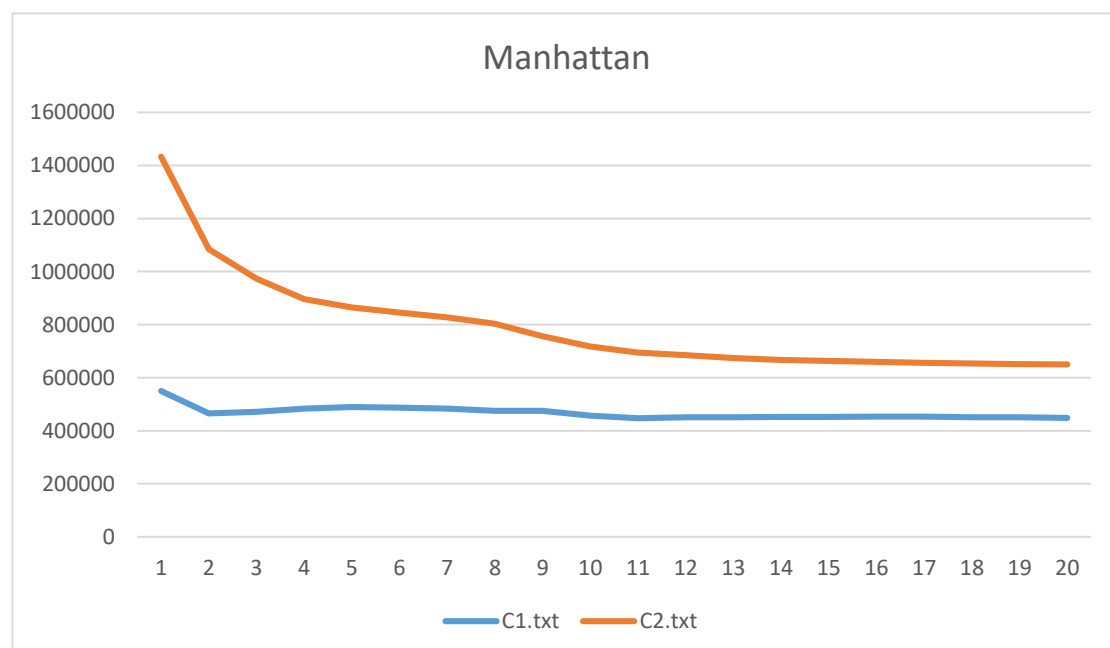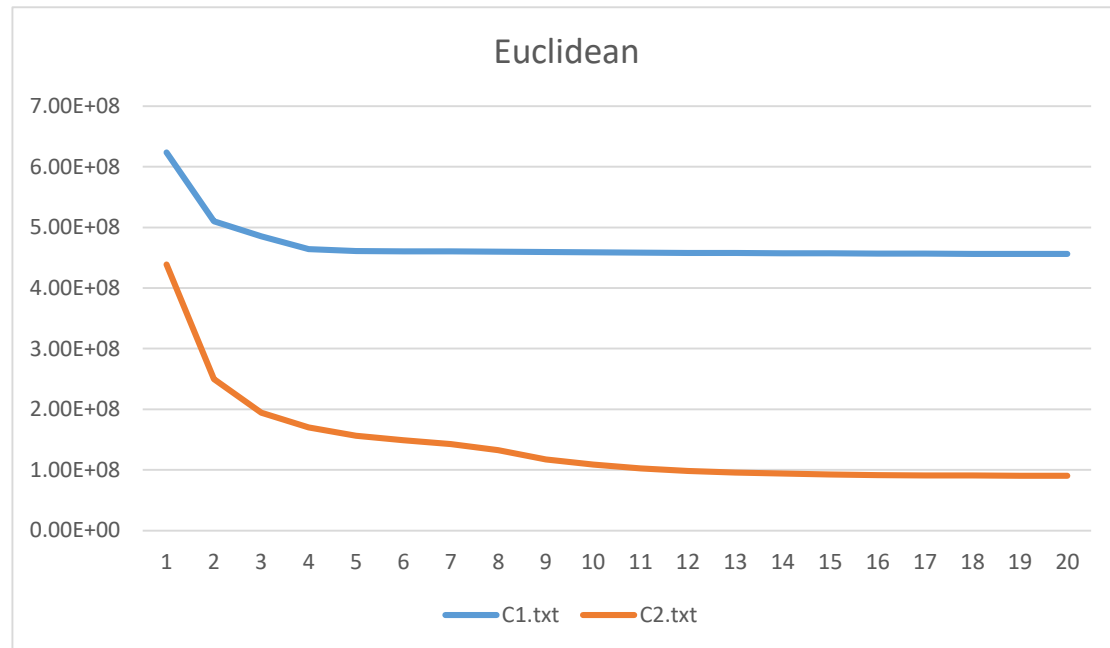# Kmeans_HW3

