



15-112
Lecture 2

Animations with
Lists

Instructor: Pat Virtue

Tuesday Logistics

Announcements

HW7

- Tetris! Plan ahead



CMU Graphics Installation

- Keep an eye on Piazza updates if you run into issues
- Come find Pat if you bump into issues that pinned Piazza update doesn't address
- Don't stress. You can do ALL the rest of the homework without this installation

Thursday Logistics

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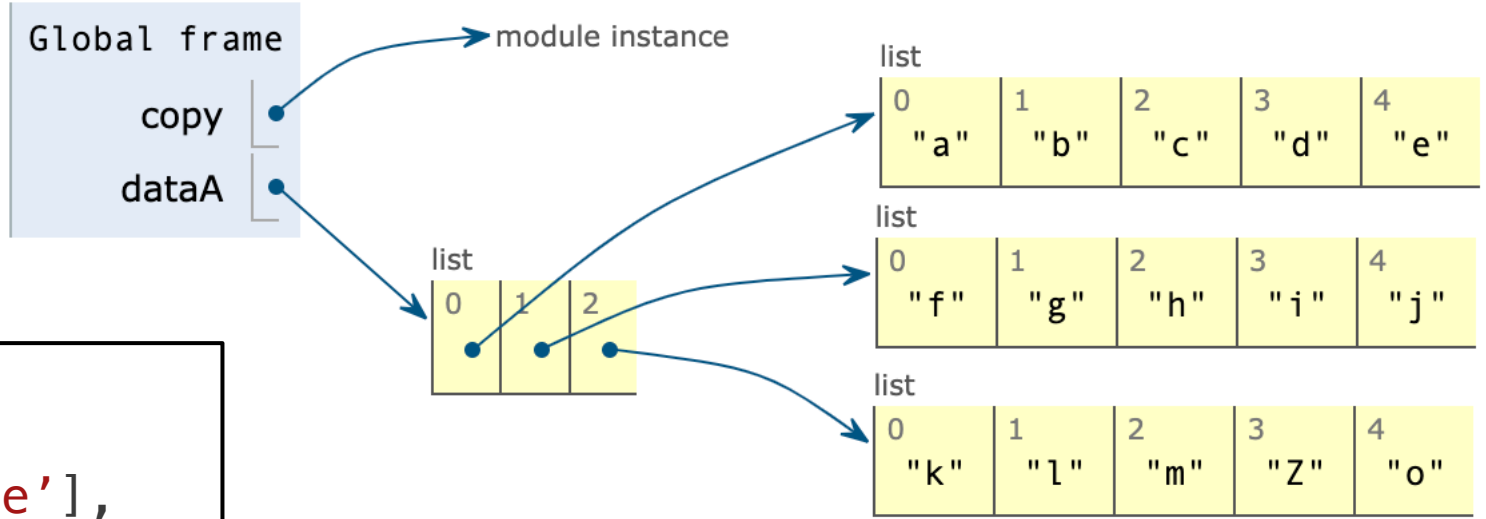
2D Lists

Copy vs Deepcopy

```
import copy

dataA = [ ['a', 'b', 'c', 'd', 'e'],
          ['f', 'g', 'h', 'i', 'j'],
          ['k', 'l', 'm', 'n', 'o'] ]
dataB = copy.copy(dataA)

dataB[2][3] = 'Z'
```

