TP+TD 03

Exercise :

The following table contains two variables, each with three characteristics. The first variable represents the type of library equipments (Cabinet, Desk, Chair), while the second variable represents the color of this equipment (Gray, Brown, Black).

	Gray	**Brown**	**Black**	**Total**
Cabinet	1	3	5	9
Desk	1	8	6	15
Chair	4	1	1	6
Total	6	12	12	30

- **After Appling the correspondence analysis by SPSS, you get the following results.**

Correspondence

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[DataSet1] C:\Users\Admin\Desktop\ACHOOR\DATA ANALISYS\td.sav
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Credit

CORRESPONDENCE
Version 1.1
by
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Row Profiles

the type of library equipment (Cabinet, Desk, Chair)	the color of this equipment (Gray, Brown, Black).			
	grey	brown	black	Active Margin
Cabinet	.111	.333	.556	1.000
Desk	.067	.533	.400	1.000
chair	.667	.167	.167	1.000
Mass	.200	.400	.400	

Column Profiles

the type of library equipment (Cabinet, Desk, Chair)	the color of this equipment (Gray, Brown, Black).			
	grey	brown	black	Mass
Cabinet	.167	.250	.417	.300
Desk	.167	.667	.500	.500
chair	.667	.083	.083	.200
Active Margin	1.000	1.000	1.000	

Summary

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.586	.343			.921	.921	.185	.037
2	.171	.029			.079	1.000	.190	
Total		.372	11.167	.025[a]	1.000	1.000		

a. 4 degrees of freedom

Overview Row Points[a]

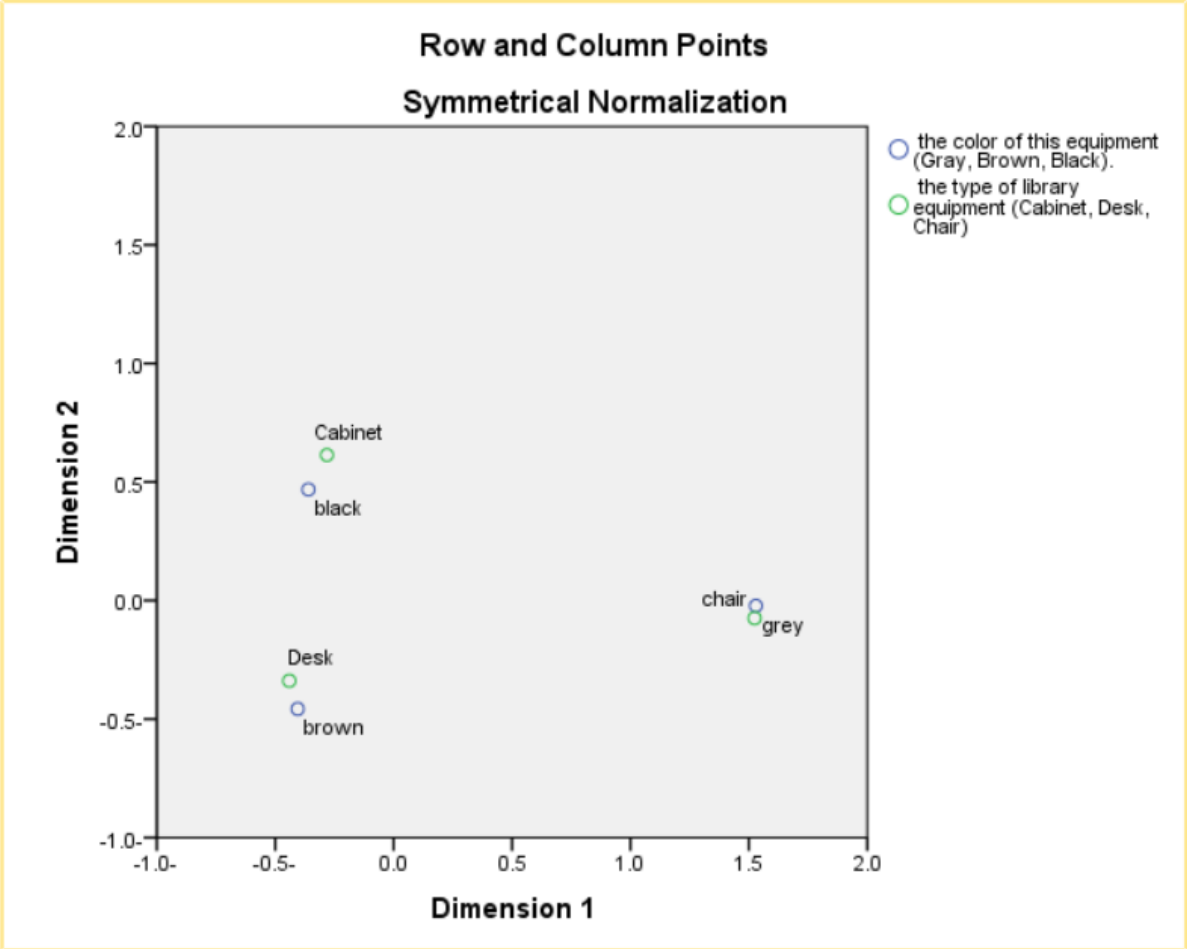
the type of library equipment (Cabinet, Desk, Chair)	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
Cabinet	.300	-.282-	.614	.033	.041	.659	.418	.582	1.000
Desk	.500	-.441-	-.339-	.067	.166	.334	.853	.147	1.000
chair	.200	1.524	-.074-	.272	.794	.006	.999	.001	1.000
Active Total	1.000			.372	1.000	1.000			

