Displaying and Describing Categorical Data

John Karuitha

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Introduction

- We have already defined categorical data.
- Categorical data falls into two categories: ordinal vs nominal.
- Again, we have seen that to summarise categorical data, we use frequency tables or contigency tables.
- We beriefly review frequency tables.

Frequency Tables

- A frequency table records the counts for each of the categories of the variable.
- These are the pure frequency tables
- Some tables report percentages. These are RELATIVE frequency tables.
- Many tables also report both counts and percentages.

Frequency Tables

- Example:
- We asked 40 people whether they watch soap operas on TV because they are interested in the program itself or due to peer pressure.
- There are four answers: I like the programs, I watch die to peer pressure, I do not watch, I don't know. ;
- The results of the poll are as follows; See the data in the file

Frequency Tables

I·like·the·programs,·¶	I·do·not·watch,·¶	I·watch·due·to·peer·pressure,·¶	I·don't·know¶
I·watch·due·to·peer·pressure,·¶	I·do·not·watch,·¶	I·like·the·programs,·¶	I·don't·know¶
I·do·not·watch,·¶	I·don't·know¶	I·watch·due·to·peer·pressure,·¶	I·like·the·programs,·¶
I·don't·know¶	I·watch·due·to·peer·pressure,·¶	I·watch·due·to·peer·pressure,·¶	I·do·not·watch,·¶
I·like·the·programs,·¶	I·like·the·programs,·¶	I·don't·know¶	I·like·the·programs,·¶
I·like·the·programs,·¶	I·watch·due·to·peer·pressure,·¶	I·like·the·programs,·¶	I·do·not·watch,·¶
I·like·the·programs,·¶	I·like·the·programs,·¶	I·watch·due·to·peer·pressure,·¶	I·like·the·programs,·¶
I·watch·due·to·peer·pressure,·¶	I·watch·due·to·peer·pressure,·¶	I·do·not·watch,·¶	I·don't·know¶
I·like·the·programs,·¶	I·like·the·programs,·¶	I·like·the·programs,·¶	I·watch·due·to·peer·pressure,·¶
I·like·the·programs,·¶	I·watch·due·to·peer·pressure,·¶	I·do·not·watch,·¶	I·watch·due·to·peer·pressure,·¶

Figure 1: data for frequency tables

Frequency Tables

Response¶	Frequency¶
I·like·the·programs,·¶	15
I·watch·due·to·peer·pressure,·¶	12
I·don't·know¶	6
I·do·not·watch,·¶	7

Figure 2: freuency table itself

Frequency Tables: Relative frequency tables

- We convert the counts to percentages to get relative frequency tables

Response¶	Relative·Frequency·(%)¶
I·like·the·programs,·¶	37.5
I·watch·due·to·peer·pressure,·¶	30
I·don't·know¶	15
I·do·not·watch,·¶	17.5

Figure 3: Relative frequency tables

Visualizing categorical data

- Two commonly used visualization tools for categorical data are
  - Pie Charts.
  - Bar graphs
- Pie charts are less favored given that they use area to represent data.
- The human mind finds it hard to interpret areas (angles).
- The bar chart is easier for the human mind because its a matter of comparing heights. It is linear.

