

# Tiny Example I: the One in the Paper

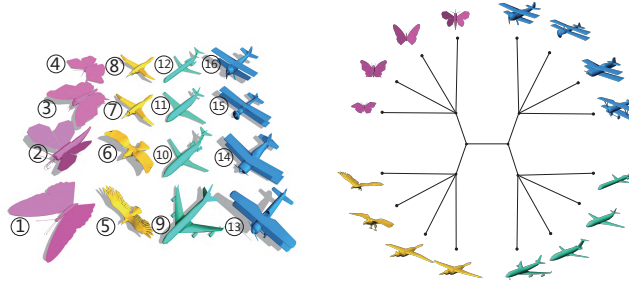
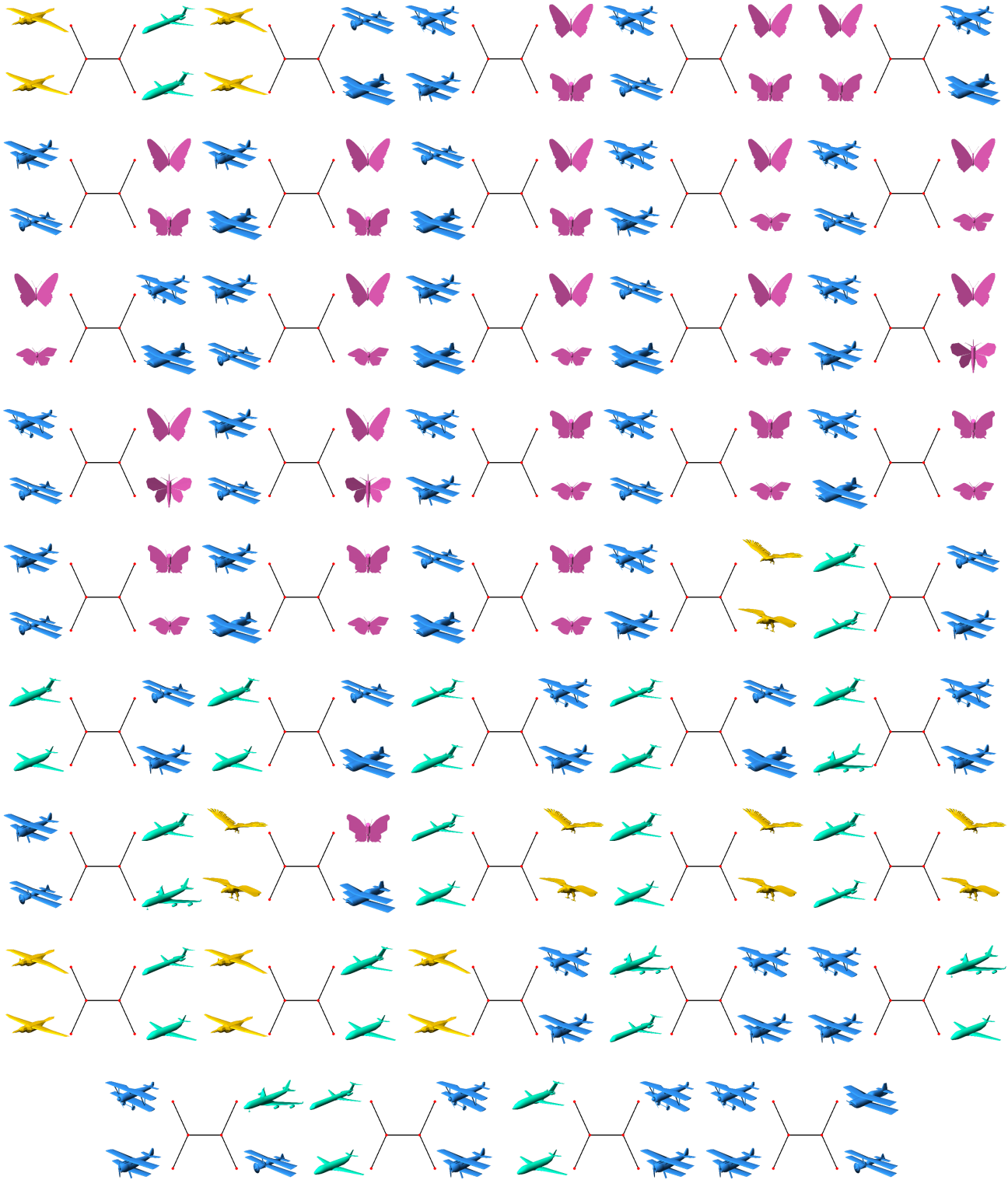


Figure 1: The shape set and the C-tree shown in Figure 2 in the paper.

