

# 1001 Inter Group Meeting (Temp)

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# Global Setting

- Objective function with the third term
- 50 seeds on  $ER(500,0.5)$  for testing with fixed number of initialization (10 by default), and 10 seeds on  $ER(500,0.5)$  for testing with fixed time.
- Maximum iteration set to 1500 for fixed initialization testing and 150 for fix time testing.

# Scipy and Handcraft L-BFGS

- Comparison by solution size: (L-BFGS-B indicates Scipy's solver)

	L-BFGS-B	Handcraft L-BFGS-B
Average solution size	11.26	10.78

- Comparison by iteration number/time:

	L-BFGS-B	Handcraft L-BFGS-B
Average iteration number	167.1	23.05
Average time	0.7411	0.1991* (median 0.0569)

# Outlier Case

- In seed 43, we have one run taking much more steps

```
===== Seed 43 =====  
Number of connected components: 1  
ER(500, 0.5, seed=43): Handcrafted projected L-BFGS-B  
init 0 → MIS size 11, iters 31, time 0.1986s  
init 1 → MIS size 10, iters 12, time 0.1333s  
init 2 → MIS size 10, iters 37, time 0.1756s  
init 3 → MIS size 9, iters 1651, time 21.4177s  
init 4 → MIS size 9, iters 21, time 2.2249s  
init 5 → MIS size 10, iters 12, time 0.9097s  
init 6 → MIS size 10, iters 23, time 1.8231s  
init 7 → MIS size 9, iters 20, time 1.8830s  
init 8 → MIS size 9, iters 16, time 2.0477s  
init 9 → MIS size 11, iters 13, time 1.3393s
```

# Handcrafted better than Scipy

- Skipped Cauchy point?
- Cheaper line search? Larger initial steps?  
(Strong Wolfe in Scipy vs Armijo in ours)

# How Useful is Cauchy Point?

- Without Cauchy point and with Cauchy point on the same instance  $ER(500, 0.5, seed = 0)$  with max iteration 1500 for a 10 initializations testing.

	Without Cauchy Point	With Cauchy Point
Best solution size	11	11
Average iteration number	19	315.8
Average runtime	0.0531	0.8783

- Two initializations hitting max iter when using Cauchy point.

# Time Limitation Testing

- Comparing Scipy's L-BFGS-B and the handcrafted version (Ours)

	Scipy's L-BFGS-B	Ours
ER(500,0.5), 5 sec	11.1	11.9
ER(1000,0.5), 5 sec	11.2	12.0
ER(1000,0.5), 10 sec	11.6	12.4
ER(2000,0.5), 10 sec	11.8	12.5
ER(2000,0.5), 20 sec	11.8	13.2

CCCP Newton