Evolution Strategies (ES)

Assignment 3 CS472-F16 Due: Tue Nov 1 at 5pm PT

Points: 200

Try to match the format and quality of answer in the results. You don't have to get an exact agreement. The comparison is with an example output. **Try to get similar amounts of error or less.**

Reference Files (these should be live links):

- rand.cpp A simple fast random number generator using the fast flea generator
- randf.cpp A simple fast random number generator using fast physics generator
- randmt.cpp A simple fast random number generator using Mersenne Twister
- rand.h Universal random number generator header

1 The problem

Let's play with solving a real number vector problem. The problem is to place k points in a unit circle so that the the minimum distance between any two points is maximized. This is a relatively hard problem. Let's try to solve it with evolution strategies. Some example solutions are seen in Figure 1.

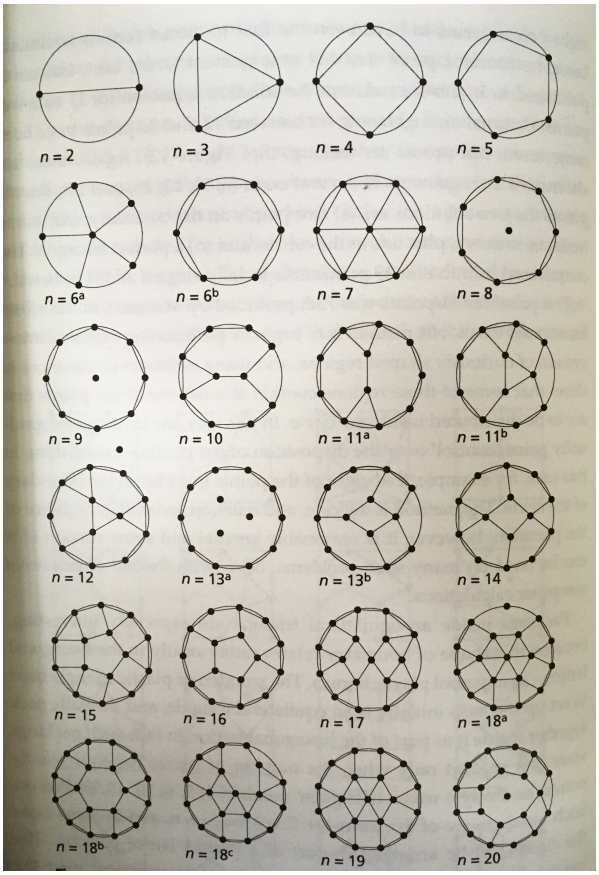

Figure 1: Dots on a circle to maximize minimum distance between points. (From *How to Cut a Cake: And Other Mathematical Conundrums* by Ian Stewart)

2 The Experiments

The output of your program should at least have the number of points followed on separate lines by the pairs of polar coordinates θ with $0 \leq \theta \leq 2\pi$ and r with $0 \leq r \leq 1$. All points are rotated so one of the points has $\theta = 0$. Either rotate the points or have your representation built that way. Include the measure of fitness.

```
** 15
***   0.000000   0.520035
***   0.386124   0.981772
***   0.926452   0.985252
***   1.116276   0.475057
***   1.467051   0.953166
***   2.015758   0.975875
***   2.342130   0.491621
***   2.562461   0.996566
***   3.105154   0.917787
***   3.668288   0.992983
***   4.109920   0.568308
***   4.469185   0.050688
***   4.612219   0.979806
***   5.092867   0.563311
***   5.728703   0.966497
***   Fit:   0.518519
```

Write a simple half page report named "yourSubmitName.pdf" describing what representation you used e.g. cartesian, polar, any special other encoding features.

Let me know how you coded the ES (e.g id you evolve sigma?) and what parameters for your evolution worked you observe. Turn in your code and the report in a tar. The tar should include a makefile that will make the program `points`.

3 Submission

Homework will be submitted as an uncompressed tar file to the homework submission page linked from the main class page. You can submit as many times as you like. The LAST file you submit BEFORE the deadline will be the one graded. For all submissions you will receive email giving you some automated feedback on the unpacking and compiling and running of code and possibly some other things that can be autotested. I will read the results of the runs and the reports you submit.

Have fun.