Buttons & Boards

CSE 120 Winter 2019

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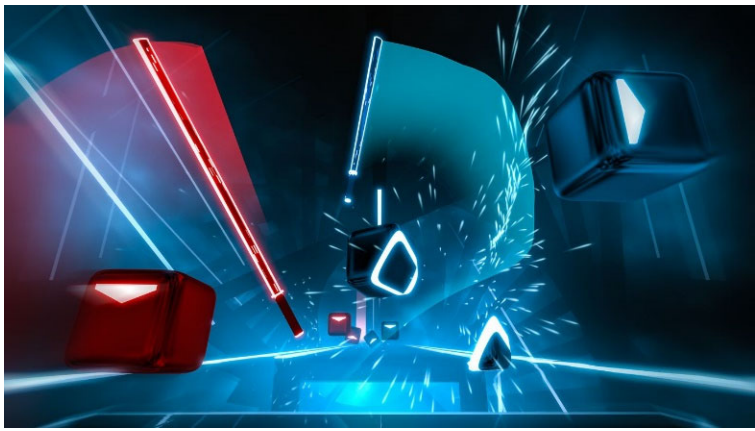
Humans playing VR game Beat Saber move faster than what Steam thought was 'humanly possible'

"Some people move so fast when they play the VR game Beat Saber, a rhythm game that's basically Dance Dance Revolution with lightsabers, that Valve developers have had to issue a fix. People were moving so fast that Steam VR couldn't track their movements.

"[D]evelopers noted that they had to 'Increase limits of what we thought was humanly possible for controller motion.' "

- https://www.theverge.com/platform/amp/2019/2/11/18220993/vr-valve-steam-beat-saber-fast-speeds

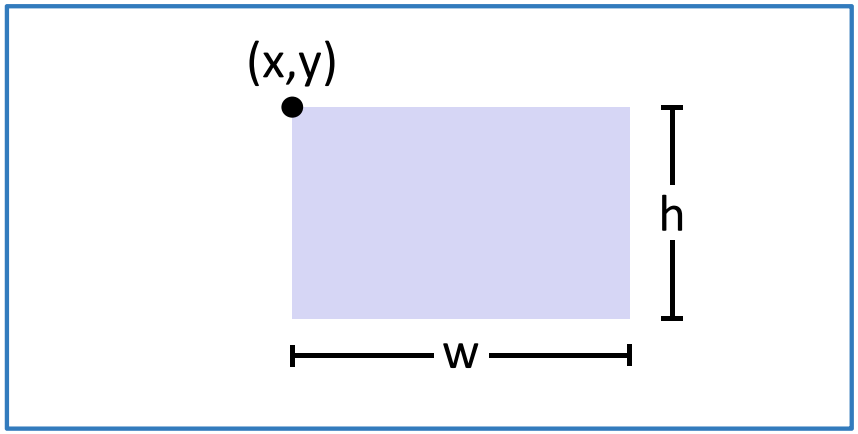


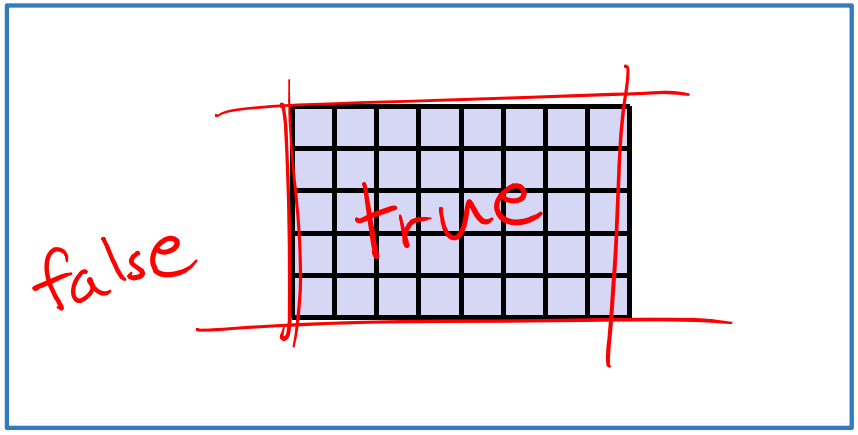
Administrivia

- Assignments:
  - Reading Check 7 due @ 3:30 pm tomorrow (2/21)
  - Controlling Elli [submit] due tomorrow (2/21)
  - Word Guessing [checkoff/submit] due Saturday (2/23)
  - Living Computers Museum Report due Tuesday (2/26)