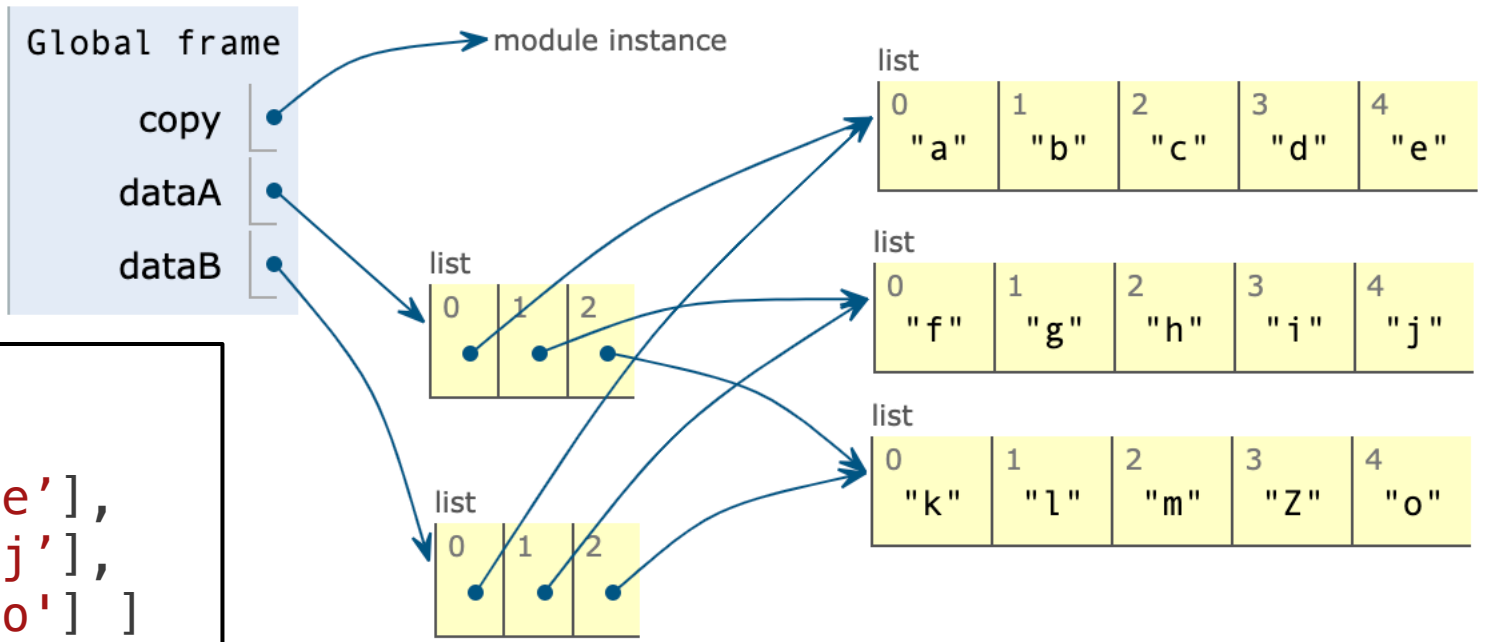


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```

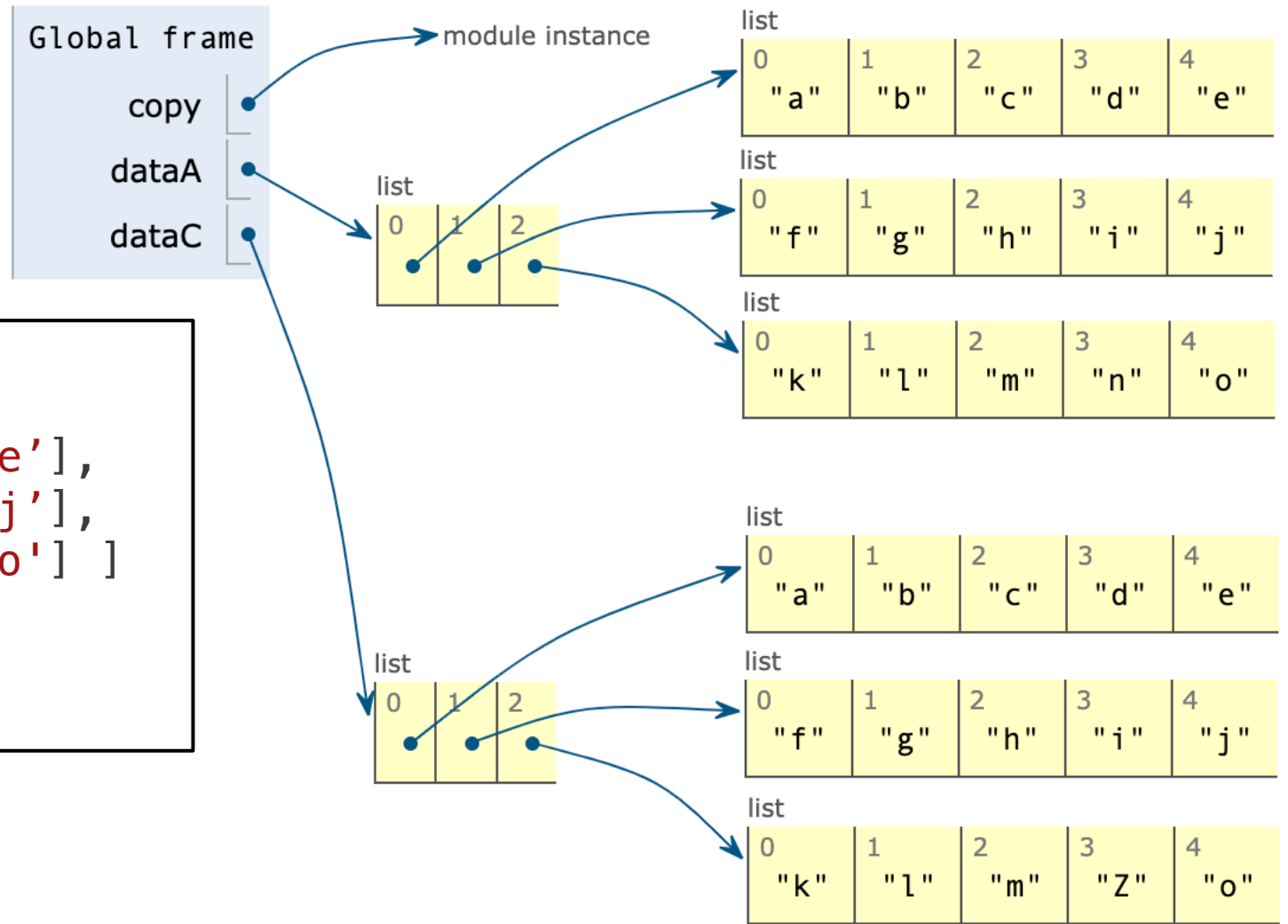


Copy vs Deepcopy

```
import copy

dataA = [ ['a', 'b', 'c', 'd', 'e'],
          ['f', 'g', 'h', 'i', 'j'],
          ['k', 'l', 'm', 'n', 'o'] ]
dataC = copy.deepcopy(dataA)

dataC[2][3] = 'Z'
```



Poll 1

How many total list objects exist after running this code?

```
import copy

dataA = [10, [200, [3000, 4000] ] ]
dataC = copy.copy(dataA)

dataD = copy.deepcopy(dataA)
```

