760-Heuristics-Assignment

Leo Mooney

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1 Question 1

Neighbors of the current solution can be found by swapping one pot in any crucible with a pot in any other crucible. This can be formally defined as following:

$N(\mathbf{x}) = \{\mathbf{y}(\mathbf{x}, k, l, m, n), k = 1, 2, 3, ..., 16, l = k+1, k+2, k+3, ...17, m = 1, 2, 3, n = 1, 2, 3\}$ where

$$\mathbf{y}(\mathbf{x}, k, l, m, n) = (y_{1,1}, y_{1,2}, y_{1,3}; y_{2,1} y_{2,2} y_{2,3}; ...y_{c,j}), y_{c,j} = \begin{cases} x_{l,n} & \text{if } c = k, j = m \\ x_{k,m} & \text{if } c = l, j = n \\ x_{c,j} & \text{otherwise} \end{cases}$$

2 Question 2

Let $h(x_c) = g(\overline{Al}[x_{c,avg}], \overline{Fe}[x_{c,avg}], \overline{Si}[x_{c,avg}])$ where

$$\overline{Al}[x_{c,avg}] = \frac{Al[x_{c,1}], Al[x_{c,2}], Al[x_{c,3}]}{3}$$
$$\overline{Fe}[x_{c,avg}] = \frac{Fe[x_{c,1}], Fe[x_{c,2}], Fe[x_{c,3}]}{3}$$
$$\overline{Si}[x_{c,avg}] = \frac{Si[x_{c,1}], Si[x_{c,2}], Si[x_{c,3}]}{3}$$

Algorithm 1 Sweep x

Let S contain all possible solutions of x
Let x, $x \in S$, be some initial configuration
Let x^* be some configuration that maximizes f(x)
Let I be the intermediate values
$I_i := h(x_i) \forall i \in c$
while not stopped **do**
  Compare each neighbor $y(x, k, l, m, n) \in N(x)$
  Let $d = h(y_k) + h(y_k) - I_k - I_l$
  if $d > 0$ for some $y \in N(x)$ **then**
    x := y
    $I_k := h(y_k)$
    $I_l := h(y_k)$
  else if $d \leq 0 \forall y \in N(x)$ **then**
    Stop
  end if
end while
$x^* := x$

3 Question 3

See Appendix A for all code and plots.

3.1 Question 3E

Best solution found using repeated next ascents with $n = 200$.

```
1 [27  4 45 ] 99.261 %Al, 0.274 %Fe, 0.110 %Si, $41.53, spread = 41
2 [ 8 13 37 ] 99.508 %Al, 0.154 %Fe, 0.153 %Si, $48.71, spread = 29
3 [50 40 30 ] 99.504 %Al, 0.143 %Fe, 0.238 %Si, $48.71, spread = 20
4 [17 51 15 ] 99.268 %Al, 0.162 %Fe, 0.386 %Si, $41.53, spread = 36
5 [24 23 46 ] 99.512 %Al, 0.053 %Fe, 0.180 %Si, $48.71, spread = 23
6 [28 12 32 ] 99.358 %Al, 0.096 %Fe, 0.348 %Si, $44.53, spread = 20
7 [18  3 42 ] 99.760 %Al, 0.040 %Fe, 0.139 %Si, $57.35, spread = 39
```

```
 8 [19 41 20 ] 99.262 %Al, 0.212 %Fe, 0.249 %Si, $41.53, spread = 22
 9 [11 25  5 ] 99.353 %Al, 0.185 %Fe, 0.325 %Si, $44.53, spread = 20
10 [ 9  6 21 ] 99.504 %Al, 0.139 %Fe, 0.253 %Si, $48.71, spread = 15
11 [ 7 36 26 ] 99.506 %Al, 0.098 %Fe, 0.268 %Si, $48.71, spread = 29
12 [47 39  2 ] 99.503 %Al, 0.114 %Fe, 0.270 %Si, $48.71, spread = 45
13 [22 33 10 ] 99.356 %Al, 0.187 %Fe, 0.219 %Si, $44.53, spread = 23
14 [34 29 38 ] 99.361 %Al, 0.209 %Fe, 0.241 %Si, $44.53, spread =  9
15 [14 43 49 ] 99.254 %Al, 0.224 %Fe, 0.307 %Si, $41.53, spread = 35
16 [ 1 35 31 ] 99.350 %Al, 0.075 %Fe, 0.336 %Si, $44.53, spread = 34
17 [48 44 16 ] 99.515 %Al, 0.143 %Fe, 0.241 %Si, $48.71, spread = 32
                                           Sum = $787.09, MxSprd = 45
```