- "Big Ideas" lecture: CS and Ethics

Review: Rectangle Detection






```
if( (mouseX >= x)     &&
    (mouseX <= x + w) &&
    (mouseY >= y)     &&
    (mouseY <= y + h) )
```

Review: Rectangle Detection

```
if( (mouseX >= x) && (mouseX <= x + w) &&
    (mouseY >= y) && (mouseY <= y + h) ) {
  // do something
}
```

- Potential Uses:
  - To detect on *every frame*, place in **`draw()`** or function called by **`draw()`**
    - *e.g.* hover detection – change color when mouse is over rectangle

see input/output lecture

  - To detect on a mouse click, place in `mousePressed()`

e.g. a button that the user can click on ← today

Circle Detection

- A circle is defined as all points in a 2-D plane that are equidistant from a center point
  - In mathematical terms, the set of all points (x, y) that satisfy:
    $(x - centerX)^2 + (y - centerY)^2 = radius^2$

- To detect the mouse being *inside* the circle, this becomes an inequality
  - $(mouseX - centerX)^2 + (mouseY - centerY)^2 <= radius^2$

- In Processing:

```
if( (mouseX-x)*(mouseX-x)+(mouseY-y)*(mouseY-y) <= r*r ) {
  // do something
}
```

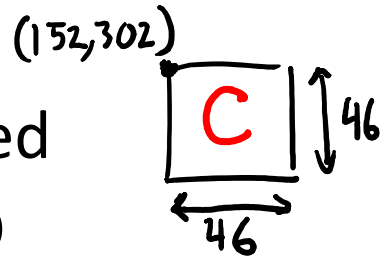
Creating a Button

- The button needs to be *visible* to the user
  - Use `rect()` or `ellipse()` to draw on your canvas

- Generally, the user should know what the button is for
  - Use `text()` to either label the button or put directions somewhere else on screen
    - Often, `textAlign(CENTER)` makes finding appropriate coordinates easier

Button Demo

- Create a "Clear" button for phone or calculator
  - Use a 500 x 500 canvas
  - The button should be of size 46 x 46 and white at position (152, 302)
  - Labeled button with a red "C" text roughly centered
    - Hints: use `textSize(40)` and `textAlign(CENTER)`