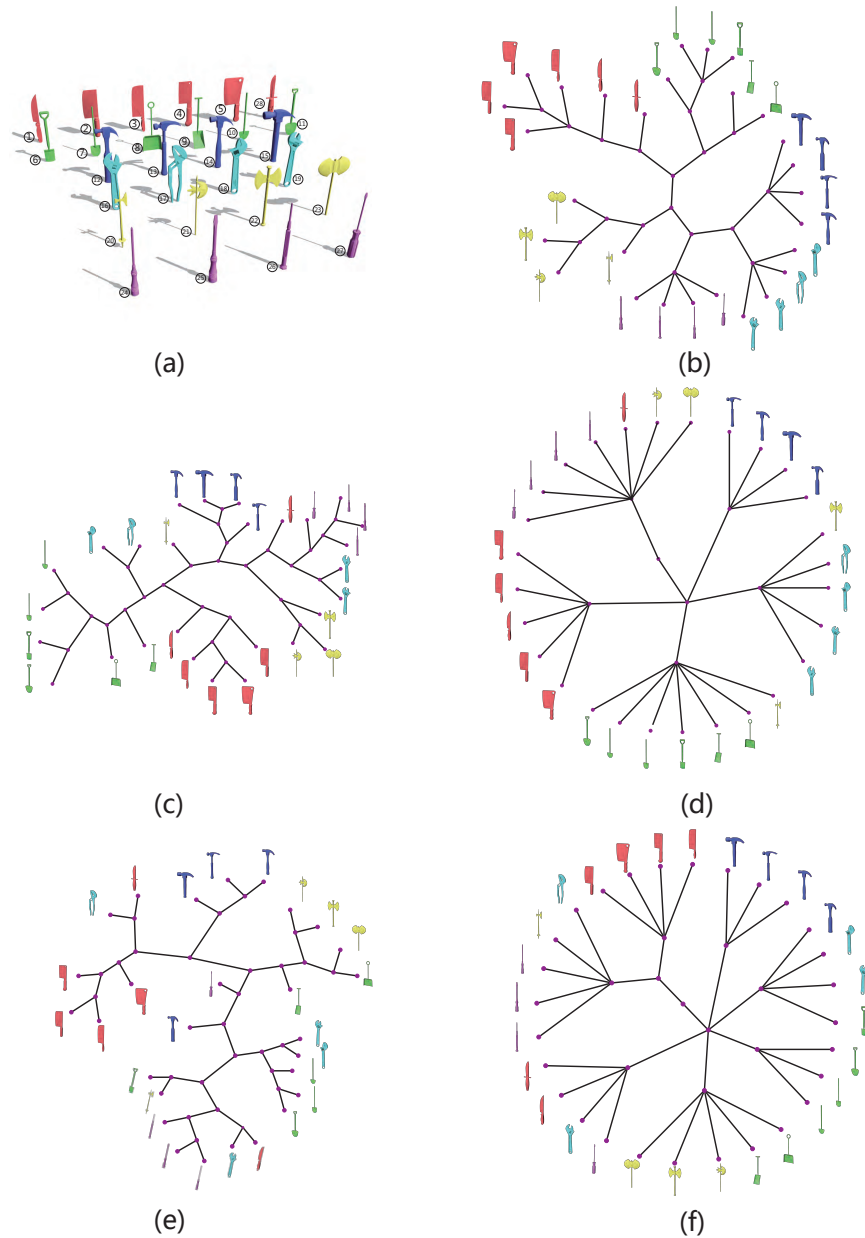
0.0	835.2	823.5	833.3	926.5	883.1	874.9	868.1	933.0	890.1	902.5	897.8	947.1	938.7	958.7	954.2
835.2	0.0	898.0	905.2	963.9	917.3	893.1	898.2	926.0	896.5	903.6	913.7	948.6	918.6	941.5	965.7
823.5	898.0	0.0	847.5	916.5	901.2	879.2	879.9	926.0	911.2	917.4	912.0	954.9	945.6	959.7	950.9
833.3	905.2	847.5	0.0	932.9	909.3	855.7	857.2	956.0	883.9	922.3	866.2	967.4	970.4	978.6	973.7
926.5	963.9	916.5	932.9	0.0	790.1	870.3	866.5	944.9	903.3	893.3	880.9	971.9	969.3	965.4	979.6
883.1	917.3	901.2	909.3	790.1	0.0	822.7	823.6	870.0	840.5	843.6	842.4	896.7	879.0	841.8	885.3
874.9	893.1	879.2	855.7	870.3	822.7	0.0	498.1	814.9	785.7	792.3	756.9	867.9	825.5	835.5	819.3
868.1	898.2	879.9	857.2	866.5	823.6	498.1	0.0	821.4	801.7	775.8	761.9	871.8	831.3	833.9	814.5
933.0	926.0	926.0	956.0	944.9	870.0	814.9	821.4	0.0	766.8	820.1	807.0	884.4	864.7	871.3	873.2
890.1	896.5	911.2	883.9	903.3	840.5	785.7	801.7	766.8	0.0	724.5	664.7	890.5	845.4	876.0	870.8
902.5	903.6	917.4	922.3	893.3	843.6	792.3	775.8	820.1	724.5	0.0	795.3	889.7	828.6	867.2	852.1
897.8	913.7	912.0	866.2	880.9	842.4	756.9	761.9	807.0	664.7	795.3	0.0	910.5	870.7	873.6	878.8
947.1	948.6	954.9	967.4	971.9	896.7	867.9	871.8	884.4	890.5	889.7	910.5	0.0	834.7	783.8	774.2
938.7	918.6	945.6	970.4	969.3	879.0	825.5	831.3	864.7	845.4	828.6	870.7	834.7	0.0	731.9	759.0
958.7	941.5	959.7	978.6	965.4	841.8	835.5	833.9	871.3	876.0	867.2	873.6	783.8	731.9	0.0	761.7
