

Appendix B

Clustering Metrics for Excluding Infrequent Itemsets

This appendix gives detailed results for the experiments conducted in Chapter 4, Section 4.1. In particular, it gives clustering metrics for each test case, along with the corresponding choice of experimental inputs. The results are presented Tables B-1 through B-5, corresponding to the 5 data sets employed.

Table B-1: Clustering metrics for hybrid distances with reduced computational complexity via *minsup*, for “Collagen” data set. Red and black text marks standard-versus-hybrid distance comparisons.

Linkage	Distances	Frequent itemsets	Clustering metric
complete	pairwise	$o_3, k = 1$	0.6000
complete	o_3^4	$o_3, k = 1$	1.0000
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
average	pairwise	$o_3, k = 1$	0.6000
average	o_3^4	$o_3, k = 1$	1.0000
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
single	pairwise	$o_3, k = 1$	0.3750
single	o_3^4	$o_3, k = 1$	1.0000
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
complete	pairwise	$o_3, k = 5$	0.5713

complete	o_3^4	$o_3, k = 5$	0.7557
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.7557
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.6813
average	pairwise	$o_3, k = 5$	0.7100
average	o_3^4	$o_3, k = 5$	0.7700
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.7700
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.7557
single	pairwise	$o_3, k = 5$	0.5450
single	o_3^4	$o_3, k = 5$	0.7900
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.7900
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.7900
complete	pairwise	$o_3, k = 10$	0.5990
complete	o_3^4	$o_3, k = 10$	0.6854
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.6854
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.6482
average	pairwise	$o_3, k = 10$	0.6779
average	o_3^4	$o_3, k = 10$	0.7050
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.7050
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.6979
single	pairwise	$o_3, k = 10$	0.4600
single	o_3^4	$o_3, k = 10$	0.7150
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.7150
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.7150
complete	pairwise	$o_4, k = 1$	0.8000
complete	o_4^4	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
average	pairwise	$o_4, k = 1$	0.8000
average	o_4^4	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
single	pairwise	$o_4, k = 1$	0.5000
single	o_4^4	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000

single	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
complete	pairwise	$o_4, k = 5$	0.5867
complete	o_4^4	$o_4, k = 5$	0.6429
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.6429
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.6429
average	pairwise	$o_4, k = 5$	0.6629
average	o_4^4	$o_4, k = 5$	0.7000
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.7000
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.7000
single	pairwise	$o_4, k = 5$	0.3000
single	o_4^4	$o_4, k = 5$	0.7000
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.7000
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.7000
complete	pairwise	$o_4, k = 10$	0.5511
complete	o_4^4	$o_4, k = 10$	0.5873
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.5873
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.5873
average	pairwise	$o_4, k = 10$	0.6424
average	o_4^4	$o_4, k = 10$	0.6533
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.6533
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.6578
single	pairwise	$o_4, k = 10$	0.3000
single	o_4^4	$o_4, k = 10$	0.6533
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.6533
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.6578

Table B-2: Clustering metrics for hybrid distances with reduced computational complexity via *minsup*, for “Quantum Gravity and Strings” data set. Red and black text marks standard-vs-hybrid distance comparisons.