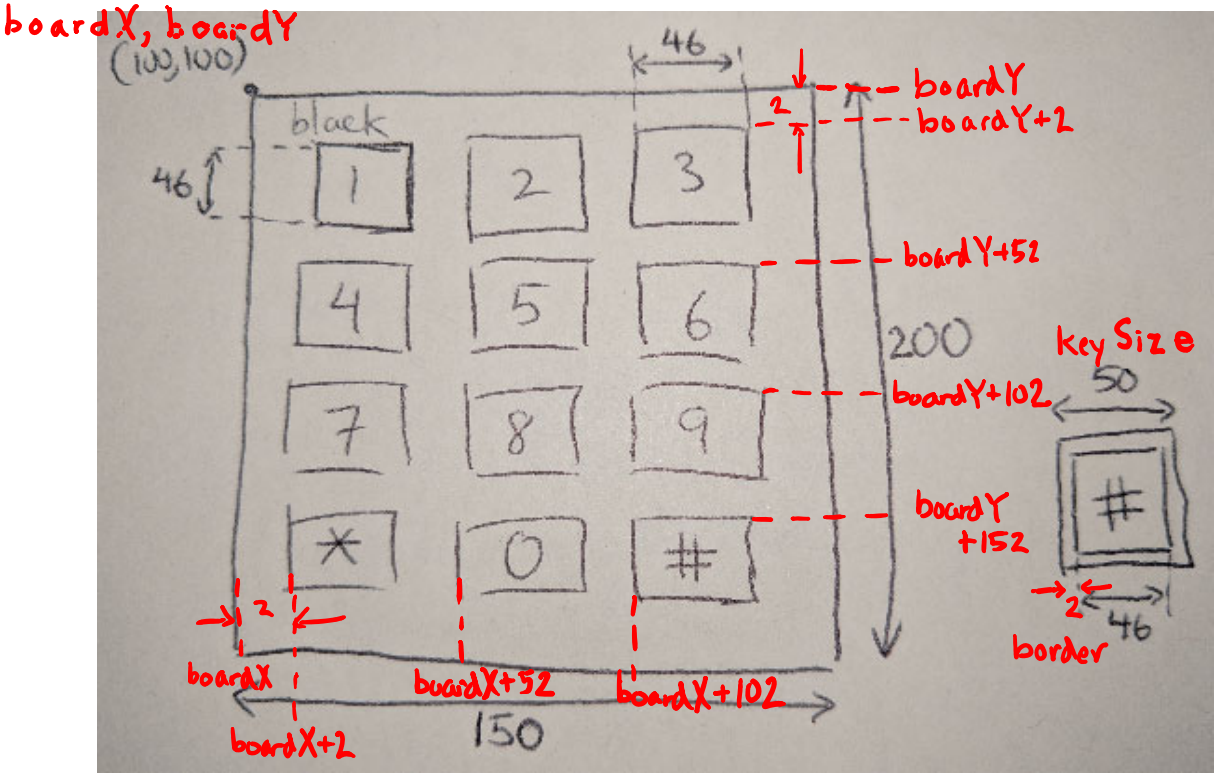


  - When the mouse is hovering over the button, it should turn yellow: `color(255, 255, 98)`
    - Requires Active Mode
  - When the button is clicked, it should print `"Cleared!"` to the console

Grids and Boards

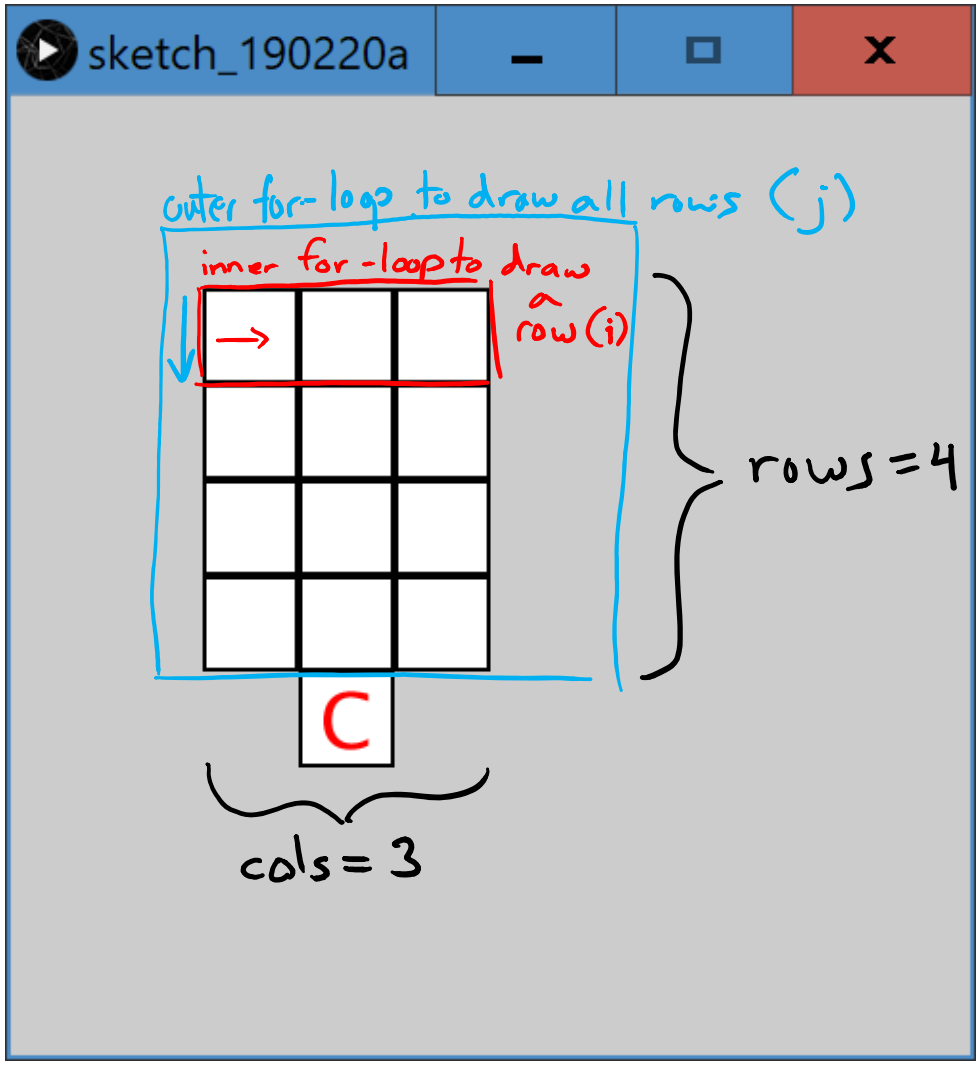
- Grids can be created using nested for-loops

