Marketing Segmentation

Cluster analysis

U.S. Cities

Segmentation

Group U.S. cities into groups that are similar on demographics attributes such as

- percentage of Asians
- percentage of Blacks
- percentage of Hispanics
- Median age
- Unemployment rate
- Median income level

City	%age Black	%age Hispanic	%age Asian	Median Age	Unemployment rate	Per capita income(000's)
Albuquerque	3	35	2	32	5	18
Atlanta	67	2	1	31	5	22
Austin	12	23	3	29	3	19
Baltimore	59	1	1	33	11	22
Boston	26	11	5	30	5	24
Charlotte	32	1	2	32	3	20
Chicago	39	20	4	31	9	24
Cincinnati	38	1	1	31	8	21
Cleveland	47	5	1	32	13	22
Columbus	23	1	2	29	3	13
Dallas	30	21	2	30	9	22
Denver	13	23	2	34	7	23
Detroit	76	3	1	31	9	21
El Paso	3	69	1	29	11	13
Fort Worth	22	20	2	30	9	20
Fresno	9	30	13	28	13	16
Honolulu	1	5	71	37	5	24
Houston	28	28	4	30	7	22
Indianapolis	22	1	1	32	5	21
Jacksonville	25	3	2	32	7	19
Kansas City	30	4	1	33	6	21
Las Vegas	11	13	4	33	5	20
Long Beach	14	24	14	30	8	21
Los Angeles	14	40	10	31	11	21
Memphis	55	1	1	32	9	20
Miami	27	63	1	36	12	17
Milwaukee	31	6	2	30	5	22
Minneapolis	13	2	4	32	5	23
Nashville	23	1	1	33	3	24
New Orleans	62	4	2	32	7	18
NY	29	24	7	34	11	27
Oakland	44	14	15	33	10	24
Oklahoma City	16	5	2	32	6	17
Omaha	13	3	1	32	5	20
Philadelphia	40	6	3	33	9	23
Phoenix	5	20	2	31	4	19
Pittsburgh	26	1	2	35	7	21
Portland	8	3	5	35	7	20
Sacramento	15	16	15	32	8	20
St. Louis	48	1	1	33	8	23
San Antonio	7	56	1	30	5	17
San Diego	9	21	12	31	8	20
San Francisco	11	14	29	36	6	31
San Jose	5	27	20	30	8	26
Seattle	10	4	12	35	5	28
Toledo	20	4	1	32	6	19
Tucson	4	29	2	31	3	19
Tulsa	14	3	1	33	4	20
Virginia Beach	14	3	4	29	6	18

- STANDARDIZE 函數(STANDARDIZE)
  - STANDARDIZE(x, mean, standard_dev)
    - **X**　必要。 這是要標準化的值。
    - **Mean**　必要。這是分配的算術平均值。(MEAN)
    - **Standard_dev**　必要。這是分配的標準差。(STDDRV)

Mean	24.34694	14.59184	6.040816	31.87755	7.020408163	20.91837	4.08E-17	-4.1E-17	-1.2E-17	2.22E-16	1.01E-16	-2.5E-16
Std dev	18.11025	16.4721	11.1448	1.99617	2.688631901	3.334396	1	1	1	1	1	1

