Coding 101:
Programming with Pictures

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Women in Computing Day 2021

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Importance of Computer Science

- How many computers does your family own?
  - More than you might think! Would you believe 60+?

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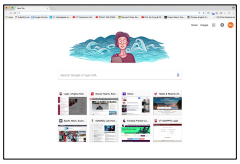
Importance of Computer Science

- What does computer science enable?
  - Solve important problems

  - Connect with people, e.g., at work or at play

  - Collect and communicate information



  - Entertainment

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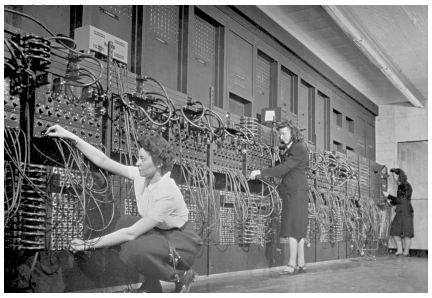
PEOPLE | *A woman programmer from the 1960s (judging by the hairdo) holds a plugboard control panel for IBM accounting machines. Photo via barrs44/Flickr (CC BY 2.0)*

The Computer Girls: 1967 Cosmo article highlights women in technology



Women computer operators program ENIAC, the first electronic digital computer, by plugging and unplugging cables and adjusting switches.

Programming was once considered to be "women's work".

The Computer Girls BY LOIS MANDEL

A trainee gets $8,000 a year ...a girl "senior systems analyst" gets $20,000—and up! Maybe it's time to investigate....

Ann Richardson, IBM systems engineer, designs a bridge via computer. Above (left) she checks her facts with fellow systems engineer, Marvin V. Fuchs. Right, she feeds facts into the computer. Below, Ann demonstrates on a viewing screen how her facts designed the bridge, and makes changes with a "light pen."

Twenty years ago, a girl could be a secretary, a school teacher . . . maybe a librarian, a social worker or a nurse. If she was really ambitious, she could go into the professions and compete with men . . . usually working harder and longer to earn less pay for the same job.

Now have come the big, dazzling computers—and a whole new kind of work for women: programming. Telling the miracle machines what to do and how to do it. Anything from predicting the weather to sending out billing notices from the local department store.

And if it doesn't sound like woman's work—well, it just is.

("I had this idea I'd be standing at a big machine and pressing buttons all day long," says a girl who programs for a Los Angeles bank. I couldn't have been further off the track. I figure out how the computer can solve a problem, and then instruct the machine to do it."

"It's just like planning a dinner," explains Dr. Grace Hopper, now a staff scientist in systems programming for Univac. (She helped develop the first electronic digital computer, the Eniac, in 1946.) "You have to plan ahead and schedule everything so it's ready when you need it. Programming requires patience and the ability to handle detail. Women are 'naturals' at computer programming."

What she's talking about is *aptitude*—the one most important quality a girl needs to become a programmer. She also needs a keen, logical mind. And if that zeroes out the old Billie Burke-Gracie Allen image of femininity, it's about time, because this is the age of the Computer Girls. There are twenty thousand of them in the United *(cont. on page 54)*

52 *Photos by Henry Grossman; Dress by Gino Charles*

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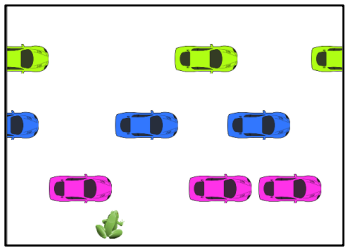
What You Will Learn

- What is a program?
- What is an algorithm?
- Introduction to visual programming in Psnap!
- How to build Frogger



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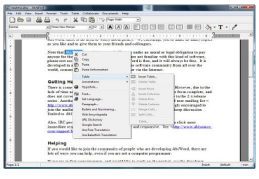
What is a Program?

A program is an algorithm that runs on a computer.



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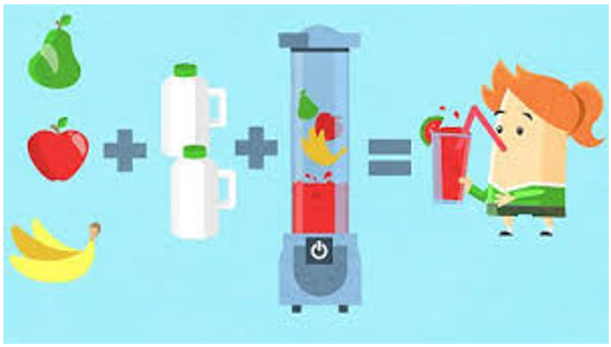
What is an Algorithm?