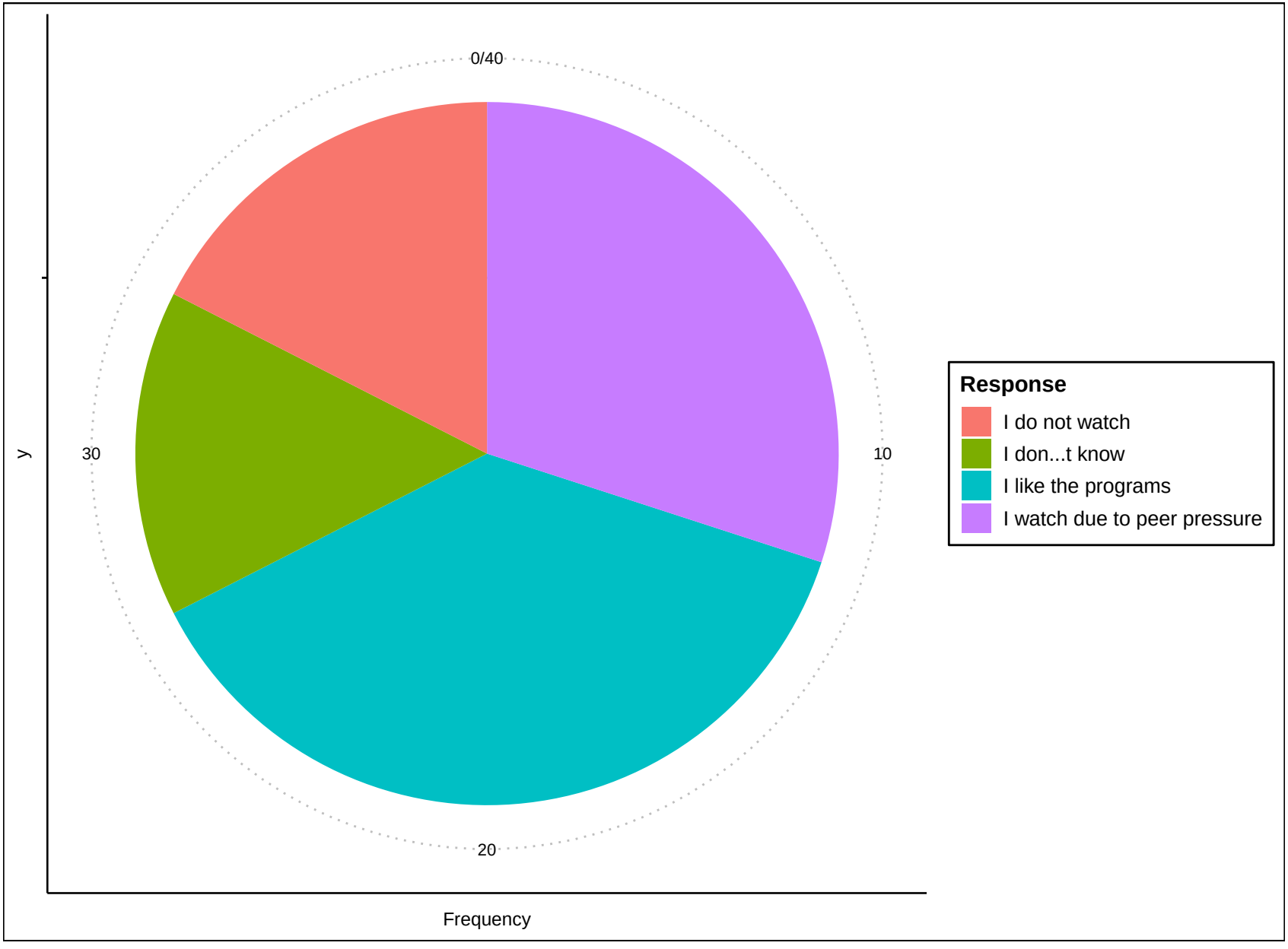
Visualizing categorical data: The area principle

- The best data displays observe a fundamental principle of graphing data called the area principle.
- - The area principle states that the area occupied by a part of the graph should correspond to the magnitude of the value it represents.
- That is why, in doing a bar graph, make sure the bars have the same widths. The comparison should only be on height.

Visualizing categorical data: The Pie Chart

Response	Frequency	Relative_frequency
I like the programs	15	37.5
I watch due to peer pressure	12	30.0
I don't know	6	15.0
I do not watch	7	17.5