z Black	z Hispanic	z Asian	z Age	z Unemp	z income
-1.17872	1.238954	-0.36257	0.061342	-0.75146	-0.87523
2.355188	-0.76443	-0.4523	-0.43962	-0.75146	0.324386
-0.68177	0.510449	-0.27285	-1.44154	-1.49534	-0.57533
1.91345	-0.82514	-0.4523	0.562301	1.480155	0.324386
0.091278	-0.21806	-0.09339	-0.94058	-0.75146	0.924195
0.422582	-0.82514	-0.36257	0.061342	-1.49534	-0.27542
0.809103	0.328323	-0.18312	-0.43962	0.736282	0.924195
0.753886	-0.82514	-0.4523	-0.43962	0.364346	0.024482
1.250842	-0.58231	-0.4523	0.061342	2.224028	0.324386
-0.07437	-0.82514	-0.36257	-1.44154	-1.49534	-2.37475
0.312147	0.389031	-0.36257	-0.94058	0.736282	0.324386
-0.62655	0.510449	-0.36257	1.063261	-0.00759	0.624291
2.852145	-0.70373	-0.4523	-0.43962	0.736282	0.024482
-1.17872	3.30305	-0.4523	-1.44154	1.480155	-2.37475
-0.12959	0.328323	-0.36257	-0.94058	0.736282	-0.27542
-0.84742	0.93541	0.624433	-1.9425	2.224028	-1.47504
-1.28916	-0.58231	5.828653	2.566139	-0.75146	0.924195
0.201712	0.813993	-0.18312	-0.94058	-0.00759	0.324386
-0.12959	-0.82514	-0.4523	0.061342	-0.75146	0.024482
0.03606	-0.70373	-0.36257	0.061342	-0.00759	-0.57533
0.312147	-0.64302	-0.4523	0.562301	-0.37953	0.024482
-0.57133	1.542497	0.355249	-0.43962	1.480155	0.024482
1.69258	-0.82514	-0.4523	0.061342	0.736282	-0.27542
0.146495	2.938798	-0.4523	2.06518	1.852091	-1.17514
0.367364	-0.5216	-0.36257	-0.94058	-0.75146	0.324386
-0.62655	-0.76443	-0.18312	0.061342	-0.75146	0.624291
-0.07437	-0.82514	-0.4523	0.562301	-1.49534	0.924195
2.079102	-0.64302	-0.36257	0.061342	-0.00759	-0.87523
0.25693	0.571158	0.086066	1.063261	1.480155	1.823908
1.08519	-0.03593	0.803889	0.562301	1.108219	0.924195
-0.4609	-0.58231	-0.36257	0.061342	-0.37953	-1.17514
-0.62655	-0.70373	-0.4523	0.061342	-0.75146	-0.27542
0.86432	-0.5216	-0.27285	0.562301	0.736282	0.624291
-1.06829	0.328323	-0.36257	-0.43962	-1.1234	-0.57533
0.091278	-0.82514	-0.36257	1.56422	-0.00759	0.024482
-0.90263	-0.70373	-0.09339	1.56422	-0.00759	-0.27542
-0.51611	0.085488	0.803889	0.061342	0.364346	-0.27542
1.306059	-0.82514	-0.4523	0.562301	0.364346	0.624291
-0.95785	2.513837	-0.4523	-0.94058	-0.75146	-1.17514
-0.84742	0.389031	0.534705	-0.43962	0.364346	-0.27542
-0.73698	-0.03593	2.06008	2.06518	-0.37953	3.023526
-1.06829	0.753284	1.252529	-0.94058	0.364346	1.524004
-0.7922	-0.64302	0.534705	1.56422	-0.75146	2.123813
-0.24003	-0.64302	-0.4523	0.061342	-0.37953	-0.57533
-1.1235	0.874701	-0.36257	-0.43962	-1.49534	-0.57533
-0.57133	-0.70373	-0.4523	0.562301	-1.1234	-0.27542
-0.57133	-0.70373	-0.18312	-1.44154	-0.37953	-0.87523

- SUMXMY2(array_x, array_y)

