

1 **SUPPLEMENTAL TABLES S1**

2 **Clustering assessment in weighted networks**

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	Louvain	leading eigen	label prop	Walktrap	spin-glass	ground truth
↑ internal density	0.39 0.479(0.02)	0.384 0.362(0.64)	0.311 0.131(1)	0.39 0.33(0.83)	0.46 0.531(0.11)	3.90e-01
↑ edges inside	197 42.6(1)	194 61(1)	252 640(0)	196 22.4(1)	95.7 40.9(1)	1.96e+02
↑ av degree	11.5 5.77(1)	11.3 5.62(1)	11.7 12.8(0)	11.4 2.66(1)	8.92 5.85(1)	1.15e+01
↑ FOMD	0.38 0.0805(1)	0.38 0.0939(1)	0.38 0.45(0)	0.38 0.0359(1)	0.25 0.084(1)	3.80e-01
↓ expansion	0.67 3.51(0)	0.73 3.59(0)	0.53 0.16(1)	0.68 5.07(0)	1.94 3.47(0)	6.70e-01
↓ cut ratio	0.00931 0.041(0)	0.00997 0.0444(0)	0.00783 0.0408(0)	0.00945 0.0581(0)	0.0245 0.0401(0)	9.31e-03
↓ conductance	0.0785 0.381(0)	0.089 0.398(0)	0.0621 0.0125(1)	0.08 0.654(0)	0.159 0.375(0)	7.86e-02
↓ norm cut	0.101 0.42(0)	0.112 0.452(0)	0.0839 0.148(0)	0.103 0.699(0)	0.195 0.412(0)	1.01e-01
↓ max ODF	0.164 0.528(0)	0.215 0.552(0)	0.203 0.00875(1)	0.222 0.673(0)	0.266 0.521(0)	1.66e-01
↓ average ODF	0.142 0.544(0)	0.157 0.563(0)	0.113 0.0259(1)	0.144 0.762(0)	0.272 0.536(0)	1.41e-01
↓ flake ODF	0.72 0.996(0)	0.72 0.994(0)	0.62 0.17(1)	0.7 0.975(0)	0.9 0.995(0)	7.10e-01
↑ clustering coef	0.312 0.011(1)	0.31 0.00904(1)	0.303 0.00563(1)	0.312 0.00402(1)	0.352 0.0109(1)	3.12e-01
↑ modularity	0.454 0.307(1)	0.447 0.242(1)	0.411 0.000267(1)	0.453 0.082(1)	0.446 0.321(1)	4.54e-01
n_communities	4 7.8(0)	4 6.84(0.02)	3 1.01(1)	4 21.8(0)	5 8.51(0)	4.00e+00
VIdist_to_GT	0.122 4.45(0)	0.299 4.17(0)	0.361 1.86(0)	0.122 4.35(0)	0.521 4.52(0)	0.00e+00

**Table 1.** Values of scoring functions for the weighted SBM graph generated with  $\lambda = 15$  (left), compared to those of their averages for 100 randomized samples (right), and its percentile rank (parentheses).

	Louvain	leading eigen	label prop	Walktrap	spin-glass	ground truth
↑ internal density	1.29 1.6(0.13)	1.32 1.24(0.69)	1.07 1.17(0.4)	1.32 1.5(0.42)	1.29 1.7(0.06)	0.7574
↑ edges inside	50.4 30.5(0.99)	47.4 37.5(0.82)	83.4 106(0.57)	51.8 41.9(0.75)	50.4 28.6(1)	103.0000
↑ av degree	10.1 8.26(1)	9.94 7.98(1)	11.6 10.4(0.72)	10.1 8.44(0.9)	10.1 8.21(1)	12.1176
↑ FOMD	0.412 0.29(0.99)	0.412 0.273(0.99)	0.471 0.38(0.71)	0.382 0.299(0.82)	0.412 0.288(0.98)	0.4412
↓ expansion	1.74 2.67(0)	1.82 2.81(0)	0.971 1.99(0.0886)	1.74 2.57(0.08)	1.74 2.69(0)	0.7353
↓ cut ratio	0.0716 0.0994(0)	0.0739 0.11(0)	0.0469 0.0994(0.0253)	0.0727 0.101(0.06)	0.0716 0.0987(0)	0.0433
↓ conductance	0.149 0.257(0)	0.179 0.293(0.02)	0.0784 0.18(0.114)	0.148 0.273(0.05)	0.149 0.264(0)	0.0573
↓ norm cut	0.194 0.302(0)	0.223 0.349(0)	0.119 0.25(0)	0.194 0.328(0.01)	0.194 0.307(0)	0.1038
↓ max ODF	0.216 0.394(0)	0.246 0.396(0.04)	0.0441 0.274(0.0506)	0.211 0.382(0.06)	0.216 0.399(0.01)	0.0833
↓ average ODF	0.183 0.389(0)	0.215 0.442(0)	0.114 0.292(0.0759)	0.185 0.391(0.01)	0.183 0.397(0)	0.0871
↓ flake ODF	0.559 0.946(0)	0.588 0.941(0)	0.5 0.827(0.0759)	0.559 0.921(0.01)	0.559 0.95(0)	0.3824
↑ clustering coef	0.245 0.031(1)	0.241 0.0226(1)	0.243 0.0248(1)	0.247 0.029(1)	0.245 0.0303(1)	0.2205
↑ modularity	0.445 0.373(0.99)	0.437 0.309(1)	0.435 0.241(1)	0.44 0.307(1)	0.445 0.376(0.99)	0.3914
n_communities	4 5.23(0)	5 5.44(0.26)	3 3.55(0.36)	4 6.16(0.03)	4 5.74(0)	2.0000
VIdist_to_GT	1.2 3.18(0)	1.34 3(0)	0.747 2.23(0)	1.17 3.1(0)	1.2 3.27(0)	0.0000