- A. 3
- B. 4
- C. 5
- D. 6
- E. 7
- F. 9

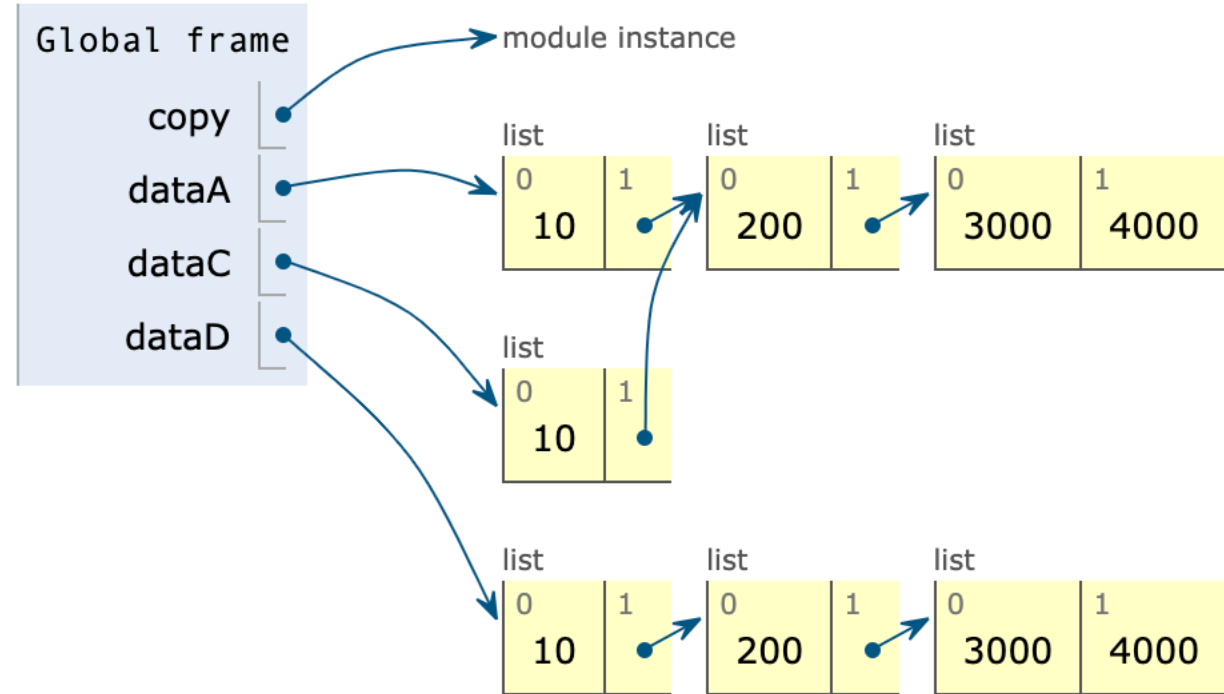
Poll 1

How many total list objects exist after running this code?

```
import copy

dataA = [10, [200, [3000, 4000] ] ]
dataC = copy.copy(dataA)

dataD = copy.deepcopy(dataA)
```



Code tracing with lists

```
x = []
```

```
for i in range(4):
```

```
    y = [0]
```

```
    z = y * 3
```

```
    x.append(z)
```

Code tracing with lists

```
x = []
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```
for i in range(4):
```

```
    y = [0]
```

```
    z = y * 3
```

```
    x.append(z)
```

Code tracing with lists

```
x = [[0]*3] * 4
```

Step by step:

```
y = [0]
```

```
z = y * 3
```

```
w = [z]
```

```
x = w * 4
```

2D lists

Things to keep in mind

Watch out for aliasing!

Think before copying

- Shallow copy
- Deep copy

Helper functions for printing

2D Board Graphics

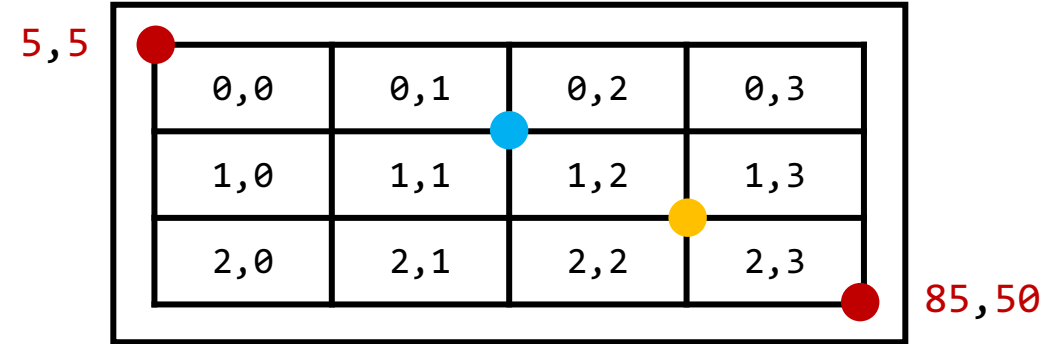
112 Graphics Grid Worksheet

Given:

app.width: 90
app.height: 55
app.margin: 5

Fill in the following grid with the value return for each call to:

$x_0, y_0 = \text{getCellLeftTop}(\text{app}, r, c)$



$\text{getCellLeftTop}(\text{app}, 0, 0)$

$\text{getCellLeftTop}(\text{app}, 0, 1)$

$\text{getCellLeftTop}(\text{app}, 0, 2)$

$\text{getCellLeftTop}(\text{app}, 0, 3)$

5, 5

____, ____

____, ____

$\text{getCellLeftTop}(\text{app}, 1, 0)$

$\text{getCellLeftTop}(\text{app}, 1, 1)$

$\text{getCellLeftTop}(\text{app}, 1, 2)$

$\text{getCellLeftTop}(\text{app}, 1, 3)$

____, ____

____, ____

$\text{getCellLeftTop}(\text{app}, 2, 0)$

$\text{getCellLeftTop}(\text{app}, 2, 1)$

$\text{getCellLeftTop}(\text{app}, 2, 2)$

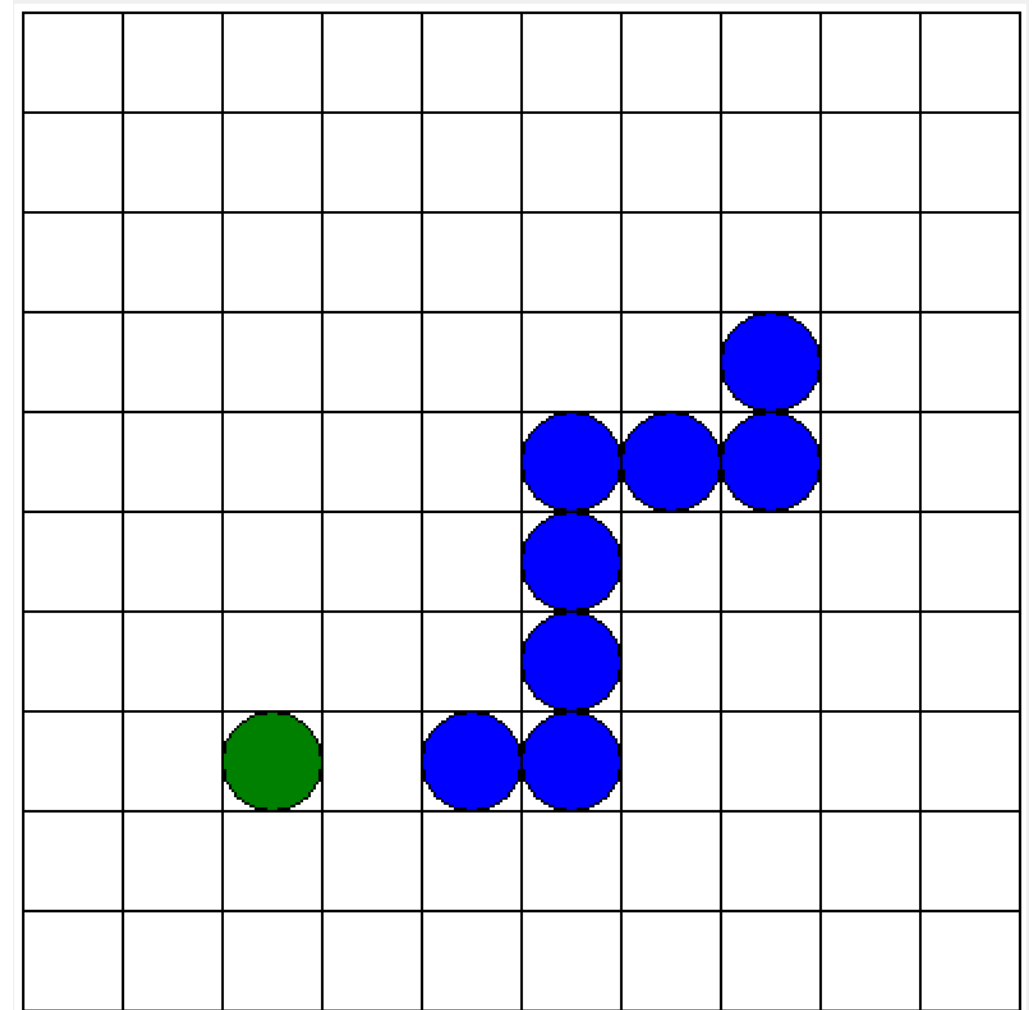
$\text{getCellLeftTop}(\text{app}, 2, 3)$

____, ____

Building an Application!