a. Symmetrical normalization

Overview Column Points[a]

the color of this equipment (Gray, Brown, Black).	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
grey	.200	1.530	-.022-	.274	.799	.001	1.000	.000	1.000
brown	.400	-.405-	-.457-	.053	.112	.488	.728	.272	1.000
black	.400	-.360-	.468	.045	.088	.512	.668	.332	1.000
Active Total	1.000			.372	1.000	1.000			

a. Symmetrical normalization



1. Find the average row vector (L_m), and the theoretical diagonal matrix for the average row.
2. Compute the distance between the row and the average row and the density for each cell, with commentary on the results.
3. Find the average column vector (C_m), and the theoretical diagonal matrix for the average column.
4. Compute the distance between the column and the average column and the density for each cell, with commentary on the results.
5. Is there a correlation between the rows and columns (i.e., between the equipment and the colors)? Justify your answer.
6. What do you conclude from the Bichat?

Solution

1- From the table of row profiles, we get the average row vector (L_m),

Row Profiles

the type of library equipment (Cabinet, Desk, Chair)	the color of this equipment (Gray, Brown, Black).			
	grey	brown	black	Active Margin
Cabinet	.111	.333	.556	1.000
Desk	.067	.533	.400	1.000
chair	.667	.167	.167	1.000
Mass	.200	.400	.400	

$L_m = \begin{bmatrix} 0.2 \\ 0.4 \\ 0.4 \end{bmatrix}$ and the theoretical diagonal matrix for (L_m) is $D_j = \begin{bmatrix} 0.2 & 0 & 0 \\ 0 & 0.4 & 0 \\ 0 & 0 & 0.4 \end{bmatrix}$

2- Compute the distance between the row and the average row (using the same table)

d^2 Cabinet= $\frac{1}{0.2}(0.111-0.2)^2 + \frac{1}{0.4}(0.333-0.4)^2 + \frac{1}{0.4}(0.556-0.4)^2 = 0.111$

d^2 (Desk) = $\frac{1}{0.2}(0.067-0.2)^2 + \frac{1}{0.4}(0.533-0.4)^2 + \frac{1}{0.4}(0.4-0.4)^2 = 0.133$

d^2 (chair) = $\frac{1}{0.2}(0.667-0.2)^2 + \frac{1}{0.4}(0.167-0.4)^2 + \frac{1}{0.4}(0.167-0.4)^2 = 1.36$

$$d_X^2(i, L_m) = \sum \frac{1}{L_{m_i}} (f_{r_i} - L_{m_i})^2$$

We can notice that the color of the chair is different from the color of the other equipment

- the density for each cell, with commentary on the results.