954.2	965.7	950.9	973.7	979.6	885.3	819.3	814.5	873.2	870.8	852.1	878.8	774.2	759.0	761.7	0.0
0.00	0.38	0.27	0.30	0.39	0.38	0.30	0.30	0.27	0.31	0.31	0.29	0.37	0.32	0.30	0.36
0.38	0.00	0.42	0.56	0.42	0.39	0.42	0.41	0.42	0.50	0.50	0.49	0.32	0.42	0.41	0.29
0.27	0.42	0.00	0.28	0.50	0.39	0.33	0.34	0.29	0.33	0.29	0.31	0.29	0.27	0.31	0.34
0.30	0.56	0.28	0.00	0.55	0.50	0.40	0.42	0.33	0.34	0.32	0.29	0.48	0.39	0.37	0.50
0.39	0.42	0.50	0.55	0.00	0.24	0.37	0.36	0.41	0.41	0.45	0.41	0.38	0.49	0.42	0.42
0.38	0.39	0.39	0.50	0.24	0.00	0.31	0.30	0.32	0.36	0.37	0.37	0.32	0.39	0.33	0.35
0.30	0.42	0.33	0.40	0.37	0.31	0.00	0.04	0.24	0.27	0.26	0.25	0.35	0.36	0.30	0.34
0.30	0.41	0.34	0.42	0.36	0.30	0.04	0.00	0.25	0.29	0.28	0.27	0.35	0.37	0.32	0.34
0.27	0.42	0.29	0.33	0.41	0.32	0.24	0.25	0.00	0.23	0.20	0.18	0.34	0.27	0.21	0.33
0.31	0.50	0.33	0.34	0.41	0.36	0.27	0.29	0.23	0.00	0.13	0.14	0.38	0.31	0.26	0.41
0.31	0.50	0.29	0.32	0.45	0.37	0.26	0.28	0.20	0.13	0.00	0.15	0.37	0.28	0.25	0.39
0.29	0.49	0.31	0.29	0.41	0.37	0.25	0.27	0.18	0.14	0.15	0.00	0.39	0.33	0.26	0.41
0.37	0.32	0.29	0.48	0.38	0.32	0.35	0.35	0.34	0.38	0.37	0.39	0.00	0.30	0.32	0.18
0.32	0.42	0.27	0.39	0.49	0.39	0.36	0.37	0.27	0.31	0.28	0.33	0.30	0.00	0.18	0.28
0.30	0.41	0.31	0.37	0.42	0.33	0.30	0.32	0.21	0.26	0.25	0.26	0.32	0.18	0.00	0.32
0.36	0.29	0.34	0.50	0.42	0.35	0.34	0.34	0.33	0.41	0.39	0.41	0.18	0.28	0.32	0.00