Snake Example

See Guided Exercise in notes



Polygons

Polygon Creator Example

```
def amongUsShape(usColor='red', usColor2='darkRed', usLineWidth=5):
```

```
    polys = [
```

```
        # Pack
```

```
(usColor, None, 0, [[-0.48, -0.396], [-0.553, -0.4], [-0.616, -0.366], [-0.653, -0.33], [-0.683, -0.276], [-0.68, 0.49], [-0.65,
```

```
(usColor2, None, 0, [[-0.476, -0.28], [-0.506, -0.27], [-0.553, -0.23], [-0.573, -0.193], [-0.586, -0.133], [-0.59, 0.586], [-0.
```

```
(None, 'black', usLineWidth, [[-0.48, -0.396], [-0.553, -0.4], [-0.616, -0.366], [-0.653, -0.33], [-0.683, -0.276], [-0.68, 0.49]
```

```
        # Body
```

```
(usColor2, None, 0, [[0.01, -0.933], [-0.033, -0.926], [-0.086, -0.913], [-0.123, -0.896], [-0.166, -0.873], [-0.203, -0.846],
```

```
(usColor, None, 0, [[-0.36, -0.686], [-0.363, -0.603], [-0.366, -0.46], [-0.363, -0.316], [-0.36, -0.173], [-0.353, -0.03],
```

```
(None, 'black', usLineWidth, [[0.01, -0.933], [-0.033, -0.926], [-0.086, -0.913], [-0.123, -0.896], [-0.166, -0.873], [-0.203, -0.846],
```

```
        # Eyes
```

```
('steelBlue', None, 0, [[0.486, -0.663], [0.316, -0.673], [0.123, -0.673], [0.016, -0.666], [-0.15, -0.663], [-0.316, -0.663],
```

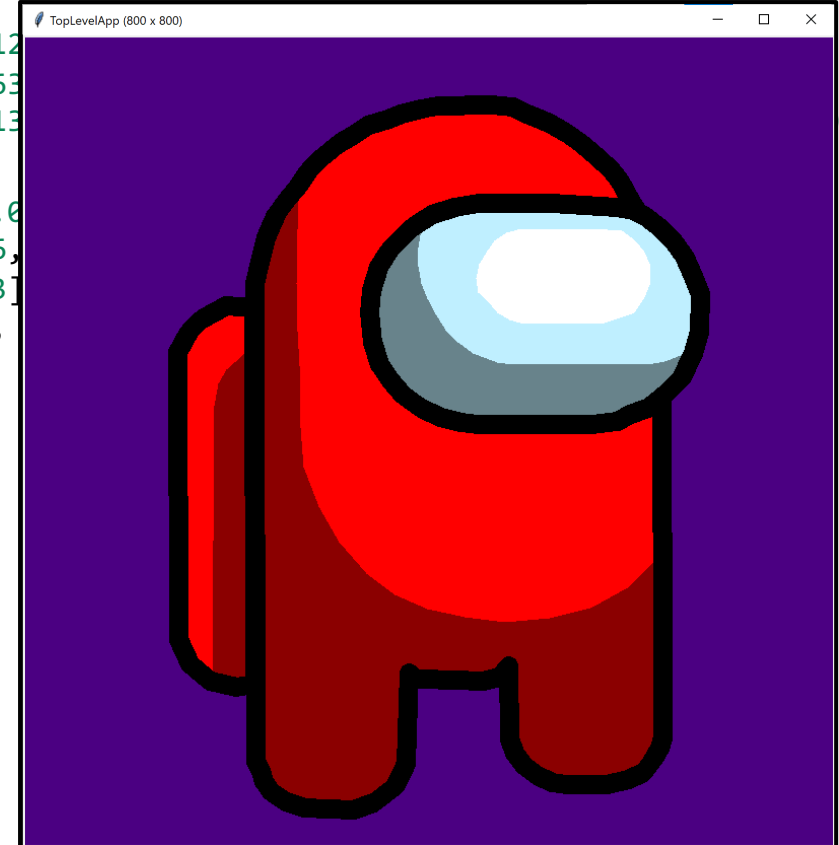
```
('lightCyan', None, 0, [[0.15, -0.67], [0.096, -0.666], [0.056, -0.66], [0.016, -0.656], [-0.03, -0.653], [-0.086, -0.653],
```

```
(None, 'black', usLineWidth, [[0.486, -0.663], [0.316, -0.673], [0.123, -0.673], [0.016, -0.666], [-0.15, -0.663], [-0.316, -0.663],
```