Best solution found using repeated steepest ascents with $n = 200$.

```
 1 [ 1 48 15 ] 99.256 %Al, 0.121 %Fe, 0.300 %Si, $41.53, spread = 47
 2 [29 36 10 ] 99.369 %Al, 0.216 %Fe, 0.272 %Si, $44.53, spread = 26
 3 [33  6 34 ] 99.268 %Al, 0.253 %Fe, 0.272 %Si, $41.53, spread = 28
 4 [42 16 49 ] 99.502 %Al, 0.161 %Fe, 0.163 %Si, $48.71, spread = 33
 5 [43 24 39 ] 99.508 %Al, 0.067 %Fe, 0.243 %Si, $48.71, spread = 19
 6 [47  8  5 ] 99.366 %Al, 0.188 %Fe, 0.317 %Si, $44.53, spread = 42
 7 [ 4 26 19 ] 99.253 %Al, 0.243 %Fe, 0.283 %Si, $41.53, spread = 22
 8 [31 28 46 ] 99.365 %Al, 0.139 %Fe, 0.196 %Si, $44.53, spread = 18
 9 [ 3 11 23 ] 99.502 %Al, 0.058 %Fe, 0.246 %Si, $48.71, spread = 20
10 [32 27 35 ] 99.501 %Al, 0.087 %Fe, 0.224 %Si, $48.71, spread =  8
11 [22 40 51 ] 99.353 %Al, 0.122 %Fe, 0.349 %Si, $44.53, spread = 29
12 [13 38  2 ] 99.504 %Al, 0.177 %Fe, 0.160 %Si, $48.71, spread = 36
13 [50 25 37 ] 99.500 %Al, 0.188 %Fe, 0.231 %Si, $48.71, spread = 25
14 [20 30 17 ] 99.522 %Al, 0.111 %Fe, 0.277 %Si, $48.71, spread = 13
15 [ 9 18 44 ] 99.750 %Al, 0.037 %Fe, 0.099 %Si, $57.35, spread = 35
16 [45 41 12 ] 99.258 %Al, 0.171 %Fe, 0.284 %Si, $41.53, spread = 33
17 [21  7 14 ] 99.360 %Al, 0.168 %Fe, 0.347 %Si, $44.53, spread = 14
                                           Sum = $787.09, MxSprd = 47
```

4 Quesion 4

There does not seem to be a significant difference in the objective value for next and steepest ascent. Steepest ascent also took far longer to converge on each local optimum. This means that fastest ascent is better than steepest ascent; however, this conclusion is from limited information so it not conclusive evidence.

5 Question 5

(a) You would expect the problem's objective function to have lots of plateus because the objective function is not continuous. This means there will be lots

Pot Number	Al	Fe	Si
1	99.23	0.063	0.054
2	99.23	0.063	0.054
3	99.23	0.063	0.054
Average Quality	3	3	3

of cases where two pots are swapped and the quality, and thus value, will remain constant.

(b) One function that could add a slope to plateus is to give a slightly higher objective value when the means of the elements in the pot are further away from their worst quality. The maximum distance from the worst quality should be the best quality, as there should be no incentive to improve on a quality that results in the highest grade. The gradient at which a higher objective value is given should be lower for aluminium than iron or silicon as the distance between the worst mean quality for aluminium is greater than that of the other two. This can be described by the following definition.

$$g'(\overline{Al}, \overline{Fe}, \overline{Si}) = g(\overline{Al}, \overline{Fe}, \overline{Si}) + a(\overline{Al}) + b(\overline{Fe}) + c(\overline{Si})$$

Where

$$a(\overline{Al}) = \begin{cases} 0.1 * (\overline{Al} - 99.1) & \text{if } \overline{Al} \leq 99.9) \\ 0 & \text{otherwise} \end{cases}$$

$$b(\overline{Fe}) = \begin{cases} 0.09 - \overline{Fe} & \text{if } \overline{Fe} \geq 0.03) \\ 0 & \text{otherwise} \end{cases}$$

$$c(\overline{Si}) = \begin{cases} 0.09 - \overline{Si} & \text{if } \overline{Si} \geq 0.01) \\ 0 & \text{otherwise} \end{cases}$$

Consider a crucible with the properties. Note the specific properties of these pots are not consistent with those provided as it is just an example of a possible configuration.

6 Question 6

$$g''(\overline{Al}, \overline{Fe}, \overline{Si}, x_{c1}, x_{c2}, x_{c3}, s) = \begin{cases} g(\overline{Al}, \overline{Fe}, \overline{Si}) - 20 * (s_c - s) & \text{if } s_c > s \\ g(\overline{Al}, \overline{Fe}, \overline{Si}) & \text{otherwise} \end{cases}$$

where $s_c = \max(x_{c1}, x_{c2}, x_{c3}) - \min(x_{c1}, x_{c2}, x_{c3})$

6.1 Task 6

See Appendix A for code.

