Chapter 2.1 Frequency Tables & Chapter 2.3

Stem-and-leaf Displays

Learning Objectives

At the end of this lecture, the student should be able to:

- State the steps for making a frequency table
- Define class, upper class limit, and lower class limit
- Explain what relative frequency is, and why it is useful for comparing groups
- State the steps for making a stem-and-leaf display
- Describe the difference between an "ordered