103062318 蔡尚倫

1. (a) 和 (b) 的 cost vs. iteration 圖

2. 做完 **10** 次 iteration 之後 (a) 和 (b) 的 Percentage improvement values

Euclidean

    C1.txt

        第一次　6.23660345306412E8

        第十次　4.590211033422913E8

        Percentage improvement values：35%

    C2.txt

        第一次　4.387477900279348E8

        第十次　1.08547377178583319E8

        Percentage improvement values：304%

Manhattan

    C1.txt

        第一次　550117.1419999964

        第十次　457232.9201150762

        Percentage improvement values：20%

    C2.txt

        第一次　1433739.3100000212

        第十次　717332.9025432788

        Percentage improvement values：99%

其中C2.txt的improvement較大，原因是C2.txt資料點的之間的距離比C1.txt還遠，所以improvement的效果較好，就如同老師上所說的，尋找這些初始的K個點，沒有一種理論上的做法，不過假如K個彼此之間距離較遠，那麼這些點是同群的機會就比較低，所以各自蒐集到屬於該群的cost就越低(也就是不會收入離自己太遠的點)，因此找K個彼此之間距離越遠的點，分群的improvement就越好，cost降低的比例就越高。

3. 做完 **20** 次 iterations 之後，所有 Cluster Centroids 兩兩之間的 Euclidean 和 Manhattan Distance

Euclidean

C1.txt

```
1 between 2 692.1578865536187
1 between 3 3490.2586403239793
1 between 4 205.75027883457204
1 between 5 346.71882253414816
1 between 6 512.6122467083617
1 between 7 444.7310005470825
1 between 8 566.2019922936282
1 between 9 1282.7708445154385
1 between 10 307.66912835221507
2 between 3 2798.8010531589434
2 between 4 897.6589863450828
2 between 5 1038.8268882911389
2 between 6 1204.0781989863117
2 between 7 1136.3273438149283
```

2 between 8 1257.4495275592424
2 between 9 669.8902282318555
2 between 10 412.076077167744
3 between 4 3695.114191079636
3 between 5 3836.9066381524567
3 between 6 4002.6890825730284
3 between 7 3934.8715588311575
3 between 8 4056.1355729719103
3 between 9 2294.57964158953
3 between 10 3195.9239010108936
4 between 5 142.43887392408647
4 between 6 309.50632446700047
4 between 7 241.7301145044183
4 between 8 363.2628951046584
4 between 9 1474.9454213642691
4 between 10 504.63411599571515
5 between 6 167.1498001315246
5 between 7 99.54554331498562
5 between 8 220.90178372040566
5 between 9 1615.852353440387
5 between 10 646.9305638786212
6 between 7 67.91186107588504
6 between 8 53.78989116172683
6 between 9 1782.2030486002302
6 between 10 814.0761501339795
7 between 8 121.63372043718282
7 between 9 1715.2531997144126
7 between 10 746.3355586141014
8 between 9 1835.6396718448902
8 between 10 867.8230790917461
9 between 10 975.3204225971708

C2.txt

1 between 2 15760.12247224593
1 between 3 14110.83439088334
1 between 4 9045.32023455239
1 between 5 5567.684524118405