6.1.1 Max Spread = 6

```
 1 [38 34 40 ] 99.371 %Al, 0.241 %Fe, 0.163 %Si, $44.53, spread =  6
 2 [17 13 19 ] 99.270 %Al, 0.297 %Fe, 0.234 %Si, $41.53, spread =  6
 3 [35 36 39 ] 99.615 %Al, 0.043 %Fe, 0.196 %Si, $48.71, spread =  4
 4 [ 6  8 10 ] 99.352 %Al, 0.257 %Fe, 0.275 %Si, $44.53, spread =  4
 5 [30 32 27 ] 99.558 %Al, 0.093 %Fe, 0.170 %Si, $48.71, spread =  5
 6 [37 42 41 ] 99.501 %Al, 0.115 %Fe, 0.198 %Si, $48.71, spread =  5
 7 [24 22 21 ] 99.532 %Al, 0.037 %Fe, 0.276 %Si, $48.71, spread =  3
 8 [33 29 28 ] 99.256 %Al, 0.151 %Fe, 0.303 %Si, $41.53, spread =  5
 9 [11 14  9 ] 99.381 %Al, 0.080 %Fe, 0.297 %Si, $44.53, spread =  5
10 [ 5  7  3 ] 99.512 %Al, 0.188 %Fe, 0.212 %Si, $48.71, spread =  4
11 [46 47 43 ] 99.359 %Al, 0.172 %Fe, 0.315 %Si, $44.53, spread =  4
12 [26 25 31 ] 99.393 %Al, 0.138 %Fe, 0.325 %Si, $44.53, spread =  6
13 [49 48 44 ] 99.511 %Al, 0.169 %Fe, 0.145 %Si, $48.71, spread =  5
14 [20 18 23 ] 99.544 %Al, 0.057 %Fe, 0.220 %Si, $48.71, spread =  5
15 [15 16 12 ] 99.369 %Al, 0.127 %Fe, 0.302 %Si, $44.53, spread =  4
16 [ 2  4  1 ] 99.356 %Al, 0.144 %Fe, 0.280 %Si, $44.53, spread =  3
17 [50 51 45 ] 99.256 %Al, 0.198 %Fe, 0.351 %Si, $41.53, spread =  6
                                        Sum = $777.27, MxSprd =  6
```

6.1.2 Max Spread = 8

```
 1 [15 13 11 ] 99.255 %Al, 0.157 %Fe, 0.277 %Si, $41.53, spread =  4
 2 [ 2  1  4 ] 99.356 %Al, 0.144 %Fe, 0.280 %Si, $44.53, spread =  3
 3 [46 49 51 ] 99.399 %Al, 0.152 %Fe, 0.259 %Si, $44.53, spread =  5
 4 [26 19 24 ] 99.355 %Al, 0.140 %Fe, 0.305 %Si, $44.53, spread =  7
 5 [32 29 36 ] 99.509 %Al, 0.087 %Fe, 0.197 %Si, $48.71, spread =  7
 6 [34 35 33 ] 99.358 %Al, 0.156 %Fe, 0.278 %Si, $44.53, spread =  2
 7 [ 8  3 10 ] 99.527 %Al, 0.176 %Fe, 0.194 %Si, $48.71, spread =  7
 8 [48 50 44 ] 99.544 %Al, 0.129 %Fe, 0.241 %Si, $48.71, spread =  6
 9 [14  6  7 ] 99.253 %Al, 0.249 %Fe, 0.360 %Si, $41.53, spread =  8
10 [16 18 17 ] 99.542 %Al, 0.132 %Fe, 0.258 %Si, $48.71, spread =  2
11 [30 27 23 ] 99.505 %Al, 0.105 %Fe, 0.199 %Si, $48.71, spread =  7
12 [20 22 21 ] 99.516 %Al, 0.060 %Fe, 0.277 %Si, $48.71, spread =  2
13 [43 45 38 ] 99.350 %Al, 0.226 %Fe, 0.125 %Si, $44.53, spread =  7
14 [ 9  5 12 ] 99.510 %Al, 0.106 %Fe, 0.258 %Si, $48.71, spread =  7
15 [40 39 47 ] 99.378 %Al, 0.169 %Fe, 0.269 %Si, $44.53, spread =  8
16 [28 25 31 ] 99.278 %Al, 0.204 %Fe, 0.285 %Si, $41.53, spread =  6
17 [42 41 37 ] 99.501 %Al, 0.115 %Fe, 0.198 %Si, $48.71, spread =  5
                                        Sum = $781.45, MxSprd =  8
```

6.1.3 Max Spread = 11

```
 1 [40 49 51 ] 99.301 %Al, 0.205 %Fe, 0.295 %Si, $41.53, spread = 11
 2 [35 33 34 ] 99.358 %Al, 0.156 %Fe, 0.278 %Si, $44.53, spread =  2
 3 [ 5  3  7 ] 99.512 %Al, 0.188 %Fe, 0.212 %Si, $48.71, spread =  4
```

```
 4 [29 31 28 ] 99.257 %Al, 0.160 %Fe, 0.310 %Si, $41.53, spread =  3
 5 [ 4  6  9 ] 99.386 %Al, 0.217 %Fe, 0.204 %Si, $44.53, spread =  5
 6 [36 32 26 ] 99.524 %Al, 0.048 %Fe, 0.266 %Si, $48.71, spread = 10
 7 [39 44 47 ] 99.500 %Al, 0.124 %Fe, 0.270 %Si, $48.71, spread =  8
 8 [25 18 16 ] 99.527 %Al, 0.153 %Fe, 0.256 %Si, $48.71, spread =  9
 9 [41 50 48 ] 99.351 %Al, 0.151 %Fe, 0.329 %Si, $44.53, spread =  9
10 [14 22 24 ] 99.362 %Al, 0.083 %Fe, 0.335 %Si, $44.53, spread = 10
11 [13 23 19 ] 99.251 %Al, 0.258 %Fe, 0.213 %Si, $41.53, spread = 10
12 [30 27 20 ] 99.530 %Al, 0.104 %Fe, 0.212 %Si, $48.71, spread = 10
13 [46 42 45 ] 99.502 %Al, 0.140 %Fe, 0.056 %Si, $48.71, spread =  4
14 [21 10 17 ] 99.369 %Al, 0.239 %Fe, 0.344 %Si, $44.53, spread = 11
15 [37 43 38 ] 99.519 %Al, 0.169 %Fe, 0.143 %Si, $48.71, spread =  6
16 [11 12 15 ] 99.361 %Al, 0.068 %Fe, 0.309 %Si, $44.53, spread =  4
17 [ 8  1  2 ] 99.526 %Al, 0.042 %Fe, 0.230 %Si, $48.71, spread =  7
                                           Sum = $781.45, MxSprd = 11
```

7 My Best Solutions

These were found by using standard simulated annealing in C.

