Tao Zhang

Hill Climbing and Simulated Annealing

Project 1a, CS 472

Feb 5th, 2014

Table of results:

**Hill Climbing for Sphere function**

1. **Interval of 0.01**

-bash-4.1$ time ./hillclimbing

Random[0]: 0.880000

Random[1]: 3.880000

Random[2]: -2.120000

Random[3]: -0.120000

Random[4]: -1.120000

Random[5]: 0.880000

Random[6]: -1.120000

Random[7]: -0.120000

Random[8]: -3.120000

Random[9]: 1.880000

Random[10]: -1.120000

Random[11]: -4.120000

Random[12]: -0.120000

Random[13]: -5.120000

Random[14]: -5.120000

Random[15]: -5.120000

Random[16]: -3.120000

Random[17]: -3.120000

Random[18]: 3.880000

Random[19]: 0.880000

Random[20]: -3.120000

Random[21]: 0.880000

Random[22]: 2.880000

Random[23]: -1.120000

Random[24]: -0.120000

Random[25]: -5.120000

Random[26]: -0.120000

Random[27]: -2.120000

Random[28]: -5.120000

Random[29]: -2.120000

RandomEval: 250.592000

BSF[0]: -0.000000

BSF[1]: 0.000000

BSF[2]: -0.000000

BSF[3]: -0.000000

BSF[4]: 0.000000

BSF[5]: -0.000000

BSF[6]: 0.000000

BSF[7]: -0.000000

BSF[8]: -0.000000

BSF[9]: -0.000000

BSF[10]: 0.000000

BSF[11]: -0.000000

BSF[12]: -0.000000

BSF[13]: 0.000000

BSF[14]: 0.000000

BSF[15]: 0.000000

BSF[16]: -0.000000

BSF[17]: -0.000000

BSF[18]: 0.000000

BSF[19]: -0.000000

BSF[20]: -0.000000

BSF[21]: -0.000000

BSF[22]: 0.000000

BSF[23]: 0.000000

BSF[24]: -0.000000

BSF[25]: 0.000000

BSF[26]: -0.000000

BSF[27]: -0.000000

BSF[28]: 0.000000

BSF[29]: -0.000000

BestEval: 0.000000

Counter: 264840

real 0m0.094s

user 0m0.089s

sys 0m0.004s

1. **Interval of 0.001**

RandomEval: 240.072000

BestEval: 0.000000

Counter: 3703380

real 0m1.216s

user 0m1.212s

sys 0m0.001s

1. **Interval of 0.0001**

RandomEval: 308.152000

BestEval: 0.000000

Counter: 41928240

real 0m13.721s

user 0m13.682s

sys 0m0.001s

**Hill Climbing for Schwefel function with interval of 0.01, no final best solution:**

**1). First run**

-bash-4.1$ time ./hillclimbing-Schwefel

Random[0]: 277.970000

Random[1]: -111.030000

Random[2]: 314.970000

Random[3]: -391.030000

Random[4]: -96.030000

Random[5]: 508.970000

Random[6]: 78.970000

Random[7]: 366.970000

Random[8]: 291.970000

Random[9]: 46.970000

Random[10]: 373.970000

Random[11]: 36.970000

Random[12]: 408.970000

Random[13]: 194.970000

Random[14]: 77.970000

Random[15]: 164.970000

Random[16]: -427.030000

Random[17]: 99.970000

Random[18]: 363.970000

Random[19]: 496.970000

Random[20]: 249.970000

Random[21]: 469.970000

Random[22]: -130.030000

Random[23]: -507.030000

Random[24]: -123.030000

Random[25]: -373.030000

Random[26]: 157.970000

Random[27]: -369.030000

Random[28]: -507.030000

Random[29]: -245.030000

RandomEval: 12377.579690

BSF[0]: 300.000000

BSF[1]: -89.000000

BSF[2]: 314.990000

BSF[3]: -418.000000

BSF[4]: -89.000000

BSF[5]: 511.970000

BSF[6]: 78.010000

BSF[7]: 355.990000

BSF[8]: 300.000000

BSF[9]: 39.990000

BSF[10]: 355.990000

BSF[11]: 36.990000

BSF[12]: 355.990000

BSF[13]: 157.990000

BSF[14]: 77.010000

BSF[15]: 157.990000

BSF[16]: -428.000000

BSF[17]: 121.990000

BSF[18]: 355.990000

BSF[19]: 511.970000

BSF[20]: 300.000000

BSF[21]: 469.000000

BSF[22]: -130.000000

BSF[23]: -483.990000

BSF[24]: -123.010000

BSF[25]: -418.000000