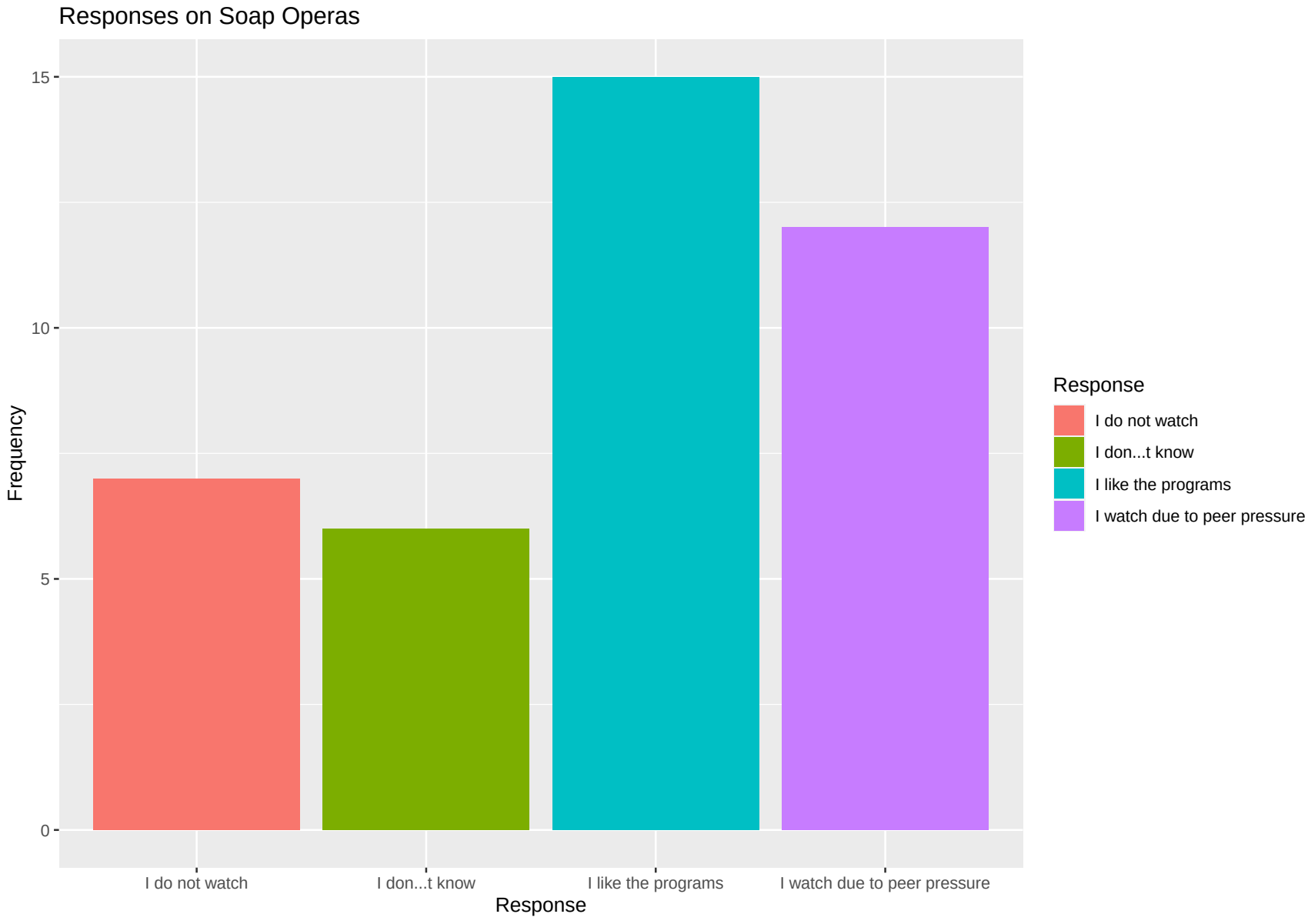
Visualizing categorical data: The Pie Chart



