Simulated Annealing

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Simulated Annealing

- Initial T is high
- T ↑ → P(accept worse solution) ↑
- T decreases with time
- Exit when $T=T_{cutoff}$
- Longer run → Better solution

Initial Solution

- Pure random – ridiculously high cost, hard to optimize
- Path scanning – near optimal

Path Scanning

- Based on rules
  - Maximize cost/demand
  - Minimize cost/demand
  - Maximize return cost
  - Minimize return cost
  - ……

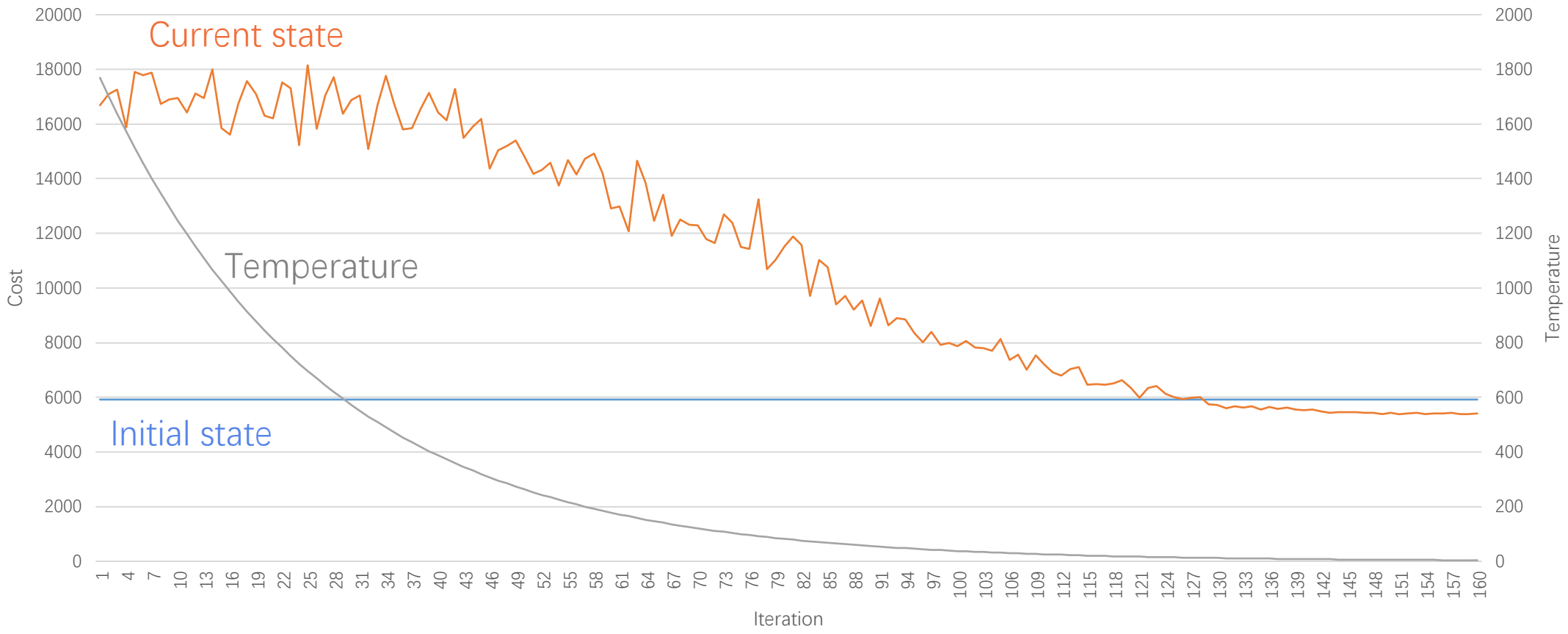
Simulated Annealing

- Randomly alter solution
  - Exchange two edges
  - Remove an edge and insert it elsewhere
  - Reverse the direction of an edge
  - ……
- Accept or reject new solution
  - Better – accept
  - Worse – accept with probability (related to T and ΔE)
- End iteration
  - Tried enough of times
  - Changed enough of times