- Example: numeric keypad



Grid Demo

- Grids can be created using nested for-loops



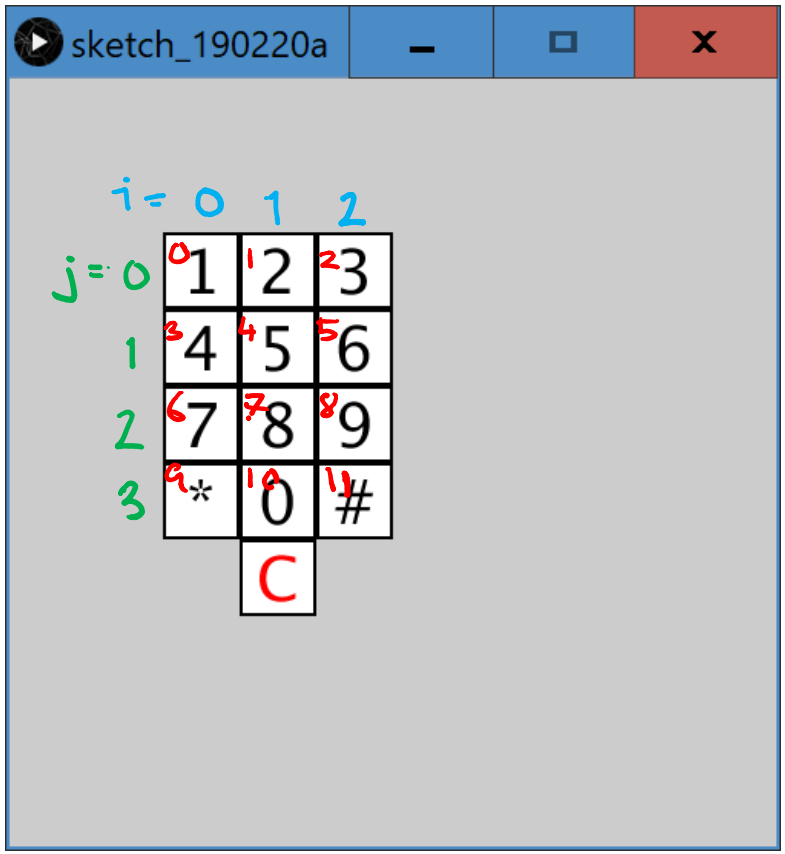
Your Board "State"

- The state of your board indicates its current configuration
  - In some applications, this never changes
    - *e.g.* numeric keypad
  - In other applications, this will change over time
    - *e.g.* tic-tac-toe

- Board state is typically represented via an **array**
  - Naturally ties a numeric location on your grid to the symbol/value currently associated with that cell
  - Similar to `pixels[]` holding the color "state" of your drawing canvas

Labeling Our Grid

- For the numeric keypad, the board state is the set of (ordered) key labels:
  - `char[] keypad = {'1','2','3',…,'*','0','#'};`