Table 1: The LFD (with inner-distance)(top) and SDF (down) based distance matrices.



**Figure 2:** All the quartets used to build the C-tree.

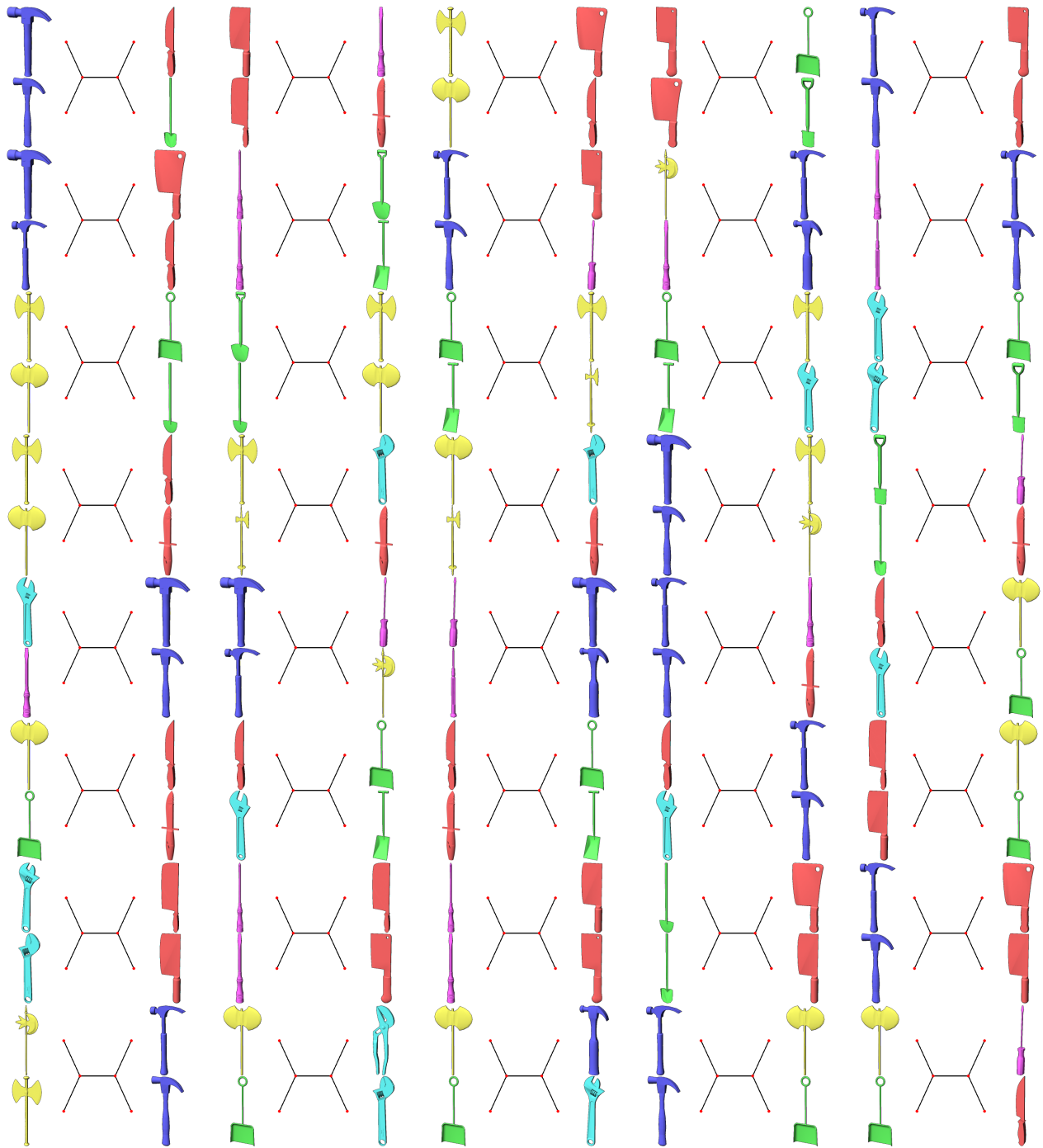
## Tiny Example II: a PSB Test



**Figure 3:** The shape set (with 28 objects in 5 categories from PSB, note that all the objects in each category of PSB are taken)(a), the C-tree(b), the NeighborJoining tree and ApCluster tree based on LFD distance measure(c-d) and the NeighborJoining tree and ApCluster tree based on SDF distance measure(e-f).

