# *KFUPM - COMPUTER ENGINEERING DEPARTMENT*

## COE-587 –Performance Evaluation and Analysis
## CSE 642 – Computer Systems Performance

Assignment # 1 - Due Monday Feb 16th, 2015

| Problem | Points | |
|---|---|---|
| 1 | 20 | |
| 2 | 20 | |
| 3 | 10 | |
| | | |
| Total | 50 | |

**Problem 1 (20 points):**

a) Plot is as shown in Fig. 1 below.

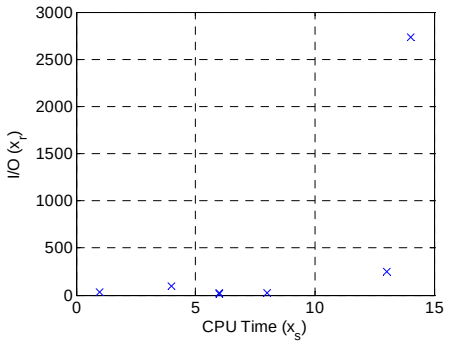



Figure 1: original data.

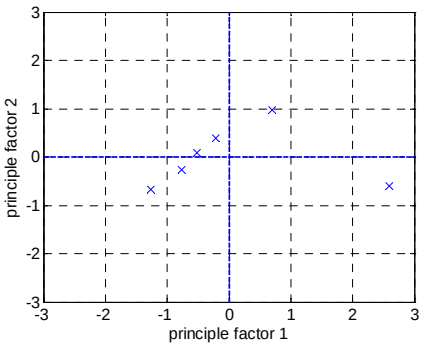



Figure 2: principle factor 1 and principle factor 2.

b) The correlation matrix is given by $C = \begin{bmatrix} 1.0 & 0.6632 \\ 0.6632 & 1.0 \end{bmatrix}$. The characteristic equation is given by $(\lambda - 1)^2 - 0.6632^2 = 0$ or $\lambda^2 - 2\lambda + 0.5602 = 0$. The eign values are as follows: $\lambda_1 = 1.6632$, $\lambda_2 = 0.3368$, and the corresponding vectors are: $q_1 = \begin{bmatrix} 0.7071 \\ 0.7071 \end{bmatrix}$, and $q_2 = \begin{bmatrix} -0.7071 \\ 0.7071 \end{bmatrix}$.

The principle component computations:

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} 0.7071 & 0.7071 \\ 0.7071 & -0.7071 \end{bmatrix} \begin{bmatrix} (x_s - 7.4286)/4.6853 \\ (x_r - 454)/1009.3227 \end{bmatrix}$$

c) The table is as follows:

```
>> Problem_6_1
-------------------------------------------------------------------
 i          x_s         x_r      x_s'      x_r'      y_1       y_2
-------------------------------------------------------------------
 1           14        2735    +1.403    +2.260    +2.590    -0.606
 2           13         253    +1.189    -0.199    +0.700    +0.982
 3            8          27    +0.122    -0.423    -0.213    +0.385
 4            6          27    -0.305    -0.423    -0.515    +0.084
 5            6          12    -0.305    -0.438    -0.525    +0.094
 6            4          91    -0.732    -0.360    -0.772    -0.263
 7            1          33    -1.372    -0.417    -1.265    -0.675
-------------------------------------------------------------------
Sum x        52        3178    -0.0      -0.000    +0.000    +0.000
Sum x2      518     7555206    +6.0      +6.000    +9.979    +2.021
mean       +7.4      +454.0   -0.000     -0.000    +0.000    +0.000
std        +4.7     +1009.3   +1.000     +1.000    +1.290    +0.580
-------------------------------------------------------------------
```

The plot for the principle factors is as shown in Fig. 2.

d) The % of variation explained by 1st factor is 9.979/(9.979+2.021) = 83.2%. The second factor explains 16.8%.

**Problem 2 (20 points):**

Executing the Spanning Tree algorithm:

Step 1: Minimum distance = 2 between 3 and 4

Step 2: Minimum distance = 8.49 between 3-4 and 7

Step 3: Minimum distance = 17.03 between 3-4-7 and 5

Step 4: Minimum distance = 66.262 between 3-4-7-5 and 6

Step 5: Minimum distance = 215.149 between 3-4-7-5-6 and 2

Step 6: Minimum distance = 2661.2 between 3-4-7-5-6-2 and 1

Therefore, the dendrogram is as shown in Fig. 3.

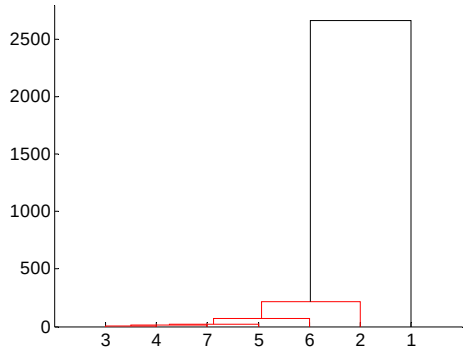



Figure 3: Dendrogram for part (a).

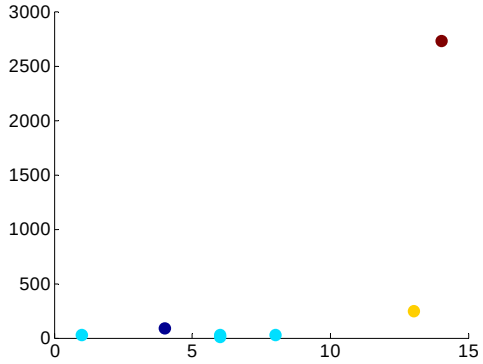



Figure 4: Clustering for Problem 2.

b) The dendrogram provides a mean to cluster the data. It is clear that this particular data is has one or two outlier points; namely the first two pairs. The COBOL and BASIC compilers have very similar performance numbers, therefore they come as the first cluster.

c) The data is as shown below – The required graph is shown in Fig. 4.

You can get the distances and in part (a) directly from the matrix Z. Printing the value of the matrix Z:

```
>> Z = linkage(Y,'centroid')

Z =

          3.00          4.00          2.00
          7.00          8.00          8.49
          5.00          9.00         17.03
          6.00         10.00         66.26
          2.00         11.00        215.15
          1.00         12.00       2661.18
```

You can see that 3 and 4 are combined first since the distance is 2, call this cluster 8. Next point 7 is grouped with cluster 8 since the distance (using the centroid option) is 8.49; call this new cluster 9. Etc.

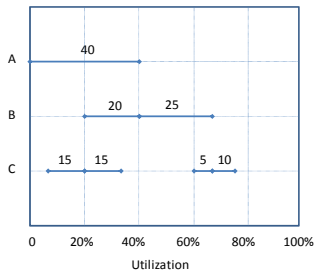
The plot for the clusters (up to 4 – distinguished by color) is as shown in Figure:

**Problem 3 (20 points):**

The draft work is shown in Fig. 5 while the corresponding Gantt chart is shown in Fig. 6.

| A | | | | A' | | | |
|---|---|---|---|---|---|---|---|
| 40 | | | | 60 | | | |
| B' | | B | | B | | B' | |
| 20 | | 20 | | 25 | | 35 | |
| C' | C | C | C' | C' | C | C | C' |
| 5 | 15 | 15 | 5 | 20 | 5 | 10 | 25 |

Draft of Gantt chart.




The corresponding Gantt chart.