



Homework #9

01286120 Elementary Systems Programming

Software Engineering Program

Faculty of Engineering, KMITL

By

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1. Write functions that generate layers with circles

The first thing you need to do in this homework exercise is to define the structure Circle for storing a point with cartesian coordinates (x, y) and radius r, and the structure Layer which has "name", "color" tag "#RRGGBBAA" (in hex color code), and a list of Circle "objects" contained in the layer. and then use it to write the following functions.

- 1.1) Write the function `gen_obj_layer_list(rng, n)` that create a list of n layers each with the name in the pattern "Layer {i}", the color in "#RRGGBBAA" (which is randomly chosen), and the objects which is a list of the Circle randomly generated using the random number generator rng for n circles within [20, 50] (inclusive) and for each point (x, y) having $-100 \leq x \leq 100$, $-100 \leq y \leq 100$, and $-10 \leq r \leq 20$. Add a unit test for the function `gen_obj_layer_list(rng, n)` to ensure the correctness of the function.

(code in attached file)

```
Finished test [unoptimized + debuginfo] target(s) in 0.01s
Running unittests src\bin\q1.rs (target\debug\deps\q1-287547d054f3d42b.exe)

running 1 test
test test_gen_layer_list ... ok

test result: ok. 1 passed; 0 failed; 0 ignored; 0 measured; 1 filtered out; finished in 0.00s
```

- 1.2) Write the function `cal_average_area(layers)` that calculate the average area of circles for each layer in layers and create a list of (layer name, average area) as a result of the function. Add a unit test for the function `cal_average_area(layers)` to ensure the correctness of the function.

(code in attached file)

```
Finished test [unoptimized + debuginfo] target(s) in 0.01s
Running unittests src\bin\q1.rs (target\debug\deps\q1-287547d054f3d42b.exe)

running 1 test
test test_cal_average_area ... ok

test result: ok. 1 passed; 0 failed; 0 ignored; 0 measured; 1 filtered out; finished in 0.00s
```

2. Write programs that analyze, load, and save layers data

2.1) Write a program to randomly generate a list of n layers using the function `gen_obj_layer_list(rng, n)` from 1.1), then save it as a CSV file.

(code in attached file)

```
outs.csv
1 Layer #, Color, xcor, ycor, radius
2 Layer 1,#65B3F483,-61.74742120066442,-32.713667272290735,16.90109866222341,-65.77943557625282,12.311591171731422,2.5188515636988803,59.43621770170418,15.972859150323998,4.366123504875032,74.63
3 Layer 2,#FDECE286,6.032983380180113,7.911949030713785,13.15423102307201,-66.51964380462124,-92.15867355712128,9.617281646044471,-59.428359367423624,56.557032670080844,6.602802001236286,-75.644
4 Layer 3,#5146075C,55.410391811419714,-77.81659869348906,7.610396701981014,-79.60623083593363,4.386099323357087,12.304332953949993,-39.373265868539804,-61.81002046187339,15.310163078208651,-92.
5 Layer 4,#E19B7004,-26.785562527114976,28.84008366542892,17.480683580104284,81.46153682900757,-9.832577191851684,12.53161661625003,95.19618853404916,-66.79067703040985,13.61591388221258,68.7182
6 Layer 5,#E8E4E864,-77.39367338458138,-15.681296758477075,18.701130208378512,-25.73822362478782,-38.72334026241971,11.353333434274365,93.98698169235888,6.649474617807698,1.6153704668846225,-60.
7 Layer 6,#C3F130B3,-69.91460743153519,97.59588660277569,13.018839115335191,-81.85794589593915,-95.46772925029714,7.081808021208515,23.158786512942726,-81.35698401357665,19.8202698624701,-36.714
8 |
```

2.2) Write a program to read a list of layers from a CSV file and use the function `cal_average_area(layers)` from 1.2) to calculate the average area of circles for each layer, then save the result as a CSV file.

(code in attached file)

```
avg.csv
1 Layer 1,377.81647265990875
2 Layer 2,482.1839033533809
3 Layer 3,442.87192784550814
4 Layer 4,495.88596859414343
5 Layer 5,394.0044452244511
6 Layer 6,474.80937731217637
7 |
```

3. Adapt programs to generate HTML table

3.1) Modify the program in 2.2) to save the output as a HTML table instead of a CSV file.

(code in attached file)

Layer Name	Average Area
Layer 1	467.0073490140219
Layer 2	486.9425967737741
Layer 3	377.5814606612417
Layer 4	409.3889134489066
Layer 5	528.9144595474631
Layer 6	362.7290903829769

3.2) Extend the program in 3.1) to add columns for minimum and maximum area of circles to the HTML table output in addition to the average area of circles.

(code in attached file)

Layer Name	Minimum Area	Average Area	Maximum Area
Layer 1	3.45	462.81	1212.08
Layer 2	6.92	502.13	1222.36
Layer 3	7.92	418.85	1216.44
Layer 4	34.73	402.57	1107.26
Layer 5	9.60	466.00	1050.28
Layer 6	5.29	412.63	1219.59