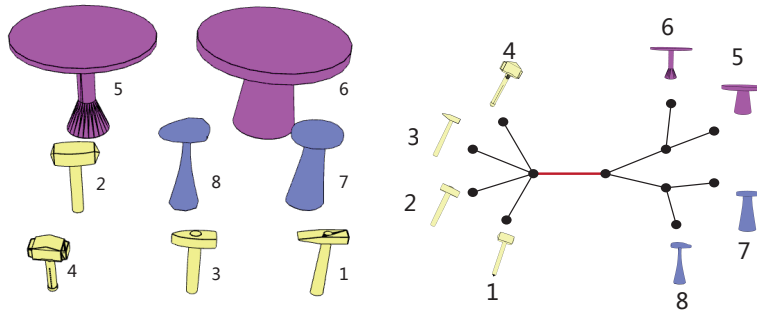
0.00	617.15	647.84	687.70	617.11	826.81	803.98	777.53	731.82	691.44	712.98	617.51	624.11	655.10	656.91	669.59	696.93	756.17	699.60	791.99	745.92	763.64	766.71	689.92	663.31	692.97	561.42	671.26
617.15	0.00	540.00	598.30	454.27	849.15	869.50	831.00	797.91	776.37	772.28	730.49	717.44	703.35	735.78	719.26	740.27	801.39	766.81	815.80	780.03	800.00	807.84	683.38	678.23	704.54	604.86	728.97
647.84	540.00	0.00	521.73	410.38	788.49	769.48	754.39	743.31	746.95	801.43	682.37	692.81	697.73	692.34	649.78	655.62	783.65	762.53	756.64	721.32	729.64	714.44	626.65	611.10	619.30	635.08	671.39
687.70	598.30	521.73	0.00	483.75	858.36	829.39	789.53	836.39	759.22	829.85	804.11	821.73	794.68	806.59	728.20	742.34	801.53	785.20	770.24	770.60	786.13	747.94	718.77	772.67	761.17	756.12	739.18
617.11	454.27	410.38	483.75	0.00	805.83	801.70	781.36	787.37	787.59	832.57	748.28	747.82	747.59	780.37	703.61	723.58	795.69	794.36	764.88	731.67	756.04	743.49	662.64	655.37	680.01	612.63	713.61
826.81	849.15	788.49	858.36	805.83	0.00	642.61	548.27	685.93	760.68	831.73	691.30	688.30	681.78	723.77	605.28	630.51	731.74	787.40	766.18	750.45	711.91	720.82	620.76	537.03	582.36	609.60	703.85
803.98	869.50	769.48	829.39	801.70	642.61	0.00	586.45	675.94	830.73	899.49	800.79	816.02	799.27	808.17	692.40	686.10	809.10	868.59	714.55	733.43	695.71	720.53	740.56	699.56	708.35	764.82	832.06
777.53	831.00	754.39	789.53	781.36	548.27	586.45	0.00	714.24	763.66	881.80	774.50	795.80	765.69	764.64	643.59	652.65	778.46	820.19	683.47	712.25	690.01	680.63	673.77	610.87	614.92	696.38	791.20
731.82	797.91	743.31	836.39	787.37	685.93	675.94	714.24	0.00	808.73	765.31	662.03	666.12	701.85	701.98	679.71	687.06	803.17	828.45	776.34	756.89	697.31	739.94	731.18	691.68	703.68	689.38	810.24
691.44	776.37	746.95	759.22	787.59	760.68	830.73	763.66	808.73	0.00	635.11	655.02	643.66	574.76	545.81	768.39	773.10	848.93	772.89	847.19	847.62	816.32	824.23	823.30	797.09	814.33	710.47	818.66
712.98	772.28	801.43	829.85	832.57	831.73	899.49	881.80	765.31	635.11	0.00	626.79	609.33	601.74	585.38	816.26	794.25	861.96	774.48	885.43	842.42	821.06	826.67	793.23	785.38	790.34	688.64	813.53
617.51	730.49	682.37	804.11	748.28	691.30	800.79	774.50	662.03	655.02	626.79	0.00	253.83	533.97	457.59	665.54	681.11	801.08	780.92	834.14	798.69	760.63	777.99	679.42	610.28	666.74	565.72	760.03
624.11	717.44	692.81	821.73	747.82	688.30	816.02	795.80	666.12	643.66	609.33	253.83	0.00	518.44	458.58	705.55	707.27	814.18	746.69	872.38	830.29	785.10	818.43	696.54	652.48	691.46	588.00	778.32