7.1 No Max Spread

```
 1 [13  4 26 ] 99.253 %Al, 0.210 %Fe, 0.373 %Si, $41.53, spread = 22
 2 [31 46 17 ] 99.500 %Al, 0.135 %Fe, 0.144 %Si, $48.71, spread = 29
 3 [49 14 29 ] 99.251 %Al, 0.207 %Fe, 0.314 %Si, $41.53, spread = 35
 4 [23 27 30 ] 99.505 %Al, 0.105 %Fe, 0.199 %Si, $48.71, spread =  7
 5 [20 50 10 ] 99.351 %Al, 0.220 %Fe, 0.327 %Si, $44.53, spread = 40
 6 [ 8 34 19 ] 99.353 %Al, 0.244 %Fe, 0.155 %Si, $44.53, spread = 26
 7 [ 1 48 24 ] 99.355 %Al, 0.069 %Fe, 0.342 %Si, $44.53, spread = 47
 8 [32  6  2 ] 99.500 %Al, 0.146 %Fe, 0.227 %Si, $48.71, spread = 30
 9 [40 36  7 ] 99.501 %Al, 0.169 %Fe, 0.121 %Si, $48.71, spread = 33
10 [28 25 43 ] 99.252 %Al, 0.218 %Fe, 0.369 %Si, $41.53, spread = 18
11 [21 45 16 ] 99.357 %Al, 0.199 %Fe, 0.232 %Si, $44.53, spread = 29
12 [ 9 47 39 ] 99.501 %Al, 0.095 %Fe, 0.228 %Si, $48.71, spread = 38
13 [37 35 11 ] 99.501 %Al, 0.067 %Fe, 0.277 %Si, $48.71, spread = 26
14 [22 15  3 ] 99.500 %Al, 0.089 %Fe, 0.165 %Si, $48.71, spread = 19
15 [18 42 44 ] 99.750 %Al, 0.044 %Fe, 0.136 %Si, $57.35, spread = 26
16 [51  5 38 ] 99.351 %Al, 0.192 %Fe, 0.349 %Si, $44.53, spread = 46
17 [41 33 12 ] 99.353 %Al, 0.099 %Fe, 0.305 %Si, $44.53, spread = 29
                                           Sum = $790.09, MxSprd = 47
```

7.2 Max Spread = 6

```
 1 [44,49,48,] 99.511 %Al, 0.169 %Fe, 0.145 %Si, $48.71, spread=5
 2 [18,19,21,] 99.512 %Al, 0.163 %Fe, 0.187 %Si, $48.71, spread=3
```

```
 3 [43,47,46,] 99.359 %Al, 0.172 %Fe, 0.315 %Si, $44.53, spread=4
 4 [9,11,12,] 99.535 %Al, 0.015 %Fe, 0.265 %Si, $48.71, spread=3
 5 [27,24,22,] 99.502 %Al, 0.068 %Fe, 0.194 %Si, $48.71, spread=5
 6 [36,39,34,] 99.502 %Al, 0.139 %Fe, 0.173 %Si, $48.71, spread=5
 7 [25,23,28,] 99.267 %Al, 0.185 %Fe, 0.332 %Si, $41.53, spread=5
 8 [38,37,42,] 99.650 %Al, 0.118 %Fe, 0.067 %Si, $52.44, spread=5
 9 [51,50,45,] 99.256 %Al, 0.198 %Fe, 0.351 %Si, $41.53, spread=6
 10 [2,7,5,] 99.505 %Al, 0.182 %Fe, 0.208 %Si, $48.71, spread=5
 11 [29,26,31,] 99.372 %Al, 0.094 %Fe, 0.350 %Si, $44.53, spread=5
 12 [16,14,20,] 99.298 %Al, 0.164 %Fe, 0.379 %Si, $41.53, spread=6
 13 [33,32,30,] 99.541 %Al, 0.070 %Fe, 0.160 %Si, $48.71, spread=3
 14 [6,8,10,] 99.352 %Al, 0.257 %Fe, 0.275 %Si, $44.53, spread=4
 15 [3,1,4,] 99.363 %Al, 0.151 %Fe, 0.284 %Si, $44.53, spread=3
 16 [13,15,17,] 99.276 %Al, 0.220 %Fe, 0.261 %Si, $41.53, spread=4
 17 [35,40,41,] 99.335 %Al, 0.141 %Fe, 0.317 %Si, $41.53, spread=6
Sum = $779.18, MxSprd = 6
```