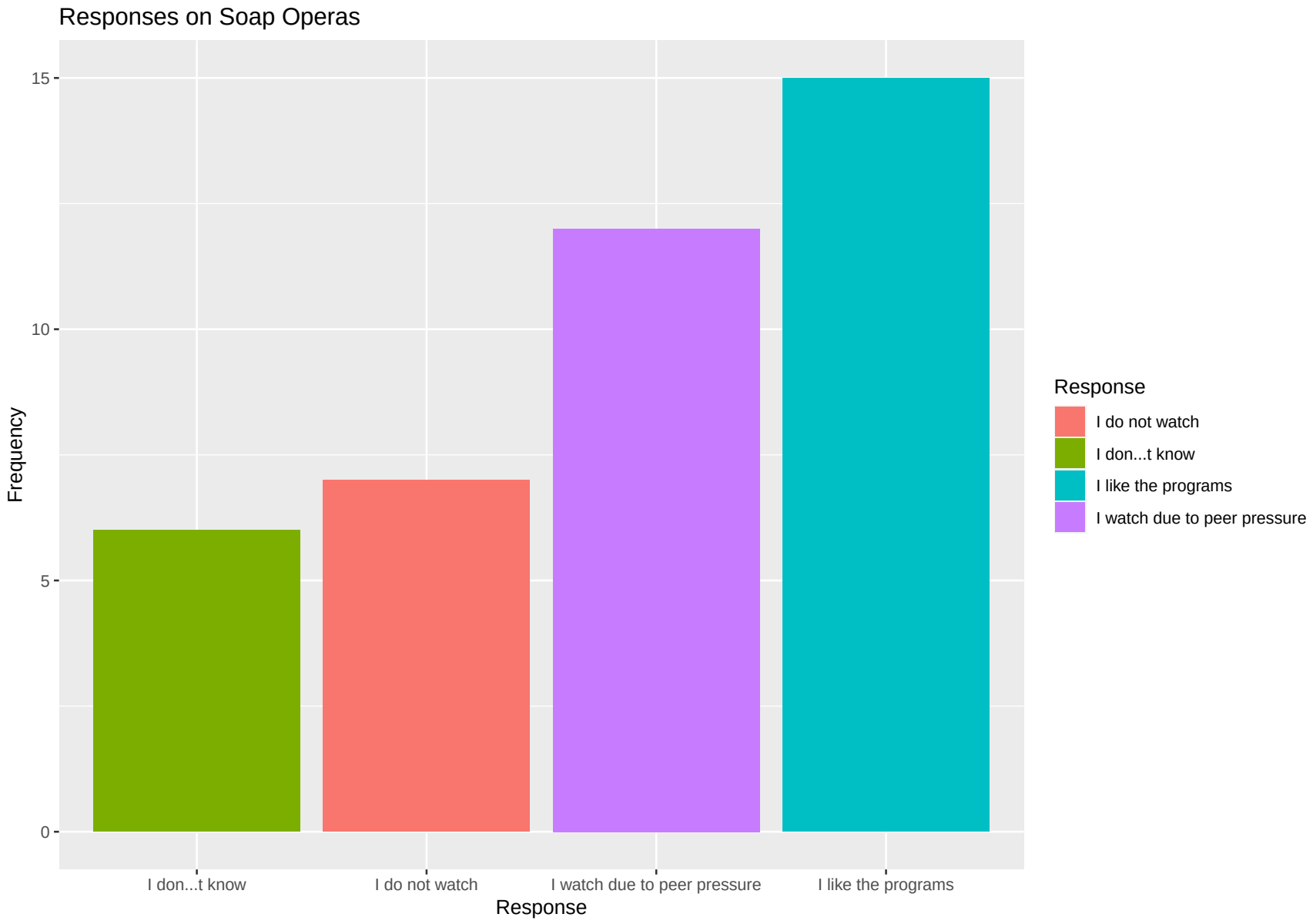
Visualizing categorical data: The bar graph

- The x - axis has the categories while the y-axis has the values.
- As noted, due to the area principle, let the width of the bars be the same so people can compare the heights only.
- Note that it is easier to interpret the bar chart as compared to the pie chart.
- When you have many categories, interpreting the pie chart gets even harder.
- For bar charts its better to arrange the bars in asceding or descending order of height. See examples.

Visualizing categorical data: The bar graph



Visualizing categorical data: The bar graph (Looks better with order)



Visualizing categorical data: The bar graph

- Visualizing and summarising data is perhaps one of the most important but under-estimated skill in statistics and data analysis.
- Before subjecting a dataset to a battery of statistical tests, do the following.
  - Draw a chart.
  - Draw a chart.
  - Draw a chart.
  - Summarise the data - mean, median, mode, SD, Variance, Quartiles, Extreme values, IQR.

Visualizing categorical data: Exercise

- The following dataset shows the responses of individuals in Kenya regarding whether they are generally happy or not.
- Draw a relative frequency table.
- Draw a pie chart from the relative frequncy table.
- Draw a bar chart with % on y -axix and responses on the x-axis, arranging the reponses in ascending order of relative frequency (%)