655.10	703.35	697.73	794.68	747.59	681.78	799.27	765.69	701.85	574.76	601.74	533.97	518.44	0.00	444.84	672.61	684.57	760.64	722.07	808.73	750.55	730.28	762.97	700.89	633.02	670.64	536.84	742.97
656.91	735.78	692.34	806.59	780.37	723.77	808.17	764.64	701.98	545.81	585.38	457.59	458.58	444.84	0.00	677.49	696.28	810.75	730.34	829.00	788.50	749.41	774.52	724.65	679.76	702.33	618.76	753.30
669.59	719.26	649.78	728.20	703.61	605.28	692.40	643.59	679.71	768.39	816.26	665.54	705.55	672.61	677.49	0.00	455.58	722.77	683.05	669.67	606.73	649.91	612.60	639.96	552.52	552.96	613.24	639.53
696.93	740.27	655.62	742.34	723.58	630.51	686.10	652.65	687.06	773.10	794.25	681.11	707.27	684.57	696.28	455.58	0.00	720.10	699.47	683.98	638.95	673.62	658.90	655.10	568.14	548.84	630.97	666.21
756.17	801.39	783.65	801.53	795.69	731.74	809.10	778.46	803.17	848.93	861.96	801.08	814.18	760.64	810.75	722.77	720.10	0.00	759.50	768.70	791.63	754.74	761.69	760.88	735.76	729.51	742.12	755.39
699.60	766.81	762.53	785.20	794.36	787.40	868.59	820.19	828.45	772.89	774.48	780.92	746.69	722.07	730.34	683.05	699.47	759.50	0.00	804.26	766.35	780.63	759.49	766.33	752.55	735.39	738.94	716.36
791.99	815.80	756.64	770.24	764.88	766.18	714.55	683.47	776.34	847.19	885.43	834.14	872.38	808.73	829.00	669.67	683.98	768.70	804.26	0.00	576.61	555.17	567.84	733.42	630.51	664.71	696.15	759.11
745.92	780.03	721.32	770.60	731.67	750.45	733.43	712.25	756.89	847.62	842.42	798.69	830.29	750.55	788.50	606.73	638.95	791.63	766.35	576.61	0.00	584.52	511.67	727.64	672.80	683.11	697.31	742.99
763.64	800.00	729.64	786.13	756.04	711.91	695.71	690.01	697.31	816.32	821.06	760.63	785.10	730.28	749.41	649.91	673.62	754.74	780.63	555.17	584.52	0.00	553.47	701.79	630.38	646.47	685.94	744.30
766.71	807.84	714.44	747.94	743.49	720.82	720.53	680.63	739.94	824.23	826.67	777.99	818.43	762.97	774.52	612.60	658.90	761.69	759.49	567.84	511.67	553.47	0.00	714.44	677.49	683.89	702.73	755.14
689.92	683.38	626.65	718.77	662.64	620.76	740.56	673.77	731.18	823.30	793.23	679.42	696.54	700.89	724.65	639.96	655.10	760.88	766.33	733.42	727.64	701.79	714.44	0.00	439.75	464.89	526.62	583.08
663.31	678.23	611.10	772.67	655.37	537.03	699.56	610.87	691.68	797.09	785.38	610.28	652.48	633.02	679.76	552.52	568.14	735.76	752.55	630.51	672.80	630.38	677.49	439.75	0.00	319.17	476.66	590.78