7.3 Max Spread = 8

```
 1 [8,1,6,] 99.358 %Al, 0.130 %Fe, 0.315 %Si, $44.53, spread=7
 2 [24,27,21,] 99.506 %Al, 0.091 %Fe, 0.245 %Si, $48.71, spread=6
 3 [26,31,29,] 99.372 %Al, 0.094 %Fe, 0.350 %Si, $44.53, spread=5
 4 [32,40,34,] 99.353 %Al, 0.199 %Fe, 0.210 %Si, $44.53, spread=8
 5 [46,44,41,] 99.507 %Al, 0.108 %Fe, 0.191 %Si, $48.71, spread=5
 6 [22,15,18,] 99.514 %Al, 0.064 %Fe, 0.164 %Si, $48.71, spread=7
 7 [17,13,20,] 99.359 %Al, 0.191 %Fe, 0.305 %Si, $44.53, spread=7
 8 [38,33,35,] 99.501 %Al, 0.105 %Fe, 0.167 %Si, $48.71, spread=5
 9 [47,39,43,] 99.370 %Al, 0.153 %Fe, 0.341 %Si, $44.53, spread=8
 10 [7,2,5,] 99.505 %Al, 0.182 %Fe, 0.208 %Si, $48.71, spread=5
 11 [51,45,50,] 99.256 %Al, 0.198 %Fe, 0.351 %Si, $41.53, spread=6
 12 [12,16,19,] 99.362 %Al, 0.204 %Fe, 0.275 %Si, $44.53, spread=7
 13 [11,9,14,] 99.381 %Al, 0.080 %Fe, 0.297 %Si, $44.53, spread=5
 14 [36,30,37,] 99.654 %Al, 0.098 %Fe, 0.129 %Si, $52.44, spread=7
 15 [10,3,4,] 99.357 %Al, 0.278 %Fe, 0.244 %Si, $44.53, spread=7
 16 [49,48,42,] 99.513 %Al, 0.147 %Fe, 0.139 %Si, $48.71, spread=7
 17 [28,25,23,] 99.267 %Al, 0.185 %Fe, 0.332 %Si, $41.53, spread=5
Sum = $784.00, MxSprd = 8
```