from the table of overview Row Points we find

Overview Row Points[a]

the type of library equipment (Cabinet, Desk, Chair)	Mass	Score in Dimension 1	Score in Dimension 2	Inertia	Contribution: Of Point to Inertia of Dimension 1	Contribution: Of Point to Inertia of Dimension 2	Contribution: Of Dimension to Inertia of Point 1	Contribution: Of Dimension to Inertia of Point 2	Contribution: Of Dimension to Inertia of Point Total
Cabinet	.300	-.282-	.614	.033	.041	.659	.418	.582	1.000
Desk	.500	-.441-	-.339-	.067	.166	.334	.853	.147	1.000
chair	.200	1.524	-.074-	.272	.794	.006	.999	.001	1.000
Active Total	1.000			.372	1.000	1.000			

a. Symmetrical normalization

or we calculate it. Inertia = disto^2 X poids

	DISTO²	Poids	INERTIE	INERTIE RELATIVE
Cabinet	0.111	0.3	0.0333	3.33
(Desk)	0.133	0.5	0.0665	6.65
(chair)	1.360	0.2	0.2720	27.2
		SUM	0.3718	37.18

It is clear from the table above that the “Chair” attribute carries a greater amount of information, while the “Cabinet” attribute carries a relatively small amount of information compared to the “Desk” attribute, despite the small number of chairs (6). However, it highlights the information better. Additionally, the amount of available information in the data equals **0.3718**. This index is important in the analysis process.

3- Find the average column vector (C_m), and the theoretical diagonal matrix for the average column.

Column Profiles

the type of library equipment (Cabinet, Desk, Chair)	the color of this equipment (Gray, Brown, Black).			
	grey	brown	black	Mass
Cabinet	.167	.250	.417	.300
Desk	.167	.667	.500	.500
chair	.667	.083	.083	.200
Active Margin	1.000	1.000	1.000	

$$C_m = \begin{bmatrix} 0.3 \\ 0.5 \\ 0.2 \end{bmatrix}, \quad D_i = \begin{bmatrix} 0.3 & 0 & 0 \\ 0 & 0.5 & 0 \\ 0 & 0 & 0.2 \end{bmatrix}$$

4- Compute the distance between the column and the average column and the density for each cell, with commentary on the results.

$$d_X^2(j, C_m) = \sum \frac{1}{C_{m_i}} \left(f_{C_i} - C_{m_i}\right)^2$$

$$d^2 \text{ GRAY} = \frac{1}{0.3}(0.167-0.3)^2+\frac{1}{0.5}(0.167-0.5)^2+\frac{1}{0.2}(0.667-0.2)^2=1.369$$

$$d^2 \text{ brown } \frac{1}{0.3}(0.250-0.3)^2+\frac{1}{0.5}(0.667-0.5)^2+\frac{1}{0.2}(0.083-0.2)^2=0.131$$

$$d^2 \text{ black} = \frac{1}{0.3}(0.417-0.3)^2+\frac{1}{0.5}(0.500-0.5)^2+\frac{1}{0.2}(0.083-0.2)^2=0.113$$

from the table of overview column points we find

Overview Column Points[a]

the color of this equipment (Gray, Brown, Black).	Mass	Score in Dimension		Inertia	Contribution				
					Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
grey	.200	1.530	-.022-	.274	.799	.001	1.000	.000	1.000
brown	.400	-.405-	-.457-	.053	.112	.488	.728	.272	1.000
black	.400	-.360-	.468	.045	.088	.512	.668	.332	1.000
Active Total	1.000			.372	1.000	1.000			

a. Symmetrical normalization

or we calculate it. Inertia = disto^2 X poids

	GRAY	BROWN	BLACK	
DISTO²	1.369	0.131	0.113	
Poids	0.2	0.4	0.4	المجموع
Inertie	0.2738	0.0524	0.0452	0.3714

The distribution of the gray color among the office equipment stands out as being different from that of the other colors. Notably, the 'color' attribute—particularly the gray color—conveys a higher amount of information compared to the other attributes.

5- Is there a correlation between the rows and columns (i.e., between the equipment and the colors)? Justify your answer.
To answer this question, we need the summary table

