National Textile University

ASSIGNMENT NO# 02

Title:

Dissimilarity Matrix of Mixed Type Attributes

Submitted To:

Respected, Sir Dr. Haseeb Ahmad

Submitted By:

Muhammad Azam	**18-NTU-CS-1178**
Muhammad Furqan Haider	**18-NTU-CS-1183**
Usama Sadiq	**18-NTU-CS-1191**

Question:

ID	Marks	Sessional	Grade	Gender
1	27	Excellent	A	M
2	23	Very Good	B	F
3	21	Good	B	M
4	20	Average	C	F

Solution:

Dissimilarity Matrix of Numeric Attribute (Marks)

ID	Marks
1	27
2	23
3	21
4	20

$$d_{(i,j)} = \frac{|x_i - x_j|}{max - min}$$

$$d_{(2,1)} = \frac{|27 - 23|}{27 - 20}$$

$$d_{(2,1)} = 0.57$$

$$d_{(3,1)} = \frac{|27 - 21|}{27 - 20}$$

$$d_{(3,1)} = 0.86$$

$$d_{(4,1)} = \frac{|27 - 20|}{27 - 20}$$

$$d_{(4,1)} = 1$$

$$d_{(3,2)} = \frac{|21 - 23|}{27 - 20}$$

$$d_{(3,2)} = 0.28$$

$$d_{(4,2)} = \frac{|20 - 23|}{27 - 20}$$

$$d_{(4,2)} = 0.43$$

$$d_{(4,3)} = \frac{|20 - 21|}{27 - 20}$$

$$d_{(4,3)} = 0.14$$

Dissimilarity Matrix

$$\begin{bmatrix} 0 & & & \\ 0.57 & 0 & & \\ 0.86 & 0.28 & 0 & \\ 1 & 0.43 & 0.14 & 0 \end{bmatrix}$$

Dissimilarity Matrix of Ordinal Attribute (Sessional)

ID	Sessional
1	Excellent
2	Very Good
3	Good
4	Average

Total State =4

Rank

Excellent=4, Very Good=3, Good=2, Average=1

Normalize Ranking

$$z_{if} = \frac{r_{if} - 1}{m_f - 1}$$

For Excellent

$$z = \frac{4 - 1}{4 - 1}$$

$$z = 1$$

For Very Good

$$z = \frac{3 - 1}{4 - 1}$$

$$z = 0.67$$

For Good

$$z = \frac{2-1}{4-1}$$

$$z = 0.33$$

For Average

$$z = \frac{1-1}{4-1}$$

$$z = 0$$

Using Manhattan Distance

$$d_{(i,j)} = |x_{i1} - x_{j1}| + |x_{i2} - x_{j2}| + \cdots + |x_{ip} - x_{jp}|$$

$$d_{(2,1)} = |0.67 - 1|$$

$$d_{(2,1)} = 0.33$$

$$d_{(3,1)} = |0.33 - 1|$$

$$d_{(3,1)} = 0.67$$

$$d_{(4,1)} = |0 - 1|$$

$$d_{(4,1)} = 1$$

$$d_{(3,2)} = |0.33 - 0.67|$$

$$d_{(3,2)} = 0.33$$

$$d_{(4,2)} = |0 - 0.67|$$

$$d_{(4,2)} = 0.67$$

$$d_{(4,3)} = |0 - 0.33|$$

$$d_{(4,3)} = 0.33$$

Dissimilarity Matrix

$$\begin{bmatrix} 0 & & & \\ 0.33 & 0 & & \\ 0.67 & 0.34 & 0 & \\ 1 & 0.67 & 0.33 & 0 \end{bmatrix}$$

Dissimilarity Matrix of Nominal Attribute (Grade)