$$SUMXMY2 = \sum (x - y)^2$$

Distance^2 to 1	Distance^2 to 2	Distance^2 to 3	Distance^2 to 4	Min Distance
7.016897	4.44672	15.08608	27.04372	4.44672
19.60865	9.505167	3.266853	30.102	3.266853
11.68898	4.411405	14.78223	32.23795	4.411405
13.52578	12.05718	1.212861	26.96212	1.212861
9.780438	3.32289	7.717853	18.93672	3.32289
16.3033	1.676812	6.601068	23.98015	1.676812
5.032486	7.102106	3.873518	19.48122	3.873518
9.259088	3.506272	1.360387	24.97923	1.360387
9.381499	12.75265	2.827259	28.64125	2.827259
21.98167	7.546867	14.77613	49.61466	7.546867
3.520536	5.660316	4.751479	24.71547	3.520536
6.415243	3.848943	9.536884	13.07848	3.848943
17.97118	14.65559	1.700234	36.15315	1.700234
10.88078	28.0051	32.50553	62.55287	10.88078
3.078873	4.537368	5.662687	27.53352	3.078873
5.577794	18.2029	18.37833	46.09383	5.577794
49.81239	47.61727	58.32659	19.60205	19.60205
3.972443	4.978902	6.898872	23.09371	3.972443
11.68407	0.35165	5.623641	20.45181	0.35165
8.753829	1.09039	3.410142	24.01824	1.09039
10.6714	1.364073	3.524699	19.0342	1.364073
9.07795	0.704171	8.970302	18.31566	0.704171
2.568309	5.327826	9.667705	20.78967	2.568309
0	11.02173	12.2774	24.15201	0
12.2774	7.606484	0	28.98115	0
10.96849	25.46892	22.62751	38.55048	10.96849
10.97794	2.392694	5.433386	23.78297	2.392694
11.20567	0.885629	8.477371	15.48488	0.885629
17.1717	2.563027	9.792292	15.28483	2.563027
15.59036	8.245393	1.103737	33.52214	1.103737
7.198553	13.08685	10.26497	11.15449	7.198553
7.38843	10.10247	4.398176	13.77755	4.398176
10.19072	0.998054	6.758993	27.88813	0.998054
11.02173	0	7.606484	21.80697	0
8.633051	5.561893	1.870802	17.50259	1.870802
9.374723	1.747548	12.76024	25.89079	1.747548
12.78879	3.439999	5.474154	16.56169	3.439999
11.67525	3.017031	9.690689	16.38318	3.017031
3.913136	3.458099	7.423928	17.09331	3.458099
12.39109	6.055185	1.348179	19.67726	1.348179
8.415201	12.2758	22.20029	39.66382	8.415201
2.773884	3.713075	9.289287	20.22997	2.773884
24.15201	21.80697	28.98115	0	0
5.419489	10.71126	17.40038	13.22124	5.419489
18.26013	9.020281	17.40984	3.897153	3.897153
9.607522	0.381364	5.103112	23.89469	0.381364
10.47943	3.640698	16.14888	27.31868	3.640698
13.56994	0.392346	8.849411	20.4805	0.392346
10.6071	2.832259	9.075938	33.00269	2.832259

- MIN
  - 會傳回一組數值中的最小值。

Distance^ 2 to 1	Distance^ 2 to 2	Distance^ 2 to 3	Distance^ 2 to 4	**Min Distance**
7.016897	4.44672	15.08608	27.04372	4.44672
19.60865	9.505167	3.266853	30.102	3.266853
11.68898	4.411405	14.78223	32.23795	4.411405
13.52578	12.05718	1.212861	26.96212	1.212861
9.780438	3.32289	7.717853	18.93672	3.32289
16.3033	1.676812	6.601068	23.98015	1.676812
5.032486	7.102106	3.873518	19.48122	3.873518
9.259088	3.506272	1.360387	24.97923	1.360387