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:



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Algorithm: PEMDAS

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

Solve:

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

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What is Psnap?

- Visual Programming Environment
- Blocks-based programming language
- Based on Scratch
- Like Scratch, it lets you easily build games, like Frogger

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Navigate to: psnap.cs.vt.edu

Parallel Programming with Pictures

Click to Run PSnap!

Click on the following link to download the 2021 module for programming in pSnap!

2021 Women in Computing Day: Coding 101

Access to older modules:

Older Modules

Acknowledgements:

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Teaching Parallel Programming with Pictures was facilitated by a parallel version of Snap! called pSnap!, which, in turn, is based on the Snap Berkeley Project.

Last updated: March 2018

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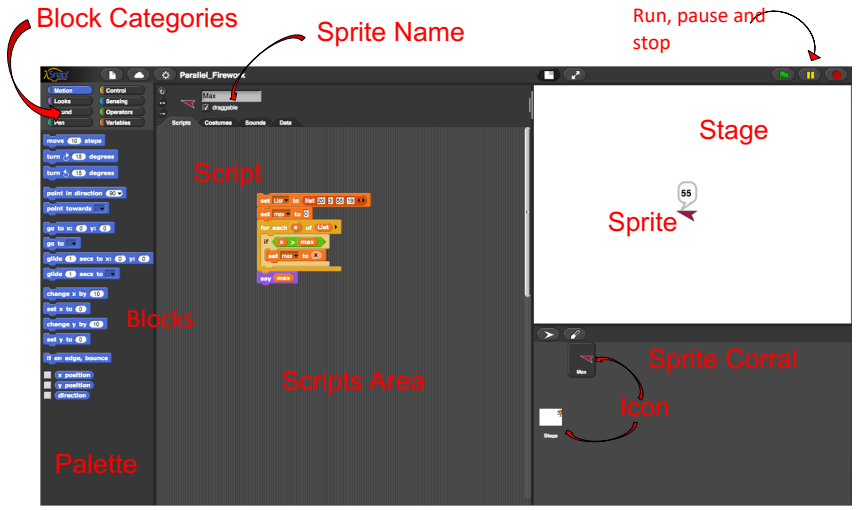
Introducing the PSnap! Environment



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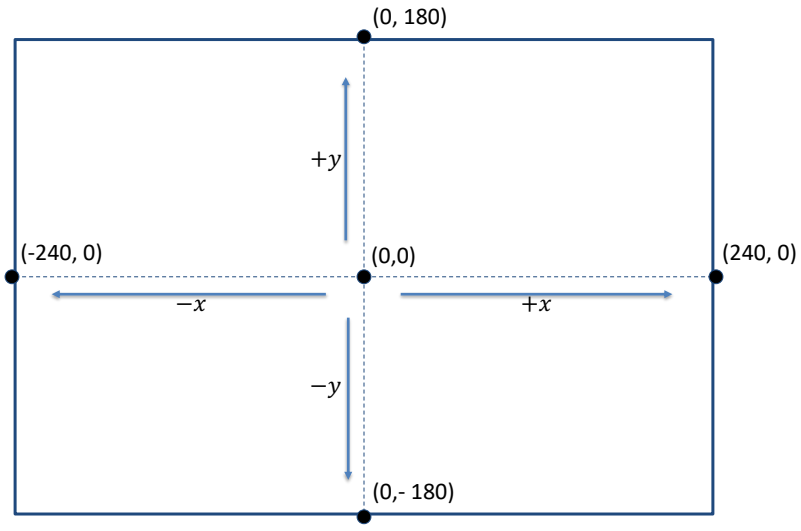
The Stage