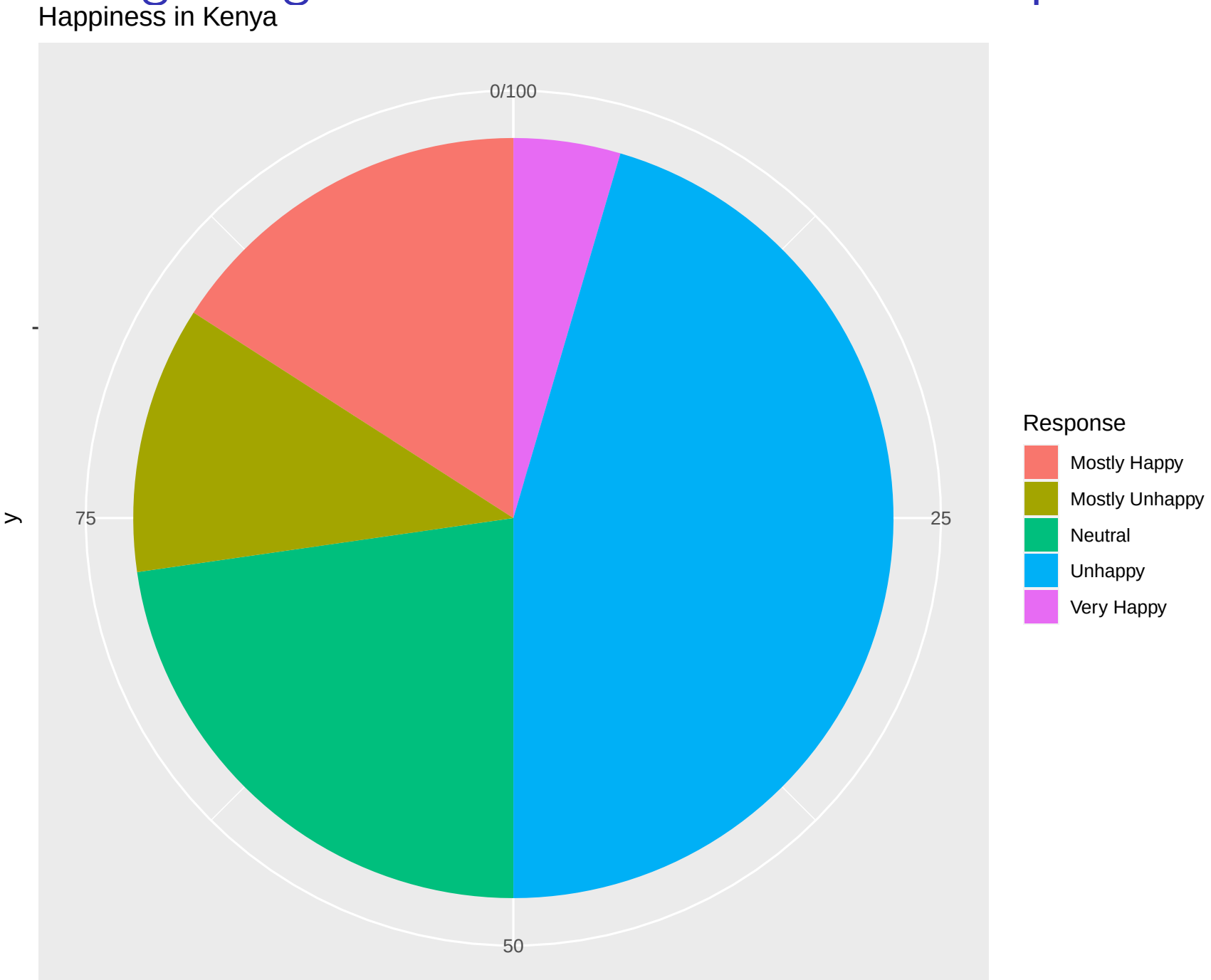
Visualizing categorical data: Exercise

Response	Frequency
Very Happy	200
Mostly Happy	700
Neutral	1000
Mostly Unhappy	500
Unhappy	2000