Linkage	Distances	Frequent itemsets	Clustering metric
complete	pairwise	$o_3, k = 1$	1.0000
complete	o_3^4	$o_3, k = 1$	1.0000
complete	$o_3^4, minsup = 2$	$o_3, k = 1$	1.0000
complete	$o_3^4, minsup = 4$	$o_3, k = 1$	1.0000
average	pairwise	$o_3, k = 1$	1.0000
average	o_3^4	$o_3, k = 1$	1.0000
average	$o_3^4, minsup = 2$	$o_3, k = 1$	1.0000
average	$o_3^4, minsup = 4$	$o_3, k = 1$	1.0000
single	pairwise	$o_3, k = 1$	1.0000
single	o_3^4	$o_3, k = 1$	1.0000
single	$o_3^4, minsup = 2$	$o_3, k = 1$	1.0000
single	$o_3^4, minsup = 4$	$o_3, k = 1$	1.0000
complete	pairwise	$o_3, k = 5$	0.9000
complete	o_3^4	$o_3, k = 5$	0.9500
complete	$o_3^4, minsup = 2$	$o_3, k = 5$	0.9500
complete	$o_3^4, minsup = 4$	$o_3, k = 5$	0.9500
average	pairwise	$o_3, k = 5$	0.9000
average	o_3^4	$o_3, k = 5$	0.9500
average	$o_3^4, minsup = 2$	$o_3, k = 5$	0.9500
average	$o_3^4, minsup = 4$	$o_3, k = 5$	0.9500
single	pairwise	$o_3, k = 5$	0.9000
single	o_3^4	$o_3, k = 5$	0.9500
single	$o_3^4, minsup = 2$	$o_3, k = 5$	0.9500
single	$o_3^4, minsup = 4$	$o_3, k = 5$	0.9500
complete	pairwise	$o_3, k = 10$	0.7123
complete	o_3^4	$o_3, k = 10$	0.7545
complete	$o_3^4, minsup = 2$	$o_3, k = 10$	0.7545
complete	$o_3^4, minsup = 4$	$o_3, k = 10$	0.7120

average	pairwise	$o_3, k = 10$	0.7425
average	o_3^4	$o_3, k = 10$	0.7975
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.7975
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.7975
single	pairwise	$o_3, k = 10$	0.6857
single	o_3^4	$o_3, k = 10$	0.8029
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.8029
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.8029
complete	pairwise	$o_4, k = 1$	0.6667
complete	o_4^4	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
average	pairwise	$o_4, k = 1$	0.8000
average	o_4^4	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
single	pairwise	$o_4, k = 1$	0.5714
single	o_4^4	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
complete	pairwise	$o_4, k = 5$	0.7394
complete	o_4^4	$o_4, k = 5$	0.8061
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.8061
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.7493
average	pairwise	$o_4, k = 5$	0.7933
average	o_4^4	$o_4, k = 5$	0.7476
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.7476
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.7667
single	pairwise	$o_4, k = 5$	0.7286
single	o_4^4	$o_4, k = 5$	0.7822
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.7822
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.7667
complete	pairwise	$o_4, k = 10$	0.7030
complete	o_4^4	$o_4, k = 10$	0.7364
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7364

complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.7080
average	pairwise	$o_4, k = 10$	0.7433
average	o_4^4	$o_4, k = 10$	0.7205
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7205
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.7300
single	pairwise	$o_4, k = 10$	0.6500
single	o_4^4	$o_4, k = 10$	0.7378
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7378
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.7300

Table B-3: Clustering metrics for hybrid distances with reduced computational complexity via *minsup*, for “Wavelets (1-500)” data set. Red and black text marks standard-versus-hybrid distance comparisons.

Linkage	Distances	Frequent itemsets	Clustering metric
complete	pairwise	$o_3, k = 1$	1.0000
complete	o_3^4	$o_3, k = 1$	1.0000
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
average	pairwise	$o_3, k = 1$	1.0000
average	o_3^4	$o_3, k = 1$	1.0000
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
single	pairwise	$o_3, k = 1$	1.0000
single	o_3^4	$o_3, k = 1$	1.0000
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
complete	pairwise	$o_3, k = 5$	0.5722
complete	o_3^4	$o_3, k = 5$	0.8700
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.8700
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.8700
average	pairwise	$o_3, k = 5$	0.5972
average	o_3^4	$o_3, k = 5$	0.8700
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.8700
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.8700
single	pairwise	$o_3, k = 5$	0.4069
single	o_3^4	$o_3, k = 5$	0.8700
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.8700
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.8700
complete	pairwise	$o_3, k = 10$	0.5222
complete	o_3^4	$o_3, k = 10$	0.7800
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.7800
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.7106