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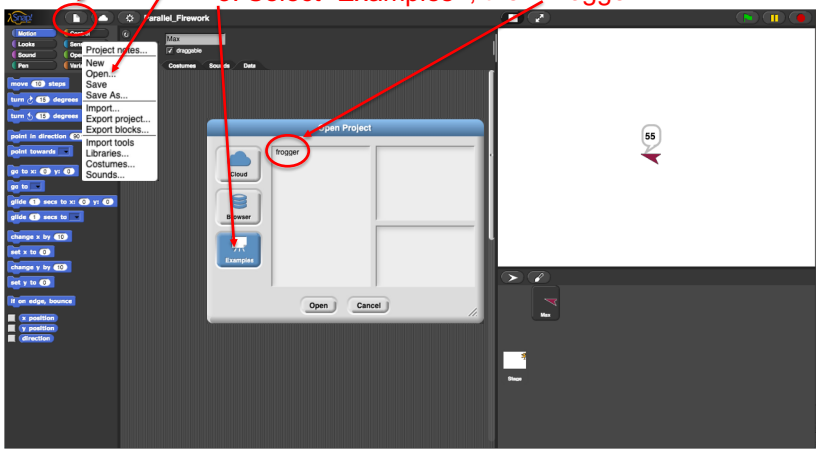
Open The Frogger Example

1. Click on the File Menu
2. Click “Open…”
3. Select “Examples” , then “frogger”



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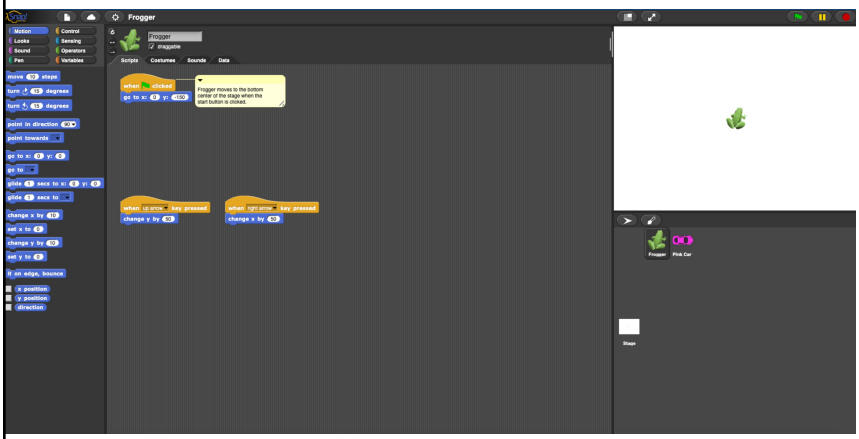
Initial Frogger Window



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First Things You Can Do

- Click and drag frogger around on the stage
- Press Start (Green Flag) Button
- Press Up Arrow
- Keep Pressing Up Arrow
- Press Down Arrow?
  - Doesn't work (yet)!
- Retrieve frogger by pressing start button
  - Also, by right-clicking on the frogger icon and selecting "show" from the menu

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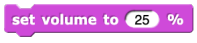
The Block Rainbow

Blocks are color-coded according to the kinds of things they are meant to handle.

For example:

Blue – Motion

Pink – Sound



Yellow - Control

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Control of the Yellow Hats

To access the control blocks, click on the yellow "Control" button just above the blocks palette.

These first five blocks have a curved shape on top.

This top curve makes them special because no other block can attach on top of them. These blocks are called "Hat Blocks" because they can only appear at the top of a script, like a hat.

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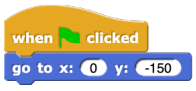
Control: Starting Scripts

Drag Frogger to a corner of the stage.

Click the Start (Green Flag) Button. 

Because Frogger has a script starting with 

that script runs when the start button is clicked.

Look at the script. 

What does it do?

It puts Frogger in his starting position at the bottom center of the stage.

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Control: Moving Frogger

With Frogger in his starting position, press Up Arrow.

This moves Frogger because of the script starting with 

Because Frogger has a script starting with 

Frogger can also move to the right.

Finish Frogger's movements by adding scripts for the left and down arrow keys.

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More Control: Adding Scripts

From the Control palette, drag and drop two 

blocks onto the scripts area.

Click on each input slot where the word "space" is.

Select "left arrow" for one, and "down arrow" for the other.

Switch the palette to the Motion Blocks.

Drag 

and 

into the scripts area

To attach a block to another, drag it close to the bottom edge of the block until a thick white line appears between the blocks, then let go.

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Final Control: Fully Mobile Frogger

Click on each input number slot and change each 10 to a -50.

When you're finished, you should have scripts that look like these:

Test out your Froggers!

If you've mixed up the change x by 10 and change y by 10 blocks, simply change the selection on the hat blocks to match the direction!

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What's Next?