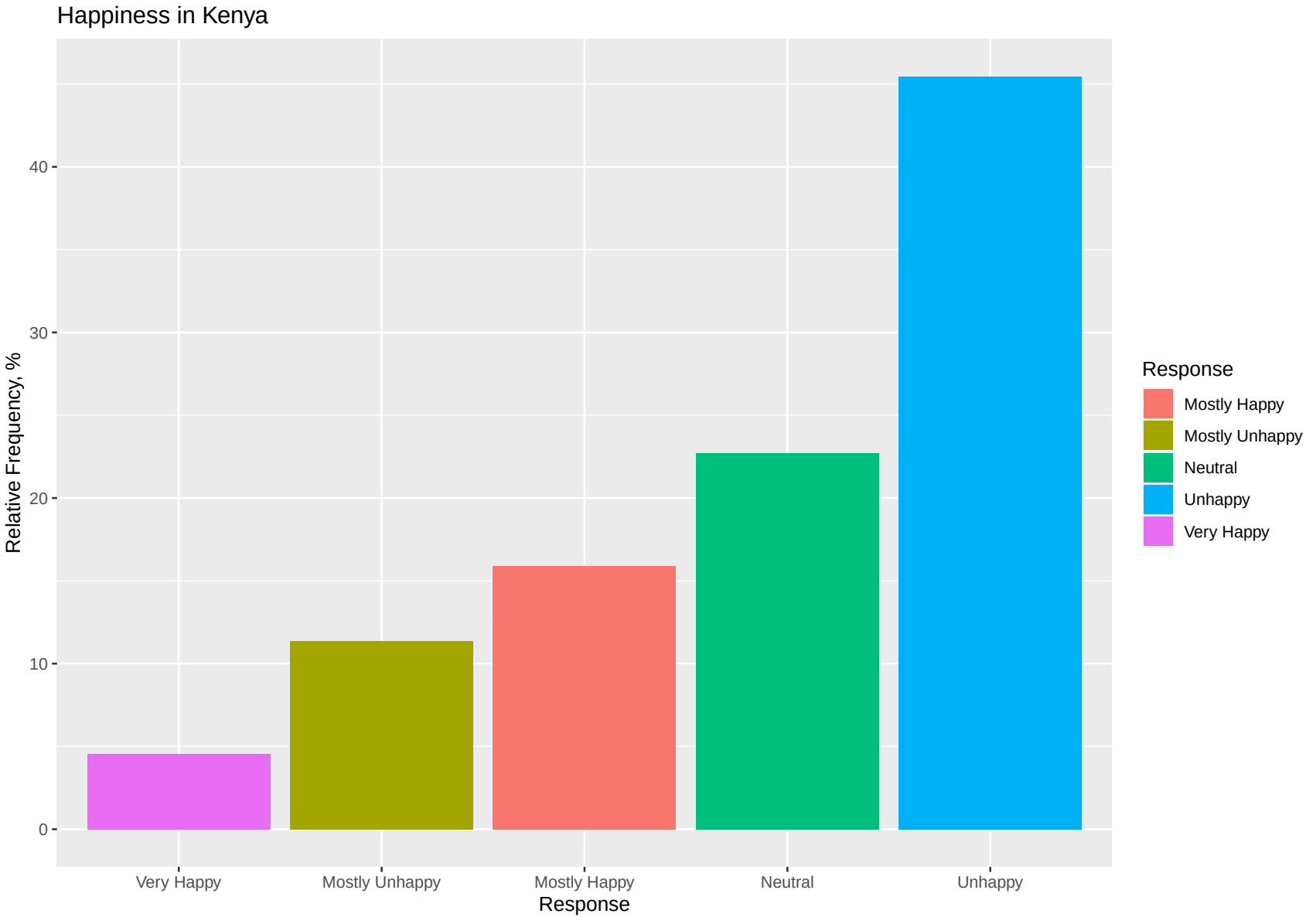
Visualizing categorical data: Exercise solutions- relative frequency table

Response	Frequency	relative_freq
Very Happy	200	4.545454
Mostly Happy	700	15.909091
Neutral	1000	22.727273
Mostly Unhappy	500	11.363636
Unhappy	2000	45.454546

Visualizing categorical data: Exercise solutions- pie chart



Visualizing categorical data: Exercise solutions- Bar chart



Exploring Two Categorical Variables: Contingency Tables

- Sometimes you have two categorical data that you want to summarise together.
- In this case you may use a special type of frequency table called the contigency table.
- The contigency table may present counts or proportions.
- The one with proportions is a relative contigency table.

Exploring Two Categorical Variables: Contingency Tables

- In the previous example, we add a variable for the sex of the respondents, Female or Male.
- See the data in excel.

Exploring Two Categorical Variables: Contingency Tables

- Here are the first 10 rows of the dataset.

Comment	Sex
I like the programs,	Male
I watch due to peer pressure,	Male
I do not watch,	Male
I don't know	Male
I like the programs,	Male
I like the programs,	Male
I like the programs,	Male
I watch due to peer pressure,	Male
I like the programs,	Male
I like the programs,	Male

Exploring Two Categorical Variables: Contingency Tables

- A contigency table will break down the data by both variables, comment and sex.
- For instance, how many men said they do not watch the programs.
- How many women watch the programs out of peer pressure. and so on.
- Again, the summaries can be in the form of counts or percentages.

Exploring Two Categorical Variables: Contingency Tables

- Here we go

	Male	Female	TOTAL
I like the programs,	6	9	15
I watch due to peer pressure,	4	8	12
I don't know	1	5	6
I do not watch,	3	4	7
TOTAL	14	26	40

Figure 4: my contigency table

- The percentages can either be horizontal, by response or vertical, by sex.

Exploring Two Categorical Variables: Contingency Tables

Table 5: Responses

	Female	Male
I do not watch,	0.5714286	0.4285714
I don't know	0.8333333	0.1666667
I like the programs,	0.6000000	0.4000000
I watch due to peer pressure,	0.6666667	0.3333333

Table 6: Responses

	Female	Male
I do not watch,	0.1538462	0.2142857
I don't know	0.1923077	0.0714286
I like the programs,	0.3461538	0.4285714
I watch due to peer pressure,	0.3076923	0.2857143