CSc 110, Spring 2018

Lecture 29: Lists of Lists

Mountain peak

Write a program that reads elevation data from a file, draws it on a `DrawingPanel` and finds the path from the highest elevation to the edge of the region and draws that path on the `DrawingPanel`.

Data:

```
34 76 87 9 34 8  22 33 33 33 45 65 43 22
5  7  88 0 56 76 76 77 4  45 55 55 4  5
…
```

This data is a different shape. How should we store it?

Lists of lists

- You can put a list in a list

```
list = [[1, 2, 3], [4, 5, 6]]
```

How can you access 2?

```
list[0][1]
```

How can you find the length of the second inner list (`[4, 5, 6]`)?

```
len(list[1])
```

Lists of lists - traversals

- We normally use nested loops to go through a list of lists

```
data = [[1, 2, 3], [4, 5, 6]]
for i in range(len(data)):
    for j in range(len(data[i])):
        # do something with data[i][j]
```

Why does are inner loop go to `len(data[i])`?

List of lists mystery

```
def mystery(data, pos, n):
    result = []
    for i in range(0, n):
        for j in range(0, n):
            result.append(data[i + pos][j + pos])
    return result
```

Suppose that a variable called grid has been declared as follows:

```
grid = [[8, 2, 7, 8, 2, 1], [1, 5, 1, 7, 4, 7],
        [5, 9, 6, 7, 3, 2], [7, 8, 7, 7, 7, 9],
        [4, 2, 6, 9, 2, 3], [2, 2, 8, 1, 1, 3]]
```

which means it will store the following 6-by-6 grid of values:

8	2	7	8	2	1
1	5	1	7	4	7
5	9	6	7	3	2
7	8	7	7	7	9
4	2	6	9	2	3
2	2	8	1	1	3

Function Call	Contents of List Returned
`mystery(grid, 2, 2)`	_____
`mystery(grid, 0, 2)`	_____
`mystery(grid, 3, 3)`	_____

For each call at right, indicate what value is returned. If the function call results in an error, write error instead.

Exercise

Write a function called `max_row` that takes a list of lists as a parameter and returns the index of the row that contains the maximum value.

Exercise

Write a function called `flip` that takes a list of lists and two columns and swaps their contents. For example if `swap(data, 2, 3)` were called on the following list

```
data = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]
```

data would contain the following afterwards:

```
data = [[1, 3, 2], [4, 6, 5], [7, 9, 8]]
```

Exercise

Write a function called `create_matrix` that takes a width and a height as parameters and returns a list of lists that is width by height and contains the numbers 0 to width - 1 in each row. For example a call to `create_matrix(5, 3)` would return the following list of lists:

```
[[0, 1, 2, 3, 4], [0, 1, 2, 3, 4], [0, 1, 2, 3, 4]]
```

Creating Lists of lists

- `list = [[0] * 4] * 5` will NOT create a list of lists
  - This will create a list with 5 spots that all contain the SAME list that is 4 long.

- Instead, write the following:

```
list = []
for i in range(0, 5):
    list.append([0] * 4)
```

Mountain peak

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5  7  88 0 56 76 76 77 4  45 55 55 4  5
…
```