- Frogger isn't a game until he has a car to dodge!
- In the Sprite Corral, you probably noticed the pink car…
- Click on it.
- The scripts area switches from Frogger's scripts to the car's scripts.
- The car has a when clicked too, but why can't we see the pink car on the stage?
- We can't see the pink car because we want it to start out of sight off the left side of the stage.
- Notice the glide 8 secs to x: 0 y: 0 block below the start script.
- Attach it to the start script and press the start button.
- Change the glide time and see how that affects the animation.

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Going Loopy Part 1

- The car only moves across the stage once and then stops.
- We want the car to keep circling back to the beginning and going across the stage repeatedly.
- How do we do that?
- When you want to repeat something, you need loops.
- Switch over the to Control Blocks and see if there's something that would let us repeat instructions.
- Drag 

into your scripts area.
- This block has a number input slot at the top and a C-shaped input area where we can drop other blocks into.
- Change the 10 to a 5.

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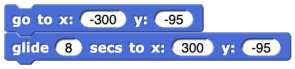
Going Loopy Part 2

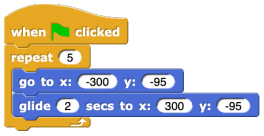
- Detach 

from 

by grabbing onto 

.
- Drop these two blocks into the C-shaped area of 

- Change the glide time to 2.
- Attach this script to the start block to get the following script:



- Test your script

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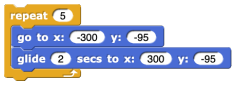
Going Loopy Forever

- Detach 

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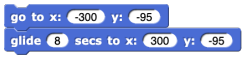
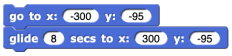
- Remove 

from 

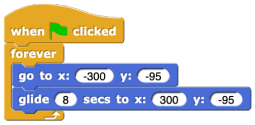
- Discard 

by dragging and dropping it back onto the palette
- Drag and drop 

into the scripts area
- Add 

inside it
- Attach the new loop to 

to get the following:



- Test your script

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Stopping The Game Part 1

- The game should end whenever the car and Frogger touch
- We can add a sensor script to Frogger to detect whenever Frogger runs into the car.
- Is there a category of blocks that can help us?
- Yes! “Sensing”!
- First click on Frogger in the Sprite Corral.
- Next, click on the Sensing category button.
- Add the first block 

to your scripts area.
- This block has a hexagonal shape which means that it asks a yes-or-no question.
- Click on its menu and select “Pink Car 1”.

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Stopping The Game Part 2

- The sensor block can't do anything on its own.
- It needs a controller.
- Click on the Control category button.
- What is it that we're asking our script to do, in English?
- "If Frogger is touching the car, stop the program."
- Which block could help us to get the computer to do that?
- The mighty 

!
- Notice the input slot is shaped just like 

.
- Insert the sensor block into the if block input slot, then look over the control blocks once more.
- What will enable us to stop our program?
- Drag and drop 

inside the if block.

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Stopping The Game Finale

- We need to "turn on" the sensor by attaching it to a hat block.
- We can give it its own 

.
- This new script should look like this:

- Test it by starting the program and getting the car to hit Frogger.
- Did it work?

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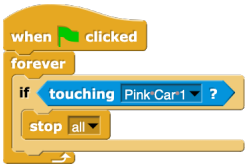
Stopping The Game Finale Part 2

- When we start the game the sensor only runs once then quits.
- We want it to run forever, as long as the game is running.
- We've seen this before! 

- Add this to your script to get the following script:



- Test.

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Frogger Exercises

- Add more cars.
  - different rows: change the Y-coordinate
  - same rows: delay starting each car by different times
- Make Frogger appear to jump by using costume changes.
- Change the background by editing the stage costume.
- Keep score (add points as you successfully jump higher).
- Add more lives.
- Change the stage to show "Game Over" or "You Win!".
- A full version of the game will later be found under
  - File --> Open… --> Examples --> full_frogger.xml

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APPENDIX

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Duplicating Sprites

1. Right Click on the Sprite Icon
2. Select **duplicate**

Duplicating a sprite copies all existing scripts (and costumes) to the new sprite.

Subsequent changes to the original sprite do NOT get copied to the new sprite.