1 between 6 1924.6240815733204

1 between 7 1100.8590503593277

1 between 8 402.89054961102914

1 between 9 2105.4425755929597

1 between 10 3169.003772849924

2 between 3 11524.505650179837

2 between 4 6743.88410019246

2 between 5 10192.525007384162

2 between 6 14455.11937212132

2 between 7 14682.450992891092

2 between 8 15362.417960805125

2 between 9 13674.707531226235

2 between 10 12597.039559531104

3 between 4 9545.879403387185

3 between 5 10883.382187801386

3 between 6 12233.959804503613

3 between 7 13208.002933714424

3 between 8 13786.484182516106

3 between 9 12508.95738096874

3 between 10 11938.376127029482

4 between 5 3494.2224155718104

4 between 6 7718.222009696623

4 between 7 7957.775949135465

4 between 8 8644.807041005524

4 between 9 6947.820636329124

4 between 10 5876.330199605868

5 between 6 4404.562590797219

5 between 7 4492.458214360271

5 between 8 5169.9372911256405

5 between 9 3488.1585187816186

5 between 10 2407.918794485802

6 between 7 1182.864189045907

6 between 8 1615.7882361392917

6 between 9 1313.3274934048693

6 between 10 2153.771471752397

7 between 8 698.4881359277906

7 between 9 1010.1976652126849

7 between 10 2085.4606764072964

8 between 9 1702.7926583344838
8 between 10 2768.6077191659247
9 between 10 1080.534943939508

Manhattan

C1.txt

1 between 2 2341.017218605991
1 between 3 11929.300151785714
1 between 4 651.187488095238
1 between 5 496.33152119047617
1 between 6 947.7432364650634
1 between 7 770.7373834915085
1 between 8 1056.7995006298163
1 between 9 1260.5105607142857
1 between 10 737.7135730519481
2 between 3 9597.441187096774
2 between 4 2778.9457620967737
2 between 5 2830.1445281720426
2 between 6 3280.3591681796074
2 between 7 3104.2857711482065
2 between 8 3388.9826482565923
2 between 9 2380.460958064516
2 between 10 1605.2701287064187
3 between 4 12323.287569444445
3 between 5 12421.263079999999
3 between 6 12871.483428978225
3 between 7 12695.554202097901
3 between 8 12979.13318018672
3 between 9 10775.939185714284
3 between 10 11196.78698181818
4 between 5 335.951213
4 between 6 558.4692581658292
4 between 7 382.4633301282051
4 between 8 667.5332295988935
4 between 9 1653.8258869047618

4 between 10 1379.165172979798
5 between 6 452.86133068676713
5 between 7 276.3264914965034
5 between 8 561.8492485408023
5 between 9 1755.105532761905
5 between 10 1226.6603546666668
6 between 7 177.59316237363976
6 between 8 110.21762404606017
6 between 9 2205.3073830102894
6 between 10 1677.666863534846
7 between 8 287.42970773365636
7 between 9 2028.901615784216
7 between 10 1500.9934102564105
8 between 9 2314.667454756965
8 between 10 1786.8113163428895
9 between 10 1006.3678264069263

C2.txt

1 between 2 15757.691264458323
1 between 3 20200.259435786043
1 between 4 9517.668232509728
1 between 5 5588.853634537063
1 between 6 3281.488246764413
1 between 7 1430.2086778758846
1 between 8 602.9548488263027
1 between 9 2102.553977579326
1 between 10 3211.4557560606645
2 between 3 16003.499
2 between 4 7219.196666666668
2 between 5 10221.031
2 between 6 16325.2705
2 between 7 14506.48588961039
2 between 8 15335.957402597402
2 between 9 14980.056095890412
2 between 10 12922.931357142857
3 between 4 10690.484333333334
3 between 5 14613.552

3 between 6 17521.517666666663
3 between 7 18775.12146103896
3 between 8 19602.262814935064
3 between 9 18111.885424657536
3 between 10 16995.133535714285
4 between 5 3935.2926666666663
4 between 6 9116.0245
4 between 7 8090.510188311688
4 between 8 8918.813116883115
4 between 9 7771.22207762557
4 between 10 6312.5300119047615
5 between 6 6110.8325
5 between 7 4293.5019025974025
5 between 8 5123.066808441558
5 between 9 4768.923
5 between 10 2710.0564999999997
6 between 7 1855.5799090909088
6 between 8 2682.5692337662335
6 between 9 1358.795894977169
6 between 10 3413.0361785714285
7 between 8 833.4302824675323
7 between 9 674.8275699163852
7 between 10 1784.5120454545456
8 between 9 1500.824883695072
8 between 10 2613.9973051948054
9 between 10 2062.251068003914