average	pairwise	$o_3, k = 10$	0.5336
average	o_3^4	$o_3, k = 10$	0.7800
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.7800
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.7800
single	pairwise	$o_3, k = 10$	0.3609
single	o_3^4	$o_3, k = 10$	0.7800
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.7800
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.7800
complete	pairwise	$o_4, k = 1$	1.0000
complete	o_4^4	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	0.8000
average	pairwise	$o_4, k = 1$	1.0000
average	o_4^4	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	0.8000
single	pairwise	$o_4, k = 1$	0.2857
single	o_4^4	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	0.8000
complete	pairwise	$o_4, k = 5$	0.2593
complete	o_4^4	$o_4, k = 5$	0.8800
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.8800
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.8800
average	pairwise	$o_4, k = 5$	0.3296
average	o_4^4	$o_4, k = 5$	0.8800
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.8800
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.8800
single	pairwise	$o_4, k = 5$	0.2684
single	o_4^4	$o_4, k = 5$	0.8800
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.8800
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.8400
complete	pairwise	$o_4, k = 10$	0.1667
complete	o_4^4	$o_4, k = 10$	0.7867
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7867

complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.5496
average	pairwise	$o_4, k = 10$	0.2407
average	o_4^4	$o_4, k = 10$	0.7867
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7867
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.5496
single	pairwise	$o_4, k = 10$	0.2277
single	o_4^4	$o_4, k = 10$	0.7867
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7867
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.5296

Table B-4: Clustering metrics for hybrid distances with reduced computational complexity via *minsup*, for “Wavelets and Brownian” data set. Red and black text marks standard-vs-hybrid distance comparisons.

Linkage	Distances	Frequent itemsets	Clustering metric
complete	pairwise	$o_3, k = 1$	1.0000
complete	o_3^4	$o_3, k = 1$	1.0000
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
complete	$o_3^4, \text{minsup} = 8$	$o_3, k = 1$	1.0000
average	pairwise	$o_3, k = 1$	1.0000
average	o_3^4	$o_3, k = 1$	1.0000
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
average	$o_3^4, \text{minsup} = 8$	$o_3, k = 1$	1.0000
single	pairwise	$o_3, k = 1$	0.6000
single	o_3^4	$o_3, k = 1$	1.0000
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	1.0000
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	1.0000
single	$o_3^4, \text{minsup} = 8$	$o_3, k = 1$	1.0000
complete	pairwise	$o_3, k = 5$	0.5600
complete	o_3^4	$o_3, k = 5$	0.6857
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.6857
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.6857
complete	$o_3^4, \text{minsup} = 8$	$o_3, k = 5$	0.7057
average	pairwise	$o_3, k = 5$	0.6857
average	o_3^4	$o_3, k = 5$	0.7057
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.7057
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.7057
average	$o_3^4, \text{minsup} = 8$	$o_3, k = 5$	0.7057
single	pairwise	$o_3, k = 5$	0.5657
single	o_3^4	$o_3, k = 5$	0.7057
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.7057

single	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.7057
single	$o_3^4, \text{minsup} = 8$	$o_3, k = 5$	0.7057
complete	pairwise	$o_3, k = 10$	0.5800
complete	o_3^4	$o_3, k = 10$	0.6479
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.6479
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.6479
complete	$o_3^4, \text{minsup} = 8$	$o_3, k = 10$	0.6379
average	pairwise	$o_3, k = 10$	0.6479
average	o_3^4	$o_3, k = 10$	0.6379
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.6379
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.6379
average	$o_3^4, \text{minsup} = 8$	$o_3, k = 10$	0.6379
single	pairwise	$o_3, k = 10$	0.5314
single	o_3^4	$o_3, k = 10$	0.6379
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.6379
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.6379
single	$o_3^4, \text{minsup} = 8$	$o_3, k = 10$	0.6379
complete	pairwise	$o_4, k = 1$	0.6667
complete	o_4^4	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
average	pairwise	$o_4, k = 1$	1.0000
average	o_4^4	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
single	pairwise	$o_4, k = 1$	0.8000
single	o_4^4	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
complete	pairwise	$o_4, k = 5$	0.6667
complete	o_4^4	$o_4, k = 5$	0.8133
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.8133
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.8133
average	pairwise	$o_4, k = 5$	0.7600