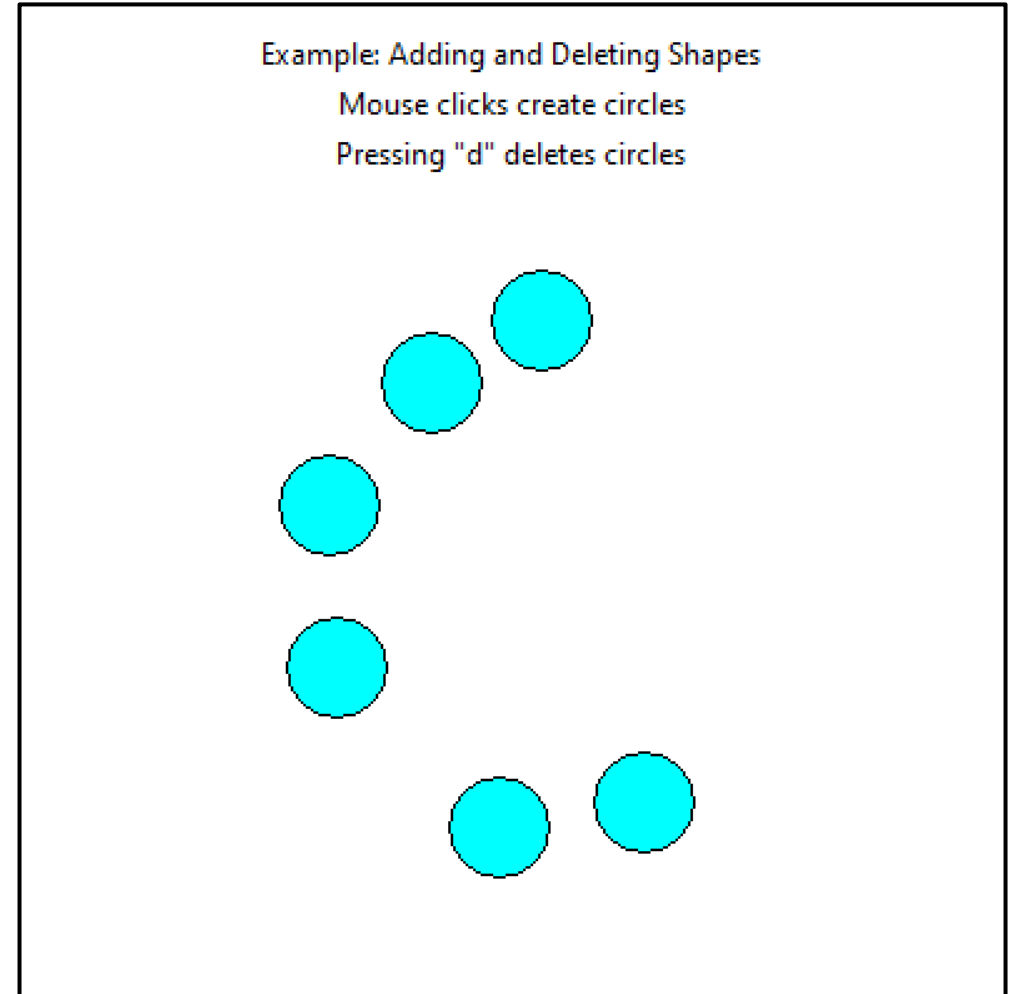
```
('white', None, 0, [[0.263, -0.606], [0.226, -0.603], [0.196, -0.596], [0.163, -0.586], [0.13, -0.573], [0.1, -0.556],
```

```
    ]
```

```
    return polys
```



Polygon Creator Example



Tetris Hints

Term Project!