BSF[26]: 157.990000

BSF[27]: -418.000000

BSF[28]: -483.990000

BSF[29]: -246.000000

BestEval: 9413.904662

Counter: 2771820

real 0m9.470s

user 0m9.446s

sys 0m0.002s

**2). Second run**

-bash-4.1$ time ./hillclimbing-Schwefel

Random[0]: -21.030000

Random[1]: -24.030000

Random[2]: -165.030000

Random[3]: 132.970000

Random[4]: -137.030000

Random[5]: 466.970000

Random[6]: -352.030000

Random[7]: -444.030000

Random[8]: 327.970000

Random[9]: -6.030000

Random[10]: -466.030000

Random[11]: 437.970000

Random[12]: 460.970000

Random[13]: -182.030000

Random[14]: -106.030000

Random[15]: -366.030000

Random[16]: 394.970000

Random[17]: 168.970000

Random[18]: -436.030000

Random[19]: -260.030000

Random[20]: -107.030000

Random[21]: 508.970000

Random[22]: 69.970000

Random[23]: -467.030000

Random[24]: -456.030000

Random[25]: 447.970000

Random[26]: -317.030000

Random[27]: -449.030000

Random[28]: 259.970000

Random[29]: 139.970000

RandomEval: 12104.257655

BSF[0]: -10.000000

BSF[1]: -24.010000

BSF[2]: -201.000000

BSF[3]: 132.990000

BSF[4]: -137.000000

BSF[5]: 466.000000

BSF[6]: -352.000000

BSF[7]: -445.000000

BSF[8]: 327.990000

BSF[9]: -7.000000

BSF[10]: -467.000000

BSF[11]: 437.000000

BSF[12]: 460.000000

BSF[13]: -201.000000

BSF[14]: -89.000000

BSF[15]: -418.000000

BSF[16]: 355.990000

BSF[17]: 157.990000

BSF[18]: -437.000000

BSF[19]: -246.990000

BSF[20]: -89.000000

BSF[21]: 511.970000

BSF[22]: 69.010000

BSF[23]: -468.000000

BSF[24]: -457.000000

BSF[25]: 447.000000

BSF[26]: -317.000000

BSF[27]: -450.000000

BSF[28]: 300.000000

BSF[29]: 139.990000

BestEval: 10623.427370

Counter: 1625040

real 0m5.622s

user 0m5.608s

sys 0m0.002s

**3) Third run:**

-bash-4.1$ time ./hillclimbing-Schwefel

Random[0]: -271.030000

Random[1]: 329.970000

Random[2]: -137.030000

Random[3]: -57.030000

Random[4]: 37.970000

Random[5]: 255.970000

Random[6]: -182.030000

Random[7]: -175.030000

Random[8]: -467.030000

Random[9]: 430.970000

Random[10]: 259.970000

Random[11]: 182.970000

Random[12]: 461.970000

Random[13]: -395.030000

Random[14]: 119.970000

Random[15]: 70.970000

Random[16]: 211.970000

Random[17]: 469.970000

Random[18]: 171.970000

Random[19]: -84.030000

Random[20]: -27.030000

Random[21]: 90.970000

Random[22]: -466.030000

Random[23]: 20.970000

Random[24]: 292.970000

Random[25]: 449.970000

Random[26]: -111.030000

Random[27]: 490.970000

Random[28]: 283.970000

Random[29]: -113.030000

RandomEval: 12523.885194

BSF[0]: -246.990000

BSF[1]: 329.990000

BSF[2]: -137.000000

BSF[3]: -63.000000

BSF[4]: 37.990000

BSF[5]: 300.000000

BSF[6]: -201.000000

BSF[7]: -201.000000

BSF[8]: -468.000000

BSF[9]: 430.000000

BSF[10]: 300.000000

BSF[11]: 157.990000

BSF[12]: 461.000000

BSF[13]: -418.000000

BSF[14]: 121.990000

BSF[15]: 70.010000

BSF[16]: 211.000000

BSF[17]: 469.000000

BSF[18]: 157.990000

BSF[19]: -84.990000

BSF[20]: -27.010000

BSF[21]: 121.990000

BSF[22]: -467.000000

BSF[23]: 22.990000

BSF[24]: 300.000000

BSF[25]: 449.000000

BSF[26]: -89.000000

BSF[27]: 511.970000

BSF[28]: 300.000000

BSF[29]: -89.000000

BestEval: 10795.706182

Counter: 2129580

real 0m7.461s

user 0m7.438s

sys 0m0.004s

**Simulated Annealing algorithm for Sphere function:**