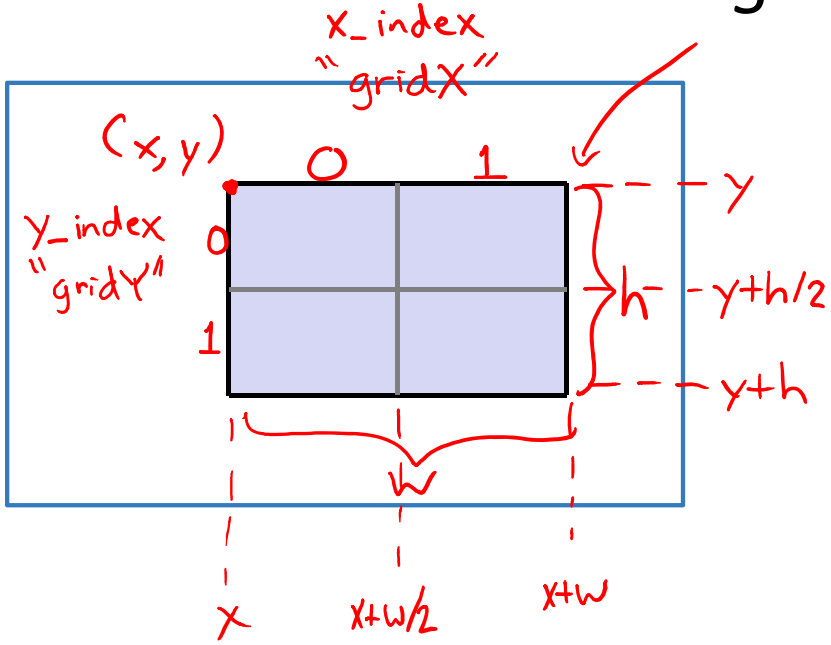
i	j	index
0	0	0
1	0	1
2	0	2
0	1	3
1	1	4
2	1	5
0	2	6
1	2	7
2	2	8
0	3	9
1	3	10
2	3	11

index = i + 3 * j

Grid Detection

distance into grid = mouseX - x
width of grid cell = w/2
float → number of cells into grid = (mouseX-x)/(w/2)
int → round down to get grid position

- Detection of mouse location within a *grid*



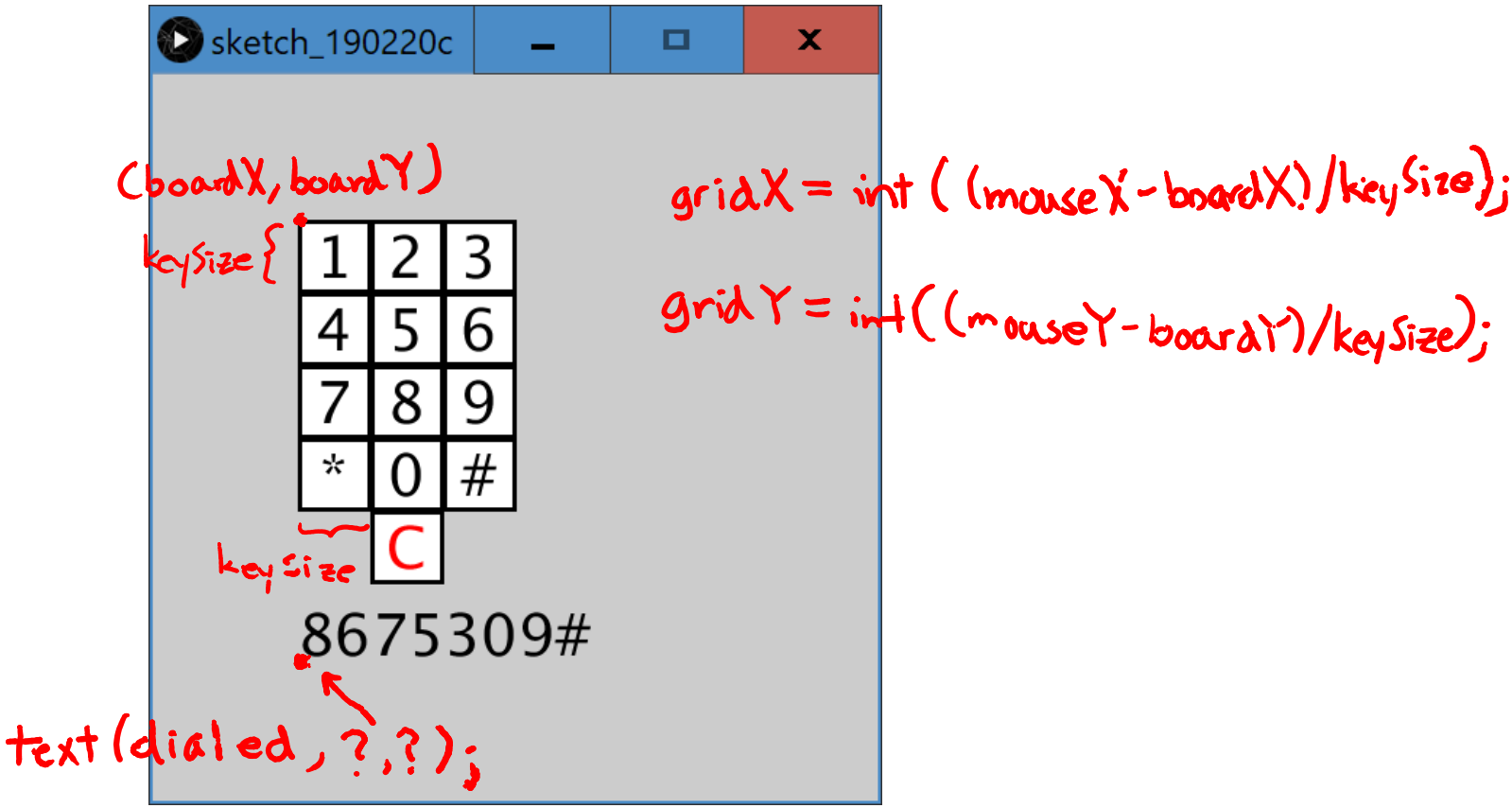

```
int x_index, y_index;
if( (mouseX >= x) && (mouseX <= x+w) &&
    (mouseY >= y) && (mouseY <= y + h) ) {
  x_index = int( (mouseX-x)/(w/2) );
  y_index = int( (mouseY-y)/(h/2) );
}
```

