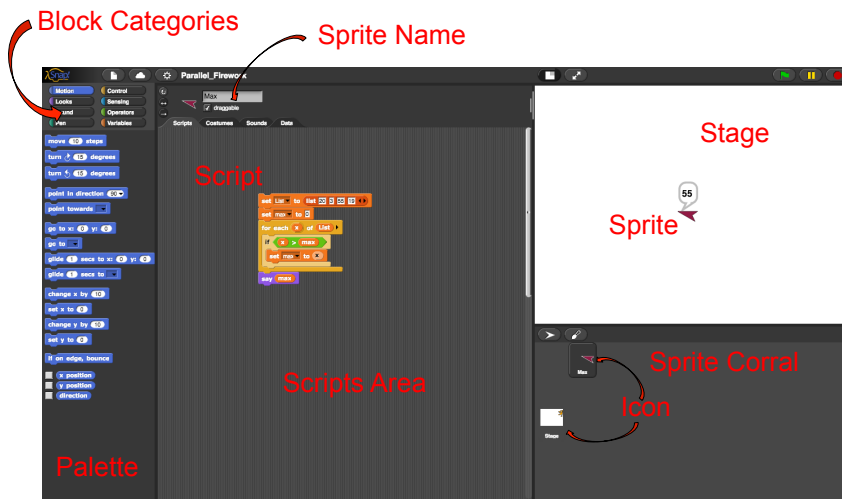6. Output *max*

JavaScript:

```
function find_max(List) {
  var max = 0;

  List.forEach(function(x) {
    if (x > max) max = x;
  });

  return max;
};
```

Parallel Snap! Programming Environment

Type http://psnap.cs.vt.edu/ into your browser.
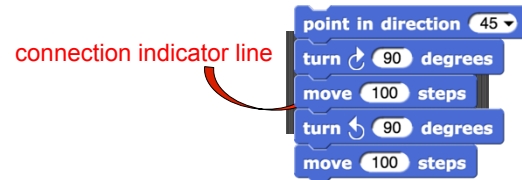

Introducing the *Parallel Snap!* Environment

Moving Sprites

- If you "lose" your sprite off the stage
  - Execute a "**go to 0, 0**" block `go to x: 0 y: 0` to bring it to center stage
  - Right-click sprite icon in sprite corral and select "show"
- Drag a *turn* block `turn ↻ 15 degrees` into your scripts area and click on it.
- Change the input numbers in the *move* and *turn* blocks; try negative numbers
- Can also *point in a direction* using "**point in direction**" block.
  - Pre-selected directions are in the pull-down menu `point in direction 90 ▼`
  - Can also type a number in the input
- To delete blocks:
  - Drag a block back to the palette and release it
  - Right-click a block and select "delete"
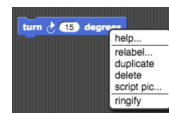
Moving Sprites: Introduction to Animation

Connect a sequence of moves and turns into a longer script to make your sprite move around the stage

connection indicator line

point in direction 45 ▾
turn ↻ 90 degrees
move 100 steps
turn ↺ 90 degrees
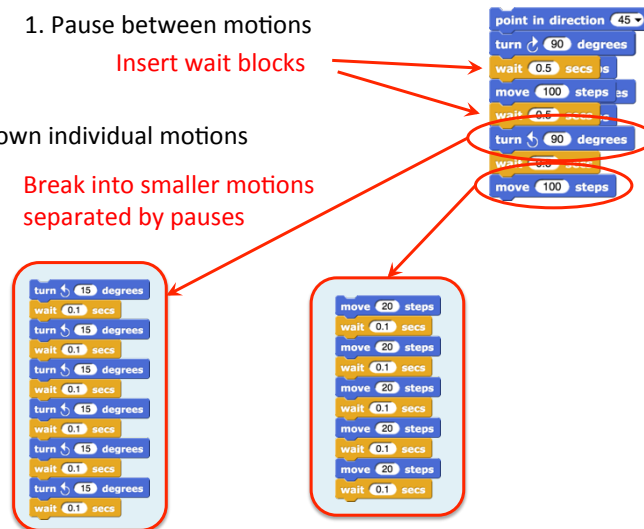move 100 steps

What happens when you run your script?