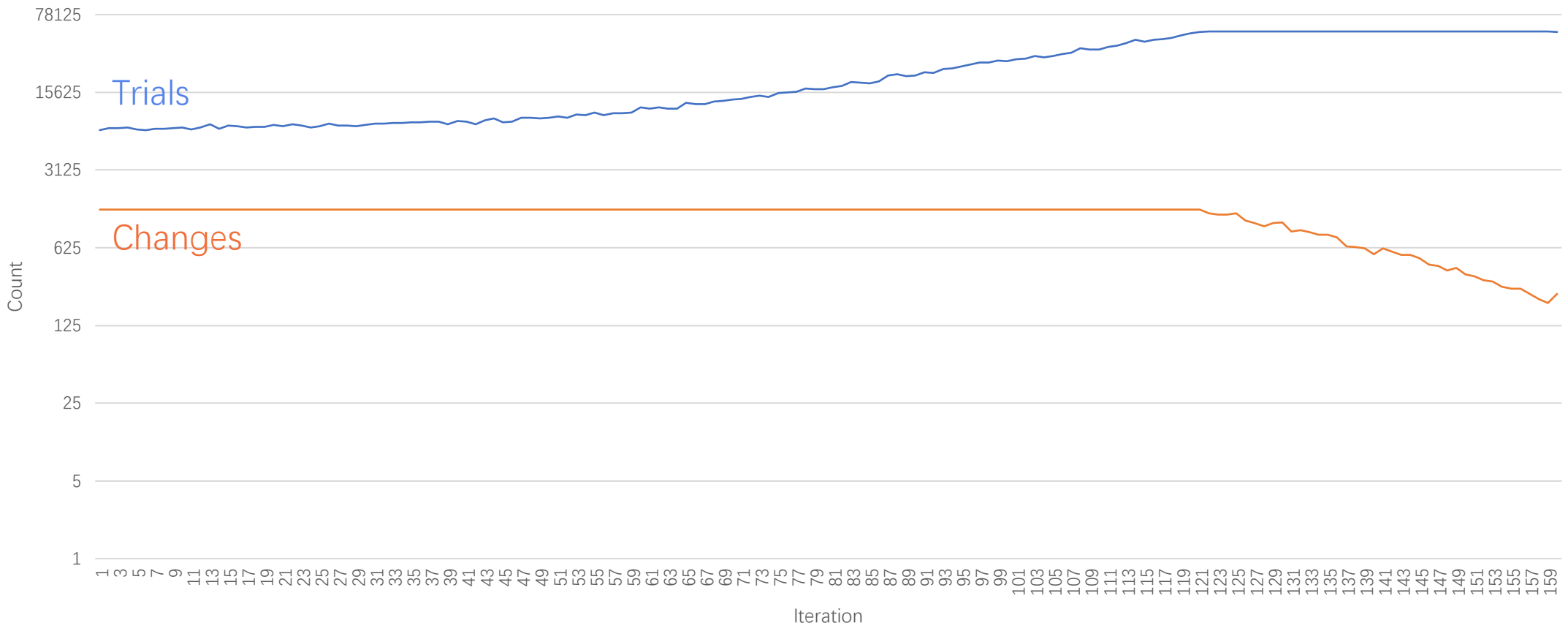
Initialization

- T_{init}
  - Should be related to specific case
  - Solution – sampling
  - Accept solution with P_{init}
- T_{final}
  - T_{init}/FACTOR
- Cooling speed
  - Related to time given
  - Solution – also sampling
  - Low temperature at the end