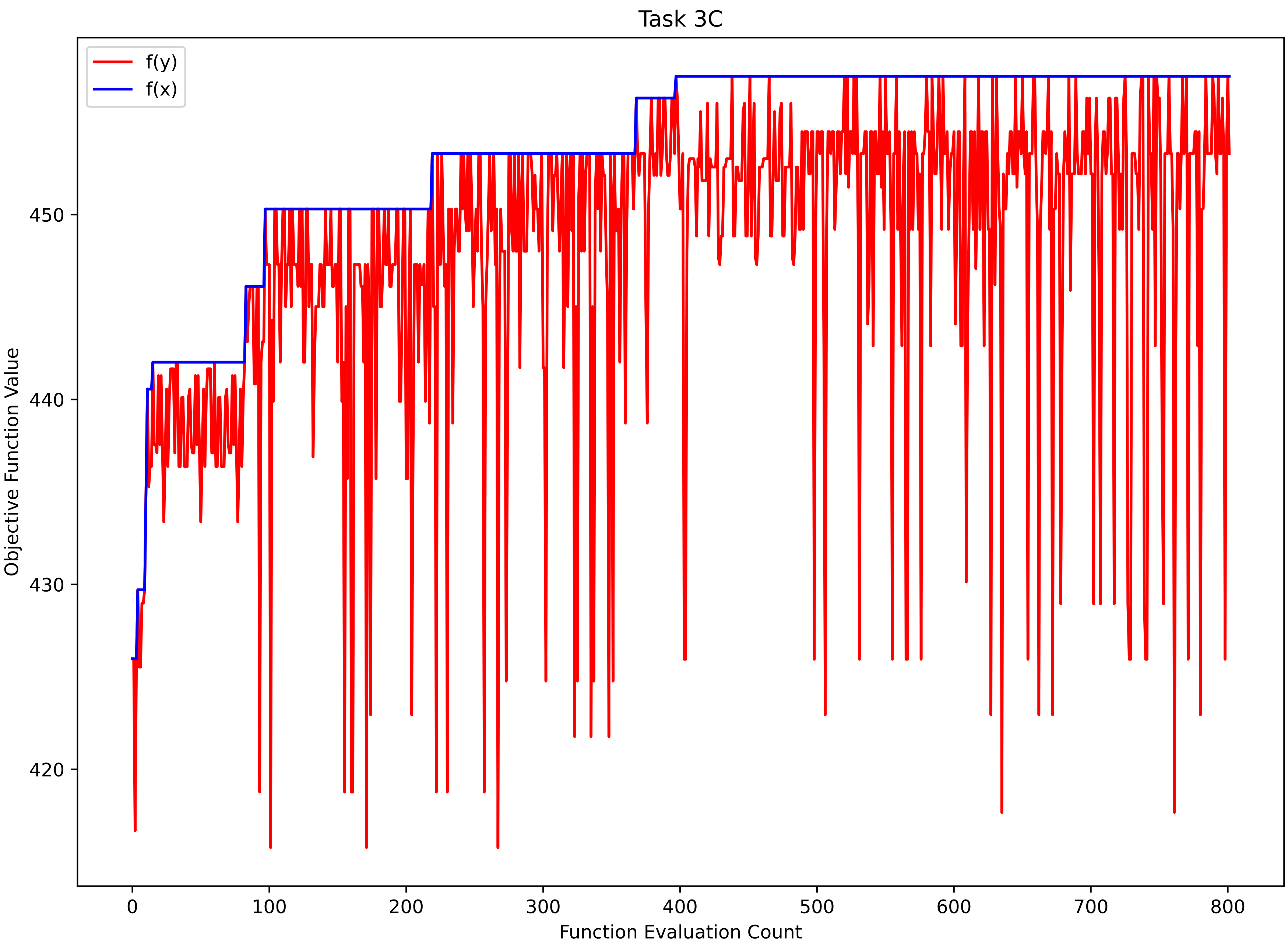
7.4 Max Spread = 11

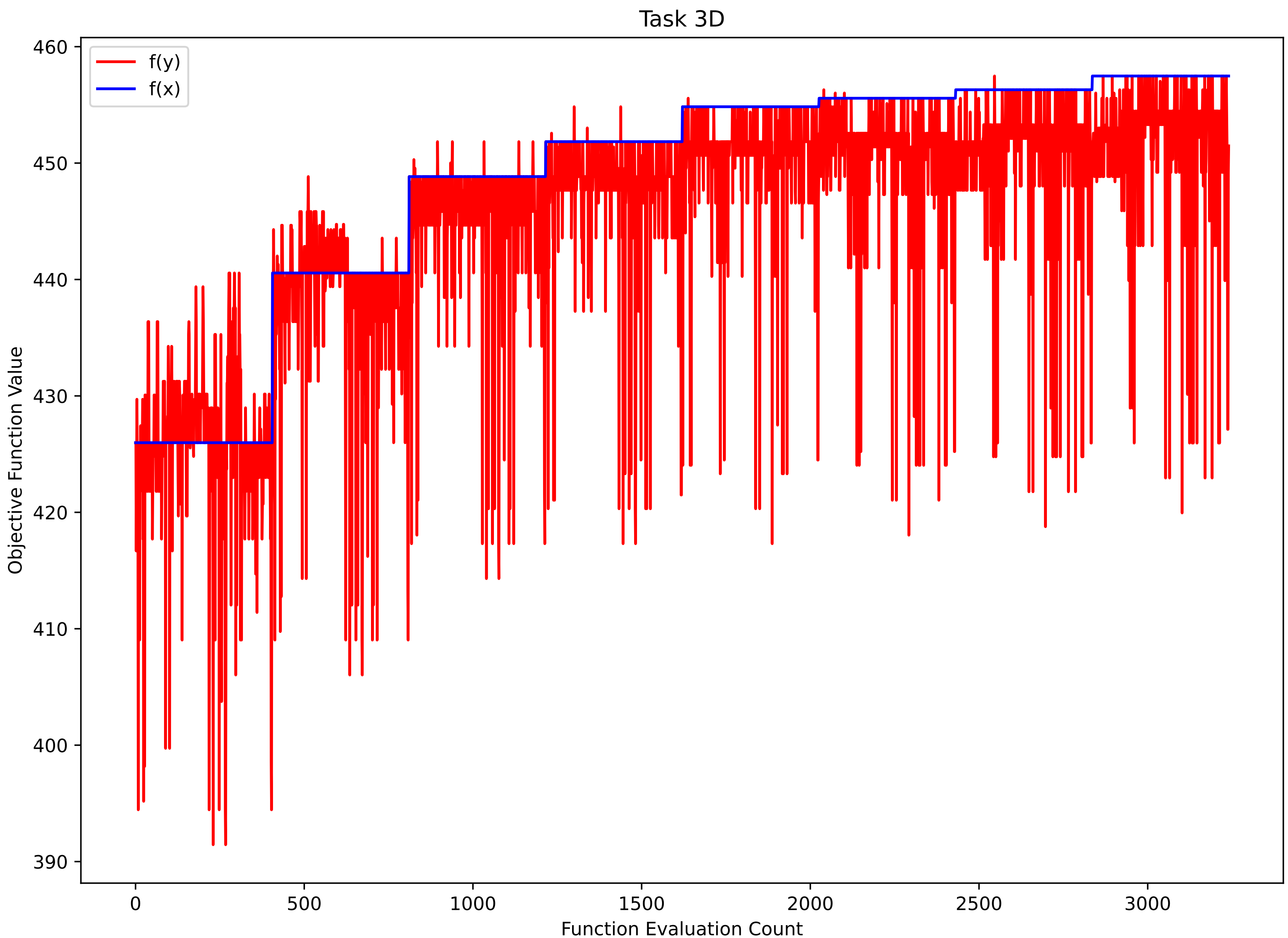
```
 1 [24,19,26,] 99.355 %Al, 0.140 %Fe, 0.305 %Si, $44.53, spread=7
 2 [27,33,37,] 99.500 %Al, 0.148 %Fe, 0.086 %Si, $48.71, spread=10
 3 [38,28,34,] 99.262 %Al, 0.236 %Fe, 0.270 %Si, $41.53, spread=10
 4 [48,50,41,] 99.351 %Al, 0.151 %Fe, 0.329 %Si, $44.53, spread=9
 5 [49,43,51,] 99.294 %Al, 0.189 %Fe, 0.367 %Si, $41.53, spread=8
 6 [44,47,39,] 99.500 %Al, 0.124 %Fe, 0.270 %Si, $48.71, spread=8
```