692.97	704.54	619.30	761.17	680.01	582.36	708.35	614.92	703.68	814.33	790.34	666.74	691.46	670.64	702.33	552.96	548.84	729.51	735.39	664.71	683.11	646.47	683.89	464.89	319.17	0.00	542.45	586.37
561.42	604.86	635.08	756.12	612.63	609.60	764.82	696.38	689.38	710.47	688.64	565.72	588.00	536.84	618.76	613.24	630.97	742.12	738.94	696.15	697.31	685.94	702.73	526.62	476.66	542.45	0.00	642.92
671.26	728.97	671.39	739.18	713.61	703.85	832.06	791.20	810.24	818.66	813.53	760.03	778.32	742.97	753.30	639.53	666.21	755.39	716.36	759.11	742.99	744.30	755.14	583.08	590.78	586.37	642.92	0.00
0.00	0.32	0.31	0.46	0.36	0.42	0.48	0.64	0.27	0.57	0.46	0.33	0.34	0.27	0.29	0.23	0.18	0.27	0.20	0.49	0.26	0.41	0.41	0.24	0.25	0.22	0.23	0.20
0.32	0.00	0.12	0.22	0.11	0.28	0.33	0.48	0.40	0.39	0.42	0.41	0.39	0.40	0.35	0.31	0.28	0.22	0.28	0.51	0.38	0.45	0.42	0.41	0.42	0.41	0.43	0.25
0.31	0.12	0.00	0.23	0.14	0.23	0.27	0.45	0.40	0.36	0.40	0.39	0.37	0.39	0.33	0.30	0.30	0.20	0.26	0.48	0.36	0.43	0.41	0.40	0.39	0.38	0.42	0.23
0.46	0.22	0.23	0.00	0.20	0.33	0.29	0.39	0.49	0.33	0.51	0.48	0.48	0.44	0.40	0.39	0.34	0.39	0.51	0.45	0.48	0.45	0.51	0.50	0.50	0.52	0.39	0.39
0.36	0.11	0.14	0.20	0.00	0.30	0.33	0.48	0.43	0.39	0.45	0.43	0.42	0.42	0.37	0.33	0.31	0.25	0.31	0.51	0.39	0.46	0.43	0.43	0.45	0.44	0.47	0.28
0.42	0.28	0.23	0.33	0.30	0.00	0.17	0.34	0.47	0.25	0.34	0.41	0.35	0.47	0.35	0.37	0.43	0.34	0.34	0.43	0.46	0.44	0.40	0.46	0.44	0.43	0.54	0.34
0.48	0.33	0.27	0.29	0.33	0.17	0.00	0.29	0.49	0.21	0.39	0.43	0.38	0.48	0.37	0.39	0.47	0.39	0.38	0.44	0.48	0.43	0.41	0.52	0.47	0.47	0.57	0.41
0.64	0.48	0.45	0.39	0.48	0.34	0.29	0.00	0.67	0.19	0.49	0.59	0.55	0.67	0.56	0.56	0.63	0.56	0.55	0.46	0.63	0.54	0.51	0.64	0.63	0.63	0.72	0.57
0.27	0.40	0.40	0.49	0.43	0.47	0.49	0.67	0.00	0.60	0.54	0.26	0.31	0.18	0.27	0.26	0.23	0.37	0.26	0.54	0.33	0.40	0.41	0.42	0.25	0.26	0.27	0.38
0.57	0.39	0.36	0.33	0.39	0.25	0.21	0.19	0.60	0.00	0.42	0.51	0.48	0.60	0.48	0.48	0.56	0.48	0.47	0.43	0.56	0.48	0.44	0.57	0.56	0.56	0.66	0.49
0.46	0.42	0.40	0.51	0.45	0.34	0.39	0.49	0.54	0.42	0.00	0.47	0.39	0.55	0.42	0.43	0.52	0.45	0.40	0.45	0.45	0.42	0.42	0.47	0.49	0.48	0.61	0.44
0.33	0.41	0.39	0.48	0.43	0.41	0.43	0.59	0.26	0.51	0.47	0.00	0.15	0.24	0.13	0.20	0.32	0.38	0.22	0.44	0.36	0.33	0.28	0.42	0.22	0.27	0.34	0.40
0.34	0.39	0.37	0.48	0.42	0.35	0.38	0.55	0.31	0.48	0.39	0.15	0.00	0.30	0.13	0.24	0.36	0.37	0.23	0.45	0.38	0.34	0.31	0.42	0.27	0.31	0.39	0.39
0.27	0.40	0.39	0.48	0.42	0.47	0.48	0.67	0.18	0.60	0.55	0.24	0.30	0.00	0.25	0.23	0.25	0.34	0.24	0.54	0.32	0.42	0.40	0.24	0.24	0.25	0.25	0.37
0.29	0.35	0.33	0.44																								