  - 找出與四個候選城市距離最小(最相似)的城市

- Decision variable(H5:H8)
  - Assume cluster =4

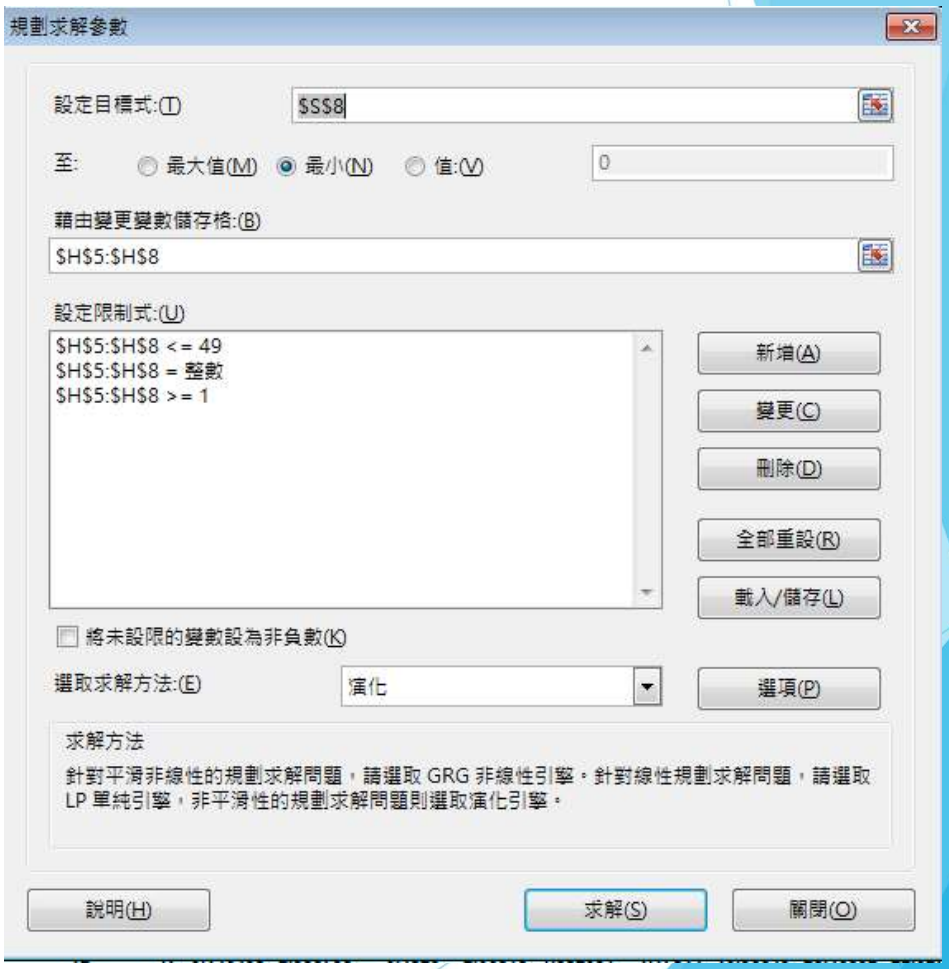
City	Cluster
Los Angeles	24
Omaha	34
Memphis	25
San Francisco	43

- Objective Function(S8)

Sum Dis^2	165.3482

- =SUM(S10:S58)

Min Distance
4.44672
3.266853
4.411405
1.212861
3.32289
1.676812
3.873518
1.360387
2.827259
7.546867
3.520536
3.848943
1.700234
10.88078
3.078873
5.577794
19.60205
3.972443
0.35165
1.09039
1.364073
0.704171
2.568309
0
0
10.96849
2.392694
0.885629
2.563027
1.103737
7.198553
4.398176
0.998054
0
1.870802
1.747548
3.439999
3.017031
3.458099
1.348179
8.415201
2.773884
0
5.419489
3.897153
0.381364
3.640698
0.392346



Distance^2 to 1	Distance^2 to 2	Distance^2 to 3	Distance^2 to 4	Min Distance	Assigned to	City
7.016897	4.44672	15.08608	27.04372	4.44672	2	Albuquerque
19.60865	9.505167	3.266853	30.102	3.266853	3	Atlanta
11.68898	4.411405	14.78223	32.23795	4.411405	2	Austin
13.52578	12.05718	1.212861	26.96212	1.212861	3	Baltimore
9.780438	3.32289	7.717853	18.93672	3.32289	2	Boston
16.3033	1.676812	6.601068	23.98015	1.676812	2	Charlotte

MATCH 函數會搜尋儲存格範圍中的指定項目，並傳回該項目於該範圍中的相對位置。

=MATCH(S10,O10:R10,0)

找出距離最近的城市為第二個城市