**Table 2.** Values of scoring functions for the karate club graph (left), compared to those of their averages for 100 randomized samples (right), and its percentile rank (parentheses).

	Louvain	leading eigen	label prop	Walktrap	spin-glass
↑ internal density	0.657 0.579(1)	0.587 0.548(1)	0.52 0.52(0)	0.586 0.408(1)	0.628 0.573(1)
↑ edges inside	186 117(0.94)	434 333(1)	1562 1562(0)	434 687(0.45)	253 149(1)
↑ av degree	14.4 11(0.96)	22.3 18.3(1)	40 40(0)	22.2 22(0.51)	17 12.5(1)
↑ FOMD	0 0(0)	0 0(0)	0.5 0.5(0)	0 0.135(0)	0 0(0)
↓ expansion	12.8 14.5(0.04)	8.89 10.9(0)	- (-)	8.9 12.3(0.301)	11.5 13.8(0)
↓ cut ratio	0.232 0.251(0)	0.229 0.25(0)	- (-)	0.229 0.254(0)	0.229 0.25(0)
↓ conductance	0.492 0.575(0.06)	0.285 0.381(0)	- (-)	0.286 0.52(0.247)	0.415 0.526(0)
↓ norm cut	0.585 0.665(0.04)	0.419 0.51(0)	- (-)	0.419 0.622(0.205)	0.522 0.626(0)
↓ max ODF	0.643 0.727(0.03)	0.472 0.544(0.04)	- (-)	0.443 0.619(0.301)	0.567 0.688(0)
↓ average ODF	0.649 0.726(0.05)	0.445 0.543(0)	- (-)	0.445 0.617(0.301)	0.58 0.687(0)
↓ flake ODF	1 1(0)	1 1(0)	- (-)	1 1(0)	1 1(0)
↑ clustering coef	0.87 0.585(1)	0.863 0.562(1)	0.812 0.539(1)	0.864 0.421(1)	0.884 0.583(1)
↑ modularity	0.0576 0.0158(1)	0.0558 0.0136(1)	-1.6e-14 -3.73e-16(0)	0.0553 0.000591(1)	0.06 0.0187(1)
n_communities	4 4.21(0.06)	2 2.45(0)	1 1(0)	2 19.3(0.27)	3 3.6(0)

**Table 3.** Values of scoring functions for the Forex graph (left), compared to those of their averages for 100 randomized samples (right), and its percentile rank (parentheses). ”-” indicates the degenerate cases for which a given score is not defined.

	Louvain	leading eigen	label prop	Walktrap	spin-glass
↑ internal density	0.235 0.183(1)	0.204 0.0997(1)	0.0574 0.0539(1)	0.444 0.244(1)	0.249 0.185(1)
↑ edges inside	5631 3779(1)	9051 5935(1)	21692 21771(0)	7123 2088(1)	5755 3409(1)
↑ av degree	35.7 24.9(1)	39 29(1)	48.4 48.4(0)	39.4 21.1(1)	36 24.9(1)
↑ FOMD	0.38 0.31(1)	0.392 0.35(1)	0.493 0.493(0)	0.384 0.244(1)	0.378 0.302(1)
↓ expansion	6.38 11.8(0)	4.69 9.74(0)	0.00334 -(-)	4.49 13.7(0)	6.2 11.8(0)
↓ cut ratio	0.0108 0.0219(0)	0.0108 0.0272(0)	0.000558 -(-)	0.00791 0.0205(0)	0.0106 0.02(0)
↓ conductance	0.205 0.391(0)	0.154 0.271(0)	0.000702 -(-)	0.22 0.57(0)	0.202 0.412(0)
↓ norm cut	0.259 0.472(0)	0.219 0.384(0)	0.111 -(-)	0.27 0.636(0)	0.257 0.487(0)
↓ max ODF	0.229 0.509(0)	0.178 0.481(0)	0.00111 -(-)	0.277 0.7(0)	0.199 0.534(0)
↓ average ODF	0.241 0.518(0)	0.185 0.425(0)	0.00113 -(-)	0.266 0.701(0)	0.238 0.54(0)
↓ flake ODF	0.759 0.999(0)	0.605 0.999(0)	0.00445 -(-)	0.727 1(0)	0.747 0.999(0)
↑ clustering coef	0.296 0.233(1)	0.152 0.221(0)	0.0437 0.217(0)	0.222 0.187(1)	0.289 0.226(1)
↑ modularity	0.373 0.149(1)	0.334 0.122(1)	0.000276 -1.13e-14(1)	0.342 0.0973(1)	0.372 0.152(1)
n_communities	14 8.1(1)	10 2.3(1)	2 1(1)	82 76.7(0.6)	16 12.4(1)