round down to an integer (drop fractional part)

Keypad Grid Click Detection

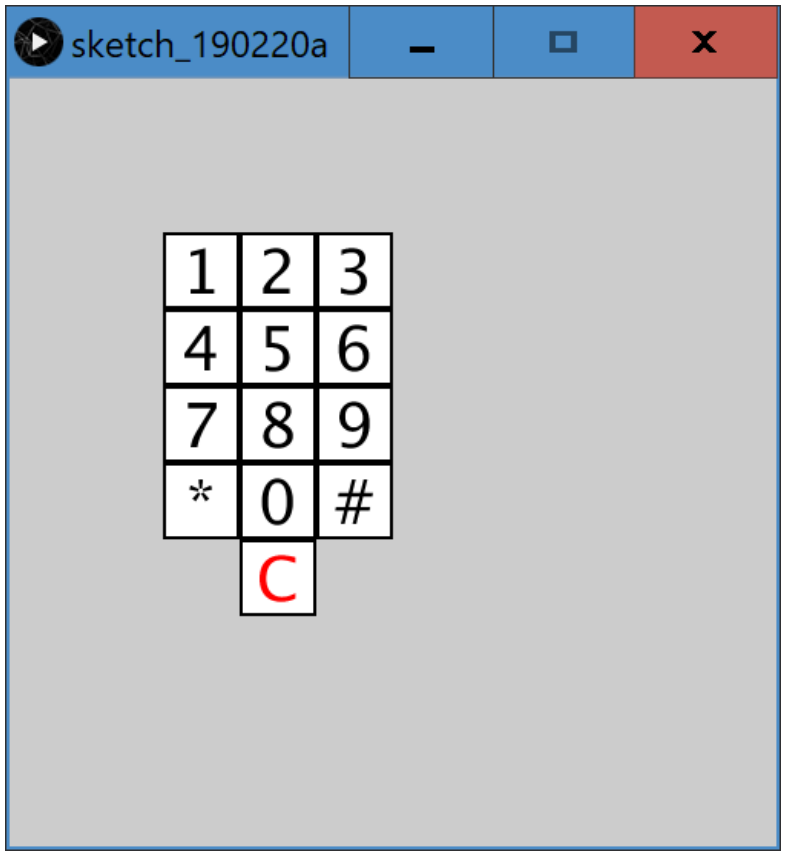
- Clicking on the keypad should add to the phone number you are trying to dial
  - Use a `String` to store and display on the canvas

String dialed = "";



Clear Functionality

- Our phone number should “reset” or “clear” when we click the clear button
  - Currently, it prints `"Cleared!"` to the console



instead, set
dialed = "";

Summary

- Sketched the idea on paper
- Planned out coding representations
- Built on previous work by adding one function or idea at a time
- Ran the program after *every* improvement to make sure that it worked correctly
  - Unit and integration testing!!!