Summary

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.586	.343			.921	.921	.185	.037
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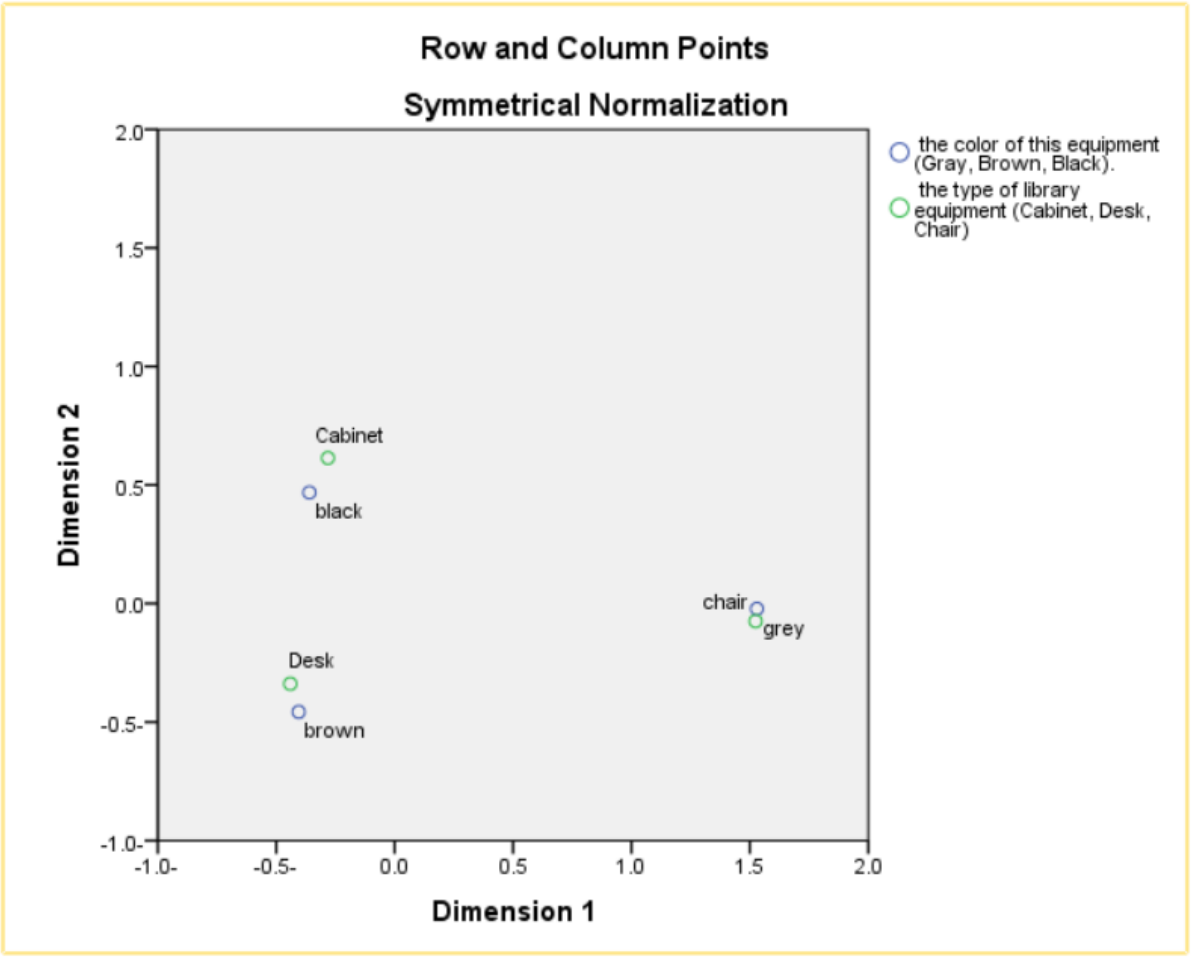
Total		.372	11.167	.025[a]	1.000	1.000		

a. 4 degrees of freedom

we note that the Chi-square value is 11.167 with a significance level of 0.025, which is less than the threshold significance level of 0.05. Therefore, we can conclude that the row and column variables are not independent. In other words, there is a relationship between the equipment and the colors.

6- What do you conclude from the Bichat?



Conclusion from the chart:

The chart shows a correspondence analysis of library equipment types and their colors. We observe the following:

1. **Chairs and the color grey** are positioned closely together, indicating a strong association. This suggests that most chairs are grey.
2. **Cabinets and the color black** are also located near each other, showing a likely connection, cabinets are mostly black.
3. **Desks are associated with the color brown**, as they appear near each other on the plot.
4. The distribution of points indicates that the **color attribute (especially grey)** contributes significantly to the variance in the data, as it is more spread along the dimensions.

Overall, the **color attribute seems to carry more discriminative information** compared to the equipment type, particularly due to how grey is strongly tied to a single type of equipment (chairs).

ZAINEB MEZDOUD