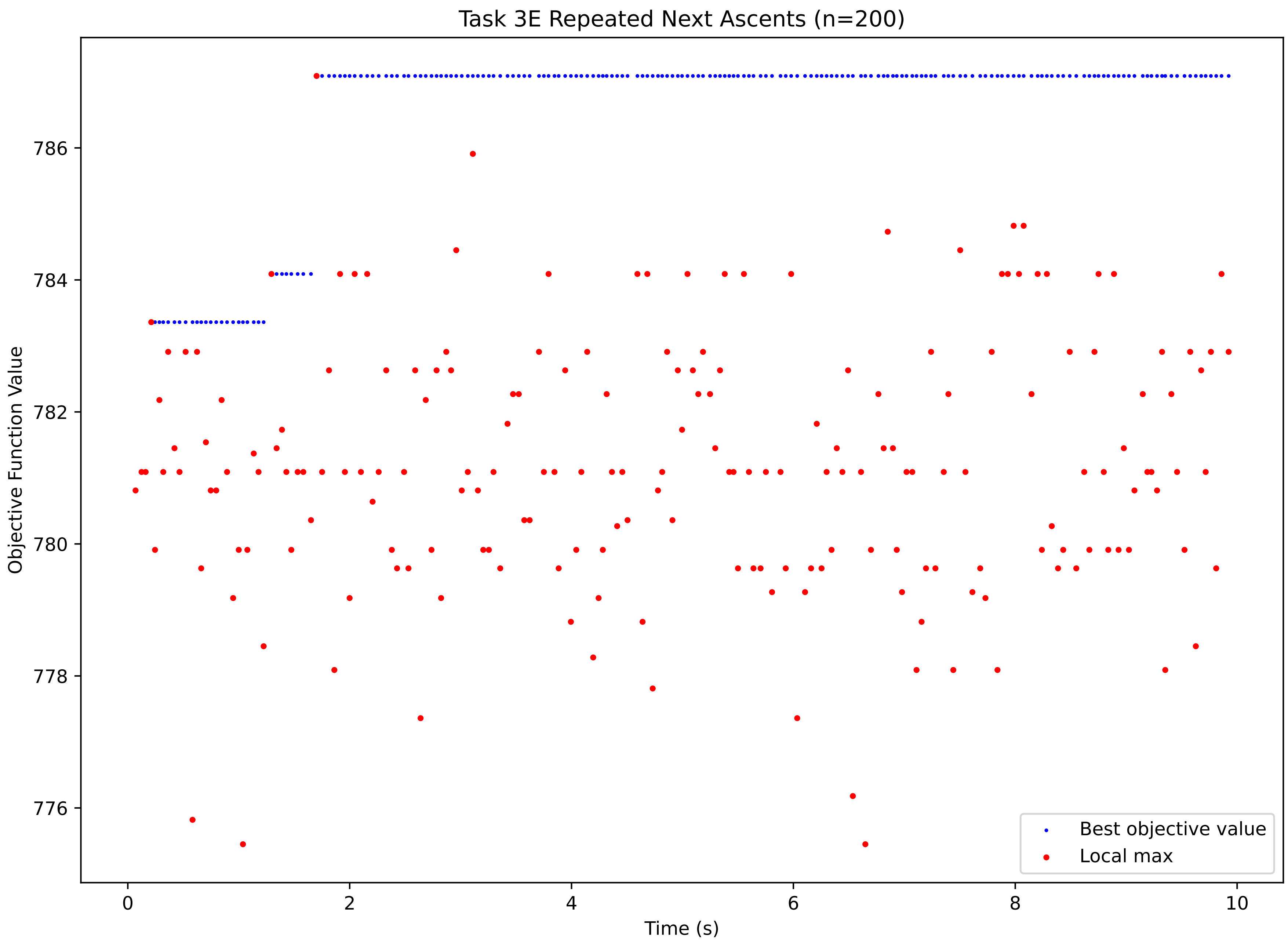
```
 7 [42,36,45,] 99.504 %Al, 0.145 %Fe, 0.069 %Si, $48.71, spread=9
 8 [35,46,40,] 99.504 %Al, 0.110 %Fe, 0.193 %Si, $48.71, spread=11
 9 [4,3,1,] 99.363 %Al, 0.151 %Fe, 0.284 %Si, $44.53, spread=3
 10 [10,6,8,] 99.352 %Al, 0.257 %Fe, 0.275 %Si, $44.53, spread=4
 11 [32,31,21,] 99.501 %Al, 0.089 %Fe, 0.201 %Si, $48.71, spread=11
 12 [14,15,12,] 99.251 %Al, 0.139 %Fe, 0.370 %Si, $41.53, spread=3
 13 [9,11,17,] 99.512 %Al, 0.072 %Fe, 0.221 %Si, $48.71, spread=8
 14 [30,20,23,] 99.503 %Al, 0.072 %Fe, 0.255 %Si, $48.71, spread=10
 15 [29,25,18,] 99.505 %Al, 0.134 %Fe, 0.271 %Si, $48.71, spread=11
 16 [16,13,22,] 99.374 %Al, 0.167 %Fe, 0.288 %Si, $44.53, spread=9
 17 [7,2,5,] 99.505 %Al, 0.182 %Fe, 0.208 %Si, $48.71, spread=5
Sum = $785.63, MxSprd = 11
```