Controlling Animation

1. Pause between motions
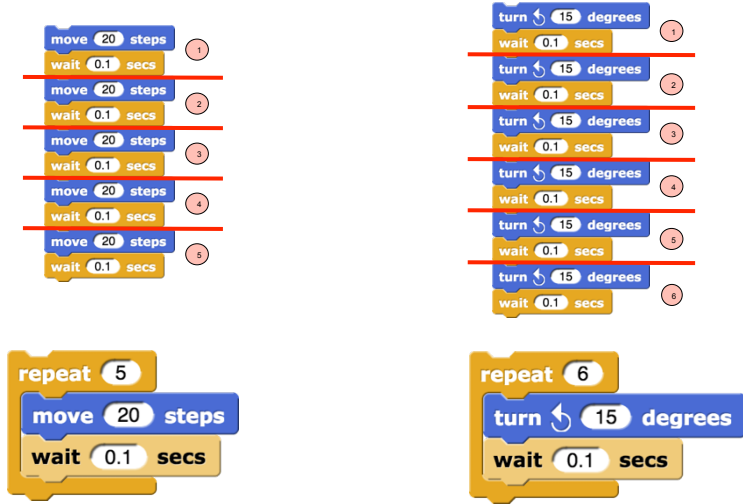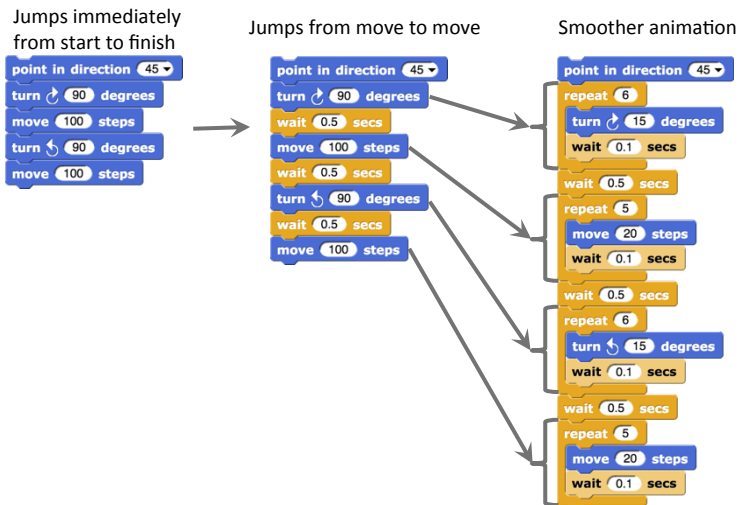
Insert wait blocks

2. Slow down individual motions

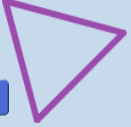Break into smaller motions separated by pauses

point in direction 45 ▾
turn ↻ 90 degrees
wait 0.5 secs
move 100 steps
wait 0.5
turn ↺ 90 degrees
wait
move 100 steps

turn ↺ 15 degrees
wait 0.1 secs
turn ↺ 15 degrees
wait 0.1 secs
turn ↺ 15 degrees
wait 0.1 secs
turn ↺ 15 degrees
wait 0.1 secs
turn ↺ 15 degrees
wait 0.1 secs
turn ↺ 15 degrees
wait 0.1 secs

move 20 steps
wait 0.1 secs
move 20 steps
wait 0.1 secs
move 20 steps
wait 0.1 secs
move 20 steps
wait 0.1 secs
move 20 steps
wait 0.1 secs

Loops

Animation Summary

Jumps immediately from start to finish

Jumps from move to move

Smoother animation

Drawing with Sprites
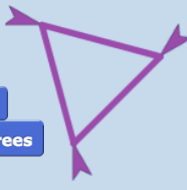
`pen down`   `pen up`   `set pen size to 1`

`set pen color to ■`   `clear`

What does this block do?   `stamp`

```
pen down
repeat 3
  move 100 steps
  turn ↻ 120 degrees
pen up
```
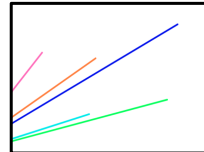
```
pen down
repeat 3
  stamp
  move 100 steps
  turn ↻ 120 degrees
pen up
```
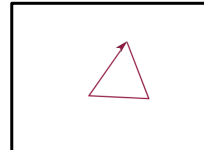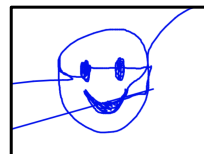
Following the Mouse

`go to mouse-pointer ▾`

`wait 3 secs`
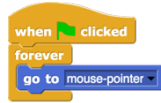`go to mouse-pointer ▾`
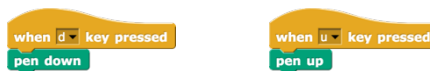
`forever`
`go to mouse-pointer ▾`

Hat Blocks

Start scripts with the start button:

Turn the pen on and off with key presses:

Program an erase button:

Exercises

- Whiteboard extensions …
  - Change pen color using key presses
  - Change pen size using key presses
- Scripts to draw stuff
  - Pentagons, hexagons, octagons, or even write your initials
  - A house
- Game: Stay on the stage
  - Program sprite to move forward continuously at a certain speed (slow, medium, fast)
  - Use the left and right arrow keys to keep the sprite from leaving the stage
  - Program ends if the sprite touches the edge of the stage