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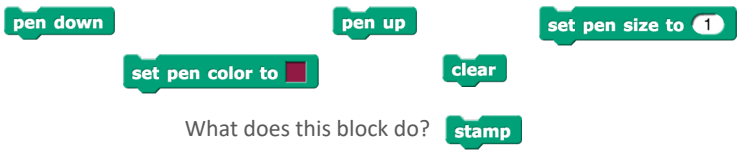
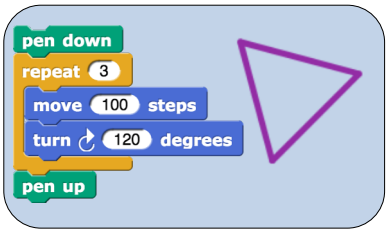
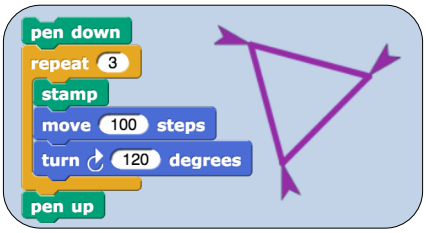
Drawing with Sprites







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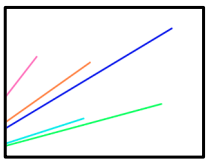
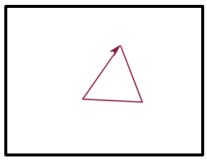
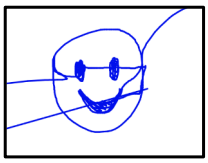
Following the Mouse







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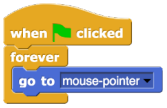
Hat Blocks

Start scripts with the start button:



Turn the pen on and off with key presses:

Program an erase button:

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Exercises

- Whiteboard extensions …
  - Change pen color using key presses
  - Change pen size using key presses
- Scripts to draw stuff → Change title to ...
  - Square, 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

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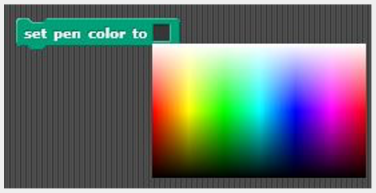
Whiteboard Extension (Solution)

Change pen color using key presses



You can also use

by inputting a different number value

Change pen size using key presses

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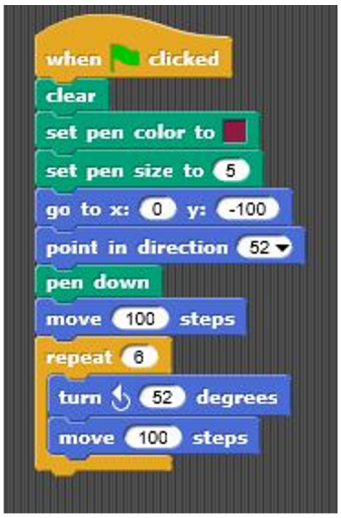
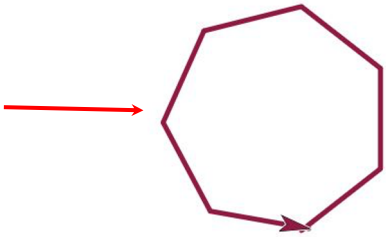
Scripts to Draw





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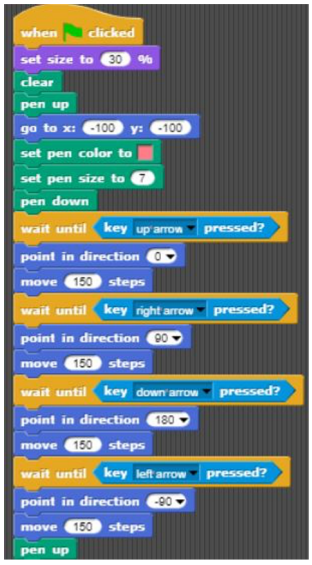
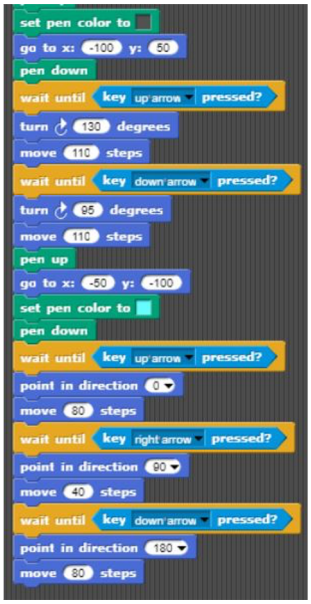
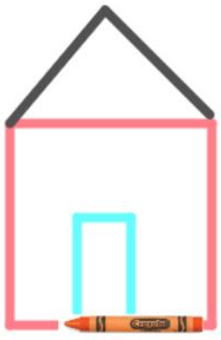
Drawing a House (Solution)







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