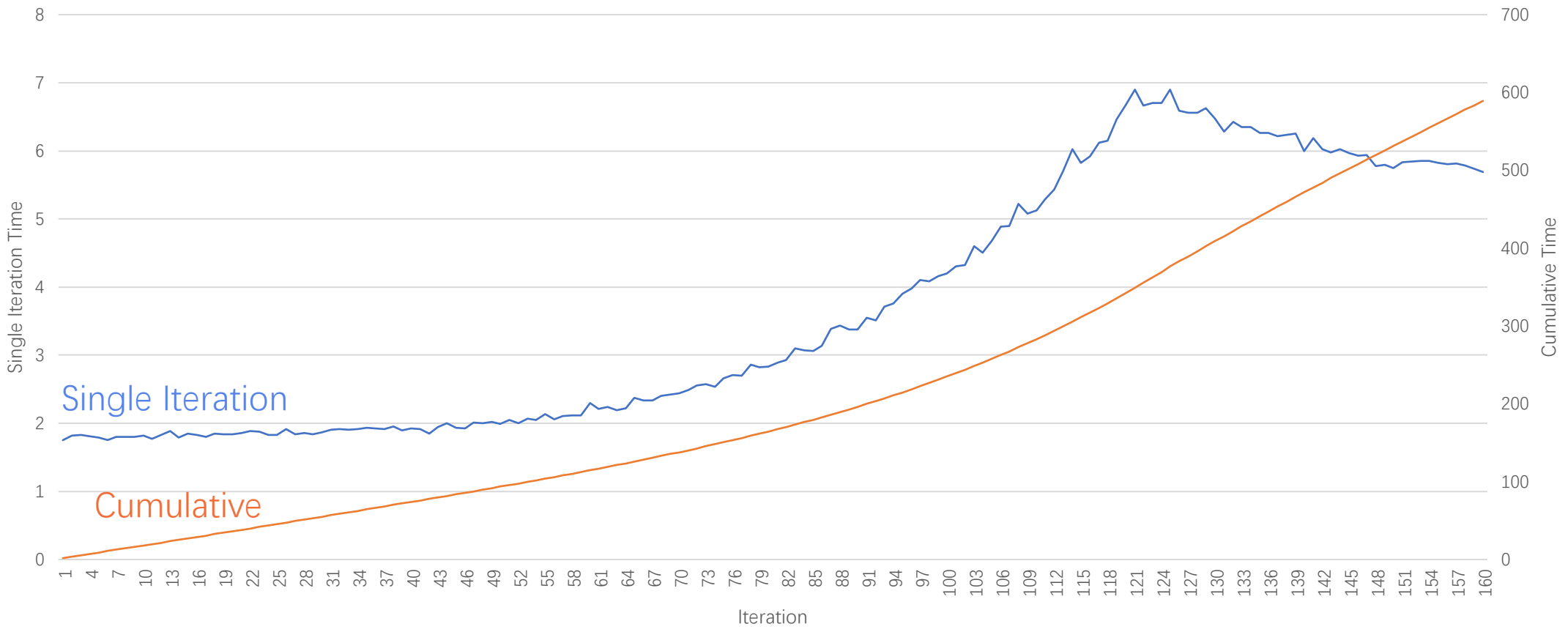
Iterations – egl-s1-A



Iterations – egl-s1-A



Time – egl-s1-A


Single Iteration Time
Cumulative Time
Iteration
Single Iteration
Cumulative
0
1
2
3
4
5
6
7
8
0
100
200
300
400
500
600
700
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85 88 91 94 97 100 103 106 109 112 115 118 121 124 127 130 133 136 139 142 145 148 151 154 157 160

Performance

Time	gdb1	%	gdb10	%
0	329		332	
10	316	3.95	298	10.24
20	316	3.95	297	10.54
30	319	3.04	295	11.14
60	316	3.95	285	14.16
90	316	3.95	283	14.76

Performance

Time	val1A	%	val4A	%	val7A	%
0	196		438		323	
30	187	4.59	435	0.68	308	4.64
60	179	8.67	438	0.00	308	4.64
120	177	9.69	430	1.83	296	8.36
240	177	9.69	418	4.57	296	8.36

Performance

Time	egl-e1-A	%	egl-s1-A	%
0	4089		5917	
60	3820	6.58	5768	2.52
180	3818	6.63	5619	5.04
300	3739	8.56	5684	3.94
420	3756	8.14	5556	6.10
600	3617	11.54	5372	9.21