Computer Science 010: Design and Implementation of Solutions to Computational Problems

Assignment 6

This is an assignment that may be done individually or as a pair. If you would like to work in a pair, you are responsible for finding a partner.

Program #1 (95%)

You are given a table of values that gives the height of a terrain at different points in a square. Write a function,
`def floodMap(terrainMap, waterLevel)`
that prints out a flood map, showing which of the points in the terrain would be flooded if the water level was the given value. In the flood map, print a `W` (Capital "W") for each flooded point and a . (period) for each point that is not flooded.

The size of the terrainMap can be assumed to be rectangular, but may vary in size.

For example:

```
terrainHeights = [
                 [1,2,3,4,5,4,3,2,1],
                 [1,2,3,5,5,4,3,2,1],
                 [1,4,5,4,5,4,3,2,1],
                 [1,4,3,4,5,4,4,3,2],
                 [1,4,3,4,5,4,3,2,2],
                 [1,5,5,5,5,4,3,2,1]
                 ]

print("1")
floodMap(terrainHeights, 1)
print("2")
floodMap(terrainHeights, 2)
print("3")
floodMap(terrainHeights, 3)
print("4")
floodMap(terrainHeights, 4)
print("5")
floodMap(terrainHeights, 5)
```

```
$ python3.5 ./sample.py
1
W.......W
W.......W
W.......W
W........
W........
W.......W
2
WW.....WW
WW.....WW
W......WW
W.......W
W......WW
W......WW
3
WWW...WWW
WWW...WWW
W.....WWW
W.W....WW
W.W...WWW
W.....WWW
4
WWWW.WWWW
WWW..WWWW
WW.W.WWWW
WWWW.WWWW
WWWW.WWWW
W....WWWW
5
WWWWWWWWW
WWWWWWWWW
WWWWWWWWW
WWWWWWWWW
WWWWWWWWW
WWWWWWWWW
```

Challenge Problem #2 (5%)

You are given a table of values that gives the height of a terrain at different points in a square as in program #1. Write a function,

`def floodDamage(heights,percent)`

that returns the lowest waterLevel at which at least `percent` squares on the map are flooded. For example:

```
1
W.......WW
W.......WW
W.......WW
W........W
W........W
W.......WW
W........W
W........W
W.......WW
W.......WW
2
WW.....WWW
WW.....WWW
W......WWW
W.......WW
W......WWW
W......WWW
W......WWW
W.......WW
W......WWW
W......WWW
3
WWW...WWWW
WWW...WWWW
W.....WWWW
W.W....WWW
W.W...WWWW
W.....WWWW
W.W...WWWW
W.W....WWW
W.....WWWW
W.....WWWW
4
WWWW.WWWWW
WWW..WWWWW
WW.W.WWWWW
WWWW.WWWWW
WWWW.WWWWW
W....WWWWW
WWWW.WWWWW
WWWW.WWWWW
WW.W.WWWWW
WW.W.WWWWW
5
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
WWWWWWWWWW
There will be 0% flooding when water level is: 0
There will be 10% flooding when water level is: 1
There will be 20% flooding when water level is: 1
There will be 30% flooding when water level is: 2
There will be 40% flooding when water level is: 2
There will be 50% flooding when water level is: 3
There will be 60% flooding when water level is: 4
There will be 70% flooding when water level is: 4
There will be 80% flooding when water level is: 4
There will be 90% flooding when water level is: 5
There will be 100% flooding when water level is: 5
```

```
terrainHeights = [
                 [1,2,3,4,5,4,3,2,1,1],
                 [1,2,3,5,5,4,3,2,1,1],
                 [1,4,5,4,5,4,3,2,1,1],
                 [1,4,3,4,5,4,4,3,2,1],
                 [1,4,3,4,5,4,3,2,2,1],
                 [1,5,5,5,5,4,3,2,1,1],
                 [1,4,3,4,5,4,3,2,2,1],
                 [1,4,3,4,5,4,4,3,2,1],
                 [1,4,5,4,5,4,3,2,1,1],
                 [1,4,5,4,5,4,3,2,1,1],
                 ]

print("1")
floodMap(terrainHeights, 1)
print("2")
floodMap(terrainHeights, 2)
print("3")
floodMap(terrainHeights, 3)
print("4")
floodMap(terrainHeights, 4)
print("5")
floodMap(terrainHeights, 5)

for i in range(0,101,10):
    print("There will be %d%% flooding when water level is:" %i,
floodDamage(terrainHeights,i/100))
```

Challenge Problem #3 (5%)

You are given a table of values that gives the height of a terrain at different points in a square as in program #1. Write a function,

```
def floodAnimation(heights)
```

that uses ezgraphics to animate the effect of rising water level. The animation should show a frame for each possible integer waterlevel from 0 to the highest value in the terrain map.

The effect should be that the land gradually goes away.

To get full points for this challenge, the animation must work with arbitrarily sized terrainMaps and should play at a reasonable pace for viewing.