average	o_4^4	$o_4, k = 5$	0.8133
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.8133
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.8133
single	pairwise	$o_4, k = 5$	0.7543
single	o_4^4	$o_4, k = 5$	0.8133
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.8133
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.8133
complete	pairwise	$o_4, k = 10$	0.6810
complete	o_4^4	$o_4, k = 10$	0.7343
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7343
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.7343
average	pairwise	$o_4, k = 10$	0.6933
average	o_4^4	$o_4, k = 10$	0.7343
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7343
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.7343
single	pairwise	$o_4, k = 10$	0.6514
single	o_4^4	$o_4, k = 10$	0.7343
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.7343
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.7343

Table B-5: Clustering metrics for hybrid distances with reduced computational complexity via *minsup*, for “Wavelets and Brownian” data set with bibliographic coupling. Red and black text marks standard-versus-hybrid distance comparisons.

Linkage	Distances	Frequent itemsets	Clustering metric
complete	pairwise	$o_3, k = 1$	0.0508
complete	o_3^4	$o_3, k = 1$	0.1071
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	0.0508
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	0.0508
average	pairwise	$o_3, k = 1$	0.2500
average	o_3^4	$o_3, k = 1$	0.5000
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	0.5000
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	0.5000
single	pairwise	$o_3, k = 1$	0.2308
single	o_3^4	$o_3, k = 1$	0.6000
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 1$	0.6000
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 1$	0.5000
complete	pairwise	$o_3, k = 5$	0.3305
complete	o_3^4	$o_3, k = 5$	0.5129
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.4903
complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.4903
average	pairwise	$o_3, k = 5$	0.5500
average	o_3^4	$o_3, k = 5$	0.7200
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.7200
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.7200
single	pairwise	$o_3, k = 5$	0.5923
single	o_3^4	$o_3, k = 5$	0.7400
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 5$	0.7400
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 5$	0.7200
complete	pairwise	$o_3, k = 10$	0.1907
complete	o_3^4	$o_3, k = 10$	0.5714
complete	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.5602

complete	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.5353
average	pairwise	$o_3, k = 10$	0.3125
average	o_3^4	$o_3, k = 10$	0.6825
average	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.6825
average	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.6783
single	pairwise	$o_3, k = 10$	0.4115
single	o_3^4	$o_3, k = 10$	0.6825
single	$o_3^4, \text{minsup} = 2$	$o_3, k = 10$	0.6825
single	$o_3^4, \text{minsup} = 4$	$o_3, k = 10$	0.6825
complete	pairwise	$o_4, k = 1$	0.0678
complete	o_4^4	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
average	pairwise	$o_4, k = 1$	0.1000
average	o_4^4	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
single	pairwise	$o_4, k = 1$	0.3077
single	o_4^4	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 1$	1.0000
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 1$	1.0000
complete	pairwise	$o_4, k = 5$	0.0678
complete	o_4^4	$o_4, k = 5$	0.6450
complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.6336
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.6336
average	pairwise	$o_4, k = 5$	0.2400
average	o_4^4	$o_4, k = 5$	0.7333
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.7261
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.7422
single	pairwise	$o_4, k = 5$	0.3077
single	o_4^4	$o_4, k = 5$	0.7533
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 5$	0.7533
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 5$	0.7533
complete	pairwise	$o_4, k = 10$	0.0678
complete	o_4^4	$o_4, k = 10$	0.5275

complete	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.5103
complete	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.5103
average	pairwise	$o_4, k = 10$	0.1700
average	o_4^4	$o_4, k = 10$	0.6600
average	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.6491
average	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.6733
single	pairwise	$o_4, k = 10$	0.3077
single	o_4^4	$o_4, k = 10$	0.6900
single	$o_4^4, \text{minsup} = 2$	$o_4, k = 10$	0.6900
single	$o_4^4, \text{minsup} = 4$	$o_4, k = 10$	0.6900