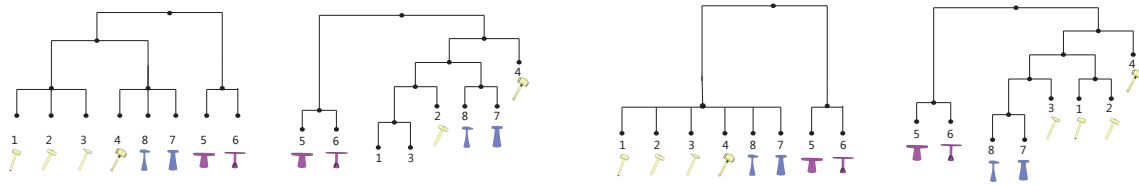


**Figure 4:** Some selected crucial quartets among the total 978 sampling quartets used to build the C-tree.

# Tiny Example III: a Google 3D Warehouse Test



**Figure 5:** The shape set (all the objects are taken from google 3D warehouse) and the C-tree.

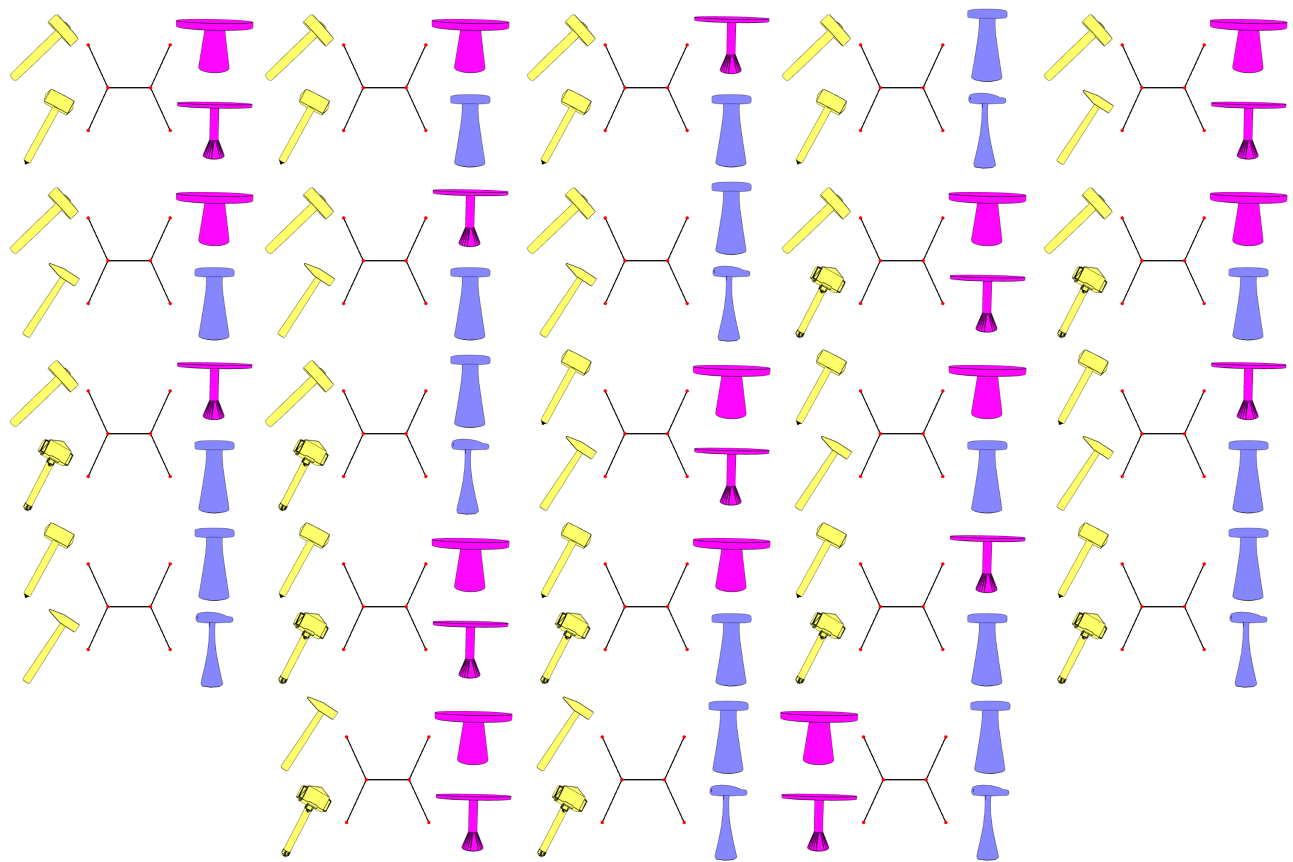


(a) The LFD based test, from left to right: ApCluster tree and NeighborJoining tree. (b) The SDF based test, from left to right: ApCluster tree and NeighborJoining tree.

**Figure 6:** The clustering trees based on the two distances separately.

0.0	625.3	624.5	845.3	1079.6	1014.0	885.4	802.2
625.3	0.0	637.3	855.8	1057.0	994.4	888.7	824.5
624.5	637.3	0.0	901.5	1090.5	1027.0	881.6	792.7
845.3	855.8	901.5	0.0	1067.8	925.1	890.2	830.5
1079.6	1057.0	1090.5	1067.8	0.0	492.6	817.9	986.1
1014.0	994.4	1027.0	925.1	492.6	0.0	827.9	886.8
885.4	888.7	881.6	890.2	817.9	827.9	0.0	596.8
802.2	824.5	792.7	830.5	986.1	886.8	596.8	0.0
0.00	0.16	0.21	0.31	0.45	0.51	0.26	0.20
0.16	0.00	0.21	0.27	0.31	0.44	0.18	0.15
0.21	0.21	0.00	0.32	0.32	0.39	0.15	0.11
0.31	0.27	0.32	0.00	0.35	0.49	0.27	0.21
0.45	0.31	0.32	0.35	0.00	0.20	0.17	0.25
0.51	0.44	0.39	0.49	0.20	0.00	0.28	0.39
0.26	0.18	0.15	0.27	0.17	0.28	0.00	0.08
0.20	0.15	0.11	0.21	0.25	0.39	0.08	0.00

**Table 3:** The LFD (inner distance)(top) and SDF(down) based distance matrices.



**Figure 7:** All the quartets used to build C-tree.