ID	Grade
1	A

2	B
3	B
4	C

$$d_{(i,j)} = \frac{p - m}{p}$$

In our question total attributes are 4 therefore p=4

$$d_{(2,1)} = \frac{4 - 0}{4}$$

$$d_{(2,1)} = 1$$

$$d_{(3,1)} = \frac{4 - 0}{4}$$

$$d_{(3,1)} = 1$$

$$d_{(4,1)} = \frac{4 - 0}{4}$$

$$d_{(4,1)} = 1$$

$$d_{(3,2)} = \frac{4 - 1}{4}$$

$$d_{(3,2)} = 0.75$$

$$d_{(4,2)} = \frac{4 - 0}{4}$$

$$d_{(4,2)} = 1$$

$$d_{(4,3)} = \frac{4 - 0}{4}$$

$$d_{(4,3)} = 1$$

Dissimilarity Matrix

$$\begin{bmatrix} 0 & & & \\ 1 & 0 & & \\ 1 & 0.75 & 0 & \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

Dissimilarity Matrix of Binary Attribute (Gender)

ID	Gender
1	M
2	F
3	M
4	F

Object i		Object j		
		M	**F**	**Sum**
	M	q	r	q+r
	F	s	t	s+t
	Sum	q+s	r+t	p

Distance Measure for Symmetric Binary Variables

$$d_{(i,j)} = \frac{r+s}{q+r+s+t}$$

$$d_{(2,1)} = \frac{0+1}{0+0+1+0}$$

$$d_{(2,1)} = 1$$

$$d_{(3,1)} = \frac{0+0}{1+0+0+0}$$

$$d_{(3,1)} = 0$$

$$d_{(4,1)} = \frac{0+1}{0+0+1+0}$$

$$d_{(4,1)} = 1$$

$$d_{(3,2)} = \frac{1+0}{0+1+0+0}$$

$$d_{(3,2)} = 1$$

$$d_{(4,2)} = \frac{0+0}{0+0+0+1}$$

$$d_{(4,2)} = 0$$

$$d_{(4,3)} = \frac{0+1}{0+0+1+0}$$

$$d_{(4,3)} = 1$$

Dissimilarity Matrix

$$\begin{bmatrix} 0 & & & \\ 1 & 0 & & \\ 0 & 1 & 0 & \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

Formula For Dissimilarity Matrix of Mixed Type Attributes

$$d_{(i,j)} = \frac{\sum_{f=1}^{p} \delta_{ij}^{(f)} d_{ij}^{(f)}}{\sum_{f=1}^{p} \delta_{ij}^{(f)}}$$

$$d_{(2,1)} = \frac{(1 * 0.57) + (1 * 0.33) + (1 * 1) + (1 * 1)}{1 + 1 + 1 + 1}$$

$$d_{(2,1)} = 0.72$$

$$d_{(3,1)} = \frac{(1 * 0.86) + (1 * 0.67) + (1 * 1) + (1 * 0)}{1 + 1 + 1 + 1}$$

$$d_{(3,1)} = 0.63$$

$$d_{(4,1)} = \frac{(1 * 1) + (1 * 1) + (1 * 1) + (1 * 1)}{1 + 1 + 1 + 1}$$

$$d_{(4,1)} = 1$$

$$d_{(3,2)} = \frac{(1 * 0.28) + (1 * 0.34) + (1 * 75) + (1 * 1)}{1 + 1 + 1 + 1}$$

$$d_{(3,2)} = 0.59$$

$$d_{(4,2)} = \frac{(1 * 0.43) + (1 * 0.67) + (1 * 1) + (1 * 0)}{1 + 1 + 1 + 1}$$

$$d_{(4,2)} = 0.52$$

$$d_{(4,3)} = \frac{(1 * 0.14) + (1 * 0.33) + (1 * 1) + (1 * 1)}{1 + 1 + 1 + 1}$$

$$d_{(4,3)} = 0.62$$

Dissimilarity Matrix

$$\begin{bmatrix} 0 & & & \\ 0.72 & 0 & & \\ 0.63 & 0.59 & 0 & \\ 1 & 0.52 & 0.62 & 0 \end{bmatrix}$$