**Table 4.** Values of scoring functions for the News on Corporations graph (left), compared to those of their averages for 100 randomized samples (right), and its percentile rank (parentheses).

	Louvain	leading eigen	label prop	Walktrap	spin-glass
↑ internal density	109 43(1)	57.3 24.4(0.98)	158 8.93(1)	65 7.23(1)	26.2 39.5(0)
↑ edges inside	14828 10482(0.89)	11351 23434(0.33)	7350 111195(0)	10451 121642(0)	6612 4502(0.99)
↑ av degree	1047 583(1)	963 650(0.94)	902 1255(0)	1001 1322(0)	440 482(0.07)
↑ FOMD	0.44 0.26(1)	0.391 0.267(0.94)	0.386 0.488(0)	0.413 0.5(0)	0.163 0.195(0.02)
↓ expansion	113 370(0)	155 357(0)	186 36.4(1)	136 -(-)	417 420(0.35)
↓ cut ratio	0.787 2.58(0)	1 3.05(0)	1.13 17(0)	0.851 -(-)	2.66 2.55(0.91)
↓ conductance	0.113 0.414(0)	0.162 0.407(0)	0.224 0.0167(1)	0.162 -(-)	0.564 0.534(0.9)
↓ norm cut	0.133 0.471(0)	0.182 0.481(0)	0.24 0.15(1)	0.177 -(-)	0.611 0.566(1)
↓ max ODF	0.248 0.608(0)	0.303 0.569(0.0426)	0.32 0.00558(1)	0.29 -(-)	0.824 0.695(1)
↓ average ODF	0.207 0.6(0)	0.308 0.578(0)	0.353 0.0277(1)	0.296 -(-)	0.713 0.705(0.63)
↓ flake ODF	0.935 0.998(0)	0.957 0.997(0)	0.967 0.423(1)	0.962 -(-)	0.989 0.999(0)
↑ clustering coef	0.0837 0.194(0)	0.0902 0.19(0)	0.123 0.19(0)	0.112 0.191(0)	0.0351 0.195(0)
↑ modularity	0.673 0.27(1)	0.615 0.202(1)	0.615 0.1(1)	0.639 0(1)	0.226 0.251(0.07)
n_communities	10 6.22(1)	12 9.54(0.74)	31 1.94(1)	19 1(1)	12 12.8(0.27)

**Table 5.** Values of scoring functions for the Enron graph (left), compared to those of their averages for 100 randomized samples (right), and its percentile rank (parentheses).

	Louvain	leading eigen	label prop	Walktrap	spin-glass
↑ internal density	45.3 3.17(1)	15.8 1.22(1)	98 1.19(1)	1.54 0(1)	4.37 5.48(0)
↑ edges inside	255578 86181(1)	1076946 223193(1)	5690431 1230459(1)	896171 0(1)	52171 113572(0)
↑ av degree	3680 342(1)	3639 499(1)	6572 1298(1)	1663 0(1)	577 337(1)
↑ FOMD	0.404 0.217(1)	0.375 0.287(0.9)	0.497 0.5(0)	0.23 0(1)	0.131 0.222(0)
↓ expansion	1594 478(1)	1615 400(1)	148 0.337(1)	2603 649(1)	3146 481(1)
↓ cut ratio	0.906 0.354(1)	1.27 0.374(1)	0.856 0.0422(1)	1.83 0.342(1)	1.81 0.401(1)
↓ conductance	0.307 0.54(0)	0.31 0.434(0.1)	0.0191 0.00021(1)	0.594 1(0)	0.858 0.49(1)
↓ norm cut	0.324 0.6(0)	0.378 0.535(0.1)	0.127 -(0.667)	0.658 1(0)	0.894 0.561(1)
↓ max ODF	0.0311 0.626(0)	0.0371 0.553(0)	0.00862 0.00189(0.9)	0.432 1(0)	0.857 0.58(1)
↓ average ODF	0.334 0.668(0)	0.478 0.563(0.1)	0.187 0.000483(1)	0.636 1(0)	0.924 0.822(1)
↓ flake ODF	0.767 0.996(0)	0.763 0.993(0)	0.209 0.0839(0.7)	0.864 0.999(0)	0.974 0.996(0)
↑ clustering coef	0.00417 0.147(0)	0.00127 0.147(0)	0.00179 0.15(0)	0.00031 0(1)	0.0038 0.143(0)
↑ modularity	0.461 0.122(1)	0.277 0.0676(1)	0.0778 0.00077(1)	0.0502 -0.00268(1)	-0.00289 0.119(0)
n_communities	26 13.7(1)	26 7.7(1)	26 3.3(1)	822 1899(0)	24 23.4(0.4)