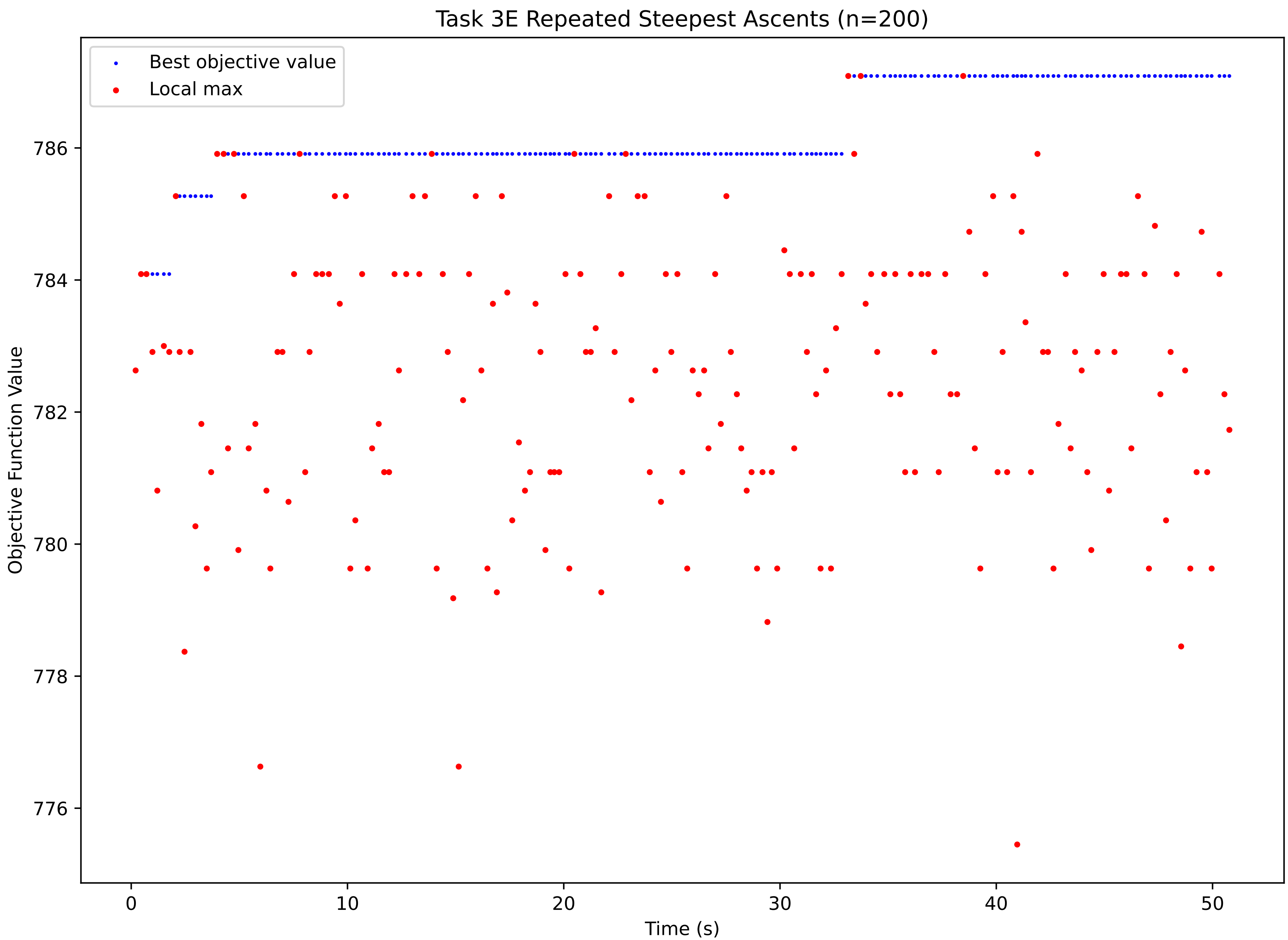
8 Appendix A

See overleaf


Task 3C
f(y)
f(x)
Objective Function Value
420
430
440
450
Function Evaluation Count
0
100
200
300
400
500
600
700
800


Task 3D
f(y)
f(x)
Objective Function Value
Function Evaluation Count
460
450
440
430
420
410
400
390
0
500
1000
1500
2000
2500
3000


Task 3E Repeated Next Ascents (n=200)
Objective Function Value
786
784
782
780
778
776
0
2
4
6
8
10
Time (s)
Best objective value
Local max



Task 3E Repeated Steepest Ascents (n=200)
Best objective value
Local max
Objective Function Value
776
778
780
782
784
786
Time (s)
0
10
20
30
40
50