**Table 6.** Values of scoring functions for the social network graph (left), compared to those their averages for 10 randomized samples (right), and its percentile rank (parentheses).

	original				randomized			
	VI	RMI	ARI	n_clusters	VI	RMI	ARI	n_clusters
Louvain	0.19	0.73	0.75	5.00	0.65	0.20	0.24	7.26
leading eigen	0.19	0.72	0.76	4.67	0.72	0.09	0.17	7.03
label prop	0.22	0.67	0.77	5.48	0.26	0.00	0.18	4.40
Walktrap	0.14	0.80	0.81	4.99	0.70	0.07	0.13	9.60
spinglass	0.39	0.45	0.53	5.74	0.76	0.08	0.19	7.82

**Table 7.** Mean values of the metrics after bootstrapping with  $R = 999$ , for both the WSBM graph and its randomized counterpart, for all tested clustering algorithms

	original				randomized			
	VI	RMI	ARI	n_clusters	VI	RMI	ARI	n_clusters
Louvain	0.27	0.66	0.67	5.57	0.49	0.39	0.42	5.49
leading eigen	0.28	0.64	0.72	5.66	0.55	0.30	0.39	5.79
label prop	0.26	0.63	0.71	5.01	0.50	0.36	0.33	4.86
Walktrap	0.27	0.68	0.71	5.94	0.42	0.49	0.47	6.57
spinglass	0.62	0.20	0.38	6.34	0.62	0.22	0.35	6.04

**Table 8.** Mean values of the metrics after bootstrapping with  $R = 999$ , for both the Zachary graph and its randomized counterpart, for all tested clustering algorithms

	original				randomized			
	VI	RMI	ARI	n_clusters	VI	RMI	ARI	n_clusters
Louvain	0.32	0.52	0.55	3.13	0.66	0.04	0.15	3.34
leading eigen	0.25	0.47	0.62	2.34	0.40	0.10	0.19	2.18
label prop	0.00			1.00	0.00		1.00	1.00
Walktrap	0.24	0.49	0.62	2.41	0.61	0.00	0.00	31.60
spinglass	0.28	0.54	0.60	3.07	0.63	0.08	0.18	3.10

**Table 9.** Mean values of the metrics after bootstrapping with  $R = 999$ , for both the Forex graph and its randomized counterpart, for all tested clustering algorithms

	original				randomized			
	VI	RMI	ARI	n_clusters	VI	RMI	ARI	n_clusters
Louvain	0.34	0.42	0.59	27.51	0.70	0.07	0.08	23.47
leading eigen	0.27	0.40	0.75	27.50	0.32	0.24	0.24	23.40
label prop	0.08	0.79	0.86	21.16	0.03	-0.00	0.00	16.62
Walktrap	0.30	0.42	0.50	85.00	0.18	0.06	0.07	91.70
spinglass	0.63	-0.12	0.13	30.65	0.94	-0.14	0.00	26.01

**Table 10.** Mean values of the metrics after bootstrapping with  $R = 999$  , for both the News graph and its randomized counterpart, for all tested clustering algorithms

	original				randomized			
	VI	RMI	ARI	n_clusters	VI	RMI	ARI	n_clusters_rnd
Louvain	0.30	0.60	0.54	10.34	0.63	0.09	0.12	5.48
leading eigen	0.42	0.46	0.40	12.78	0.50	0.14	0.20	5.96
label prop	0.34	0.54	0.48	16.36	0.02	0.22	0.48	1.44
Walktrap	0.32	0.58	0.51	17.08	1.36	0.00	0.03	170.93
spinglass	0.93	-0.20	0.03	12.63	0.74	0.08	0.13	9.36

**Table 11.** Mean values of the metrics after bootstrapping with  $R = 999$  , for both the Enron graph and its randomized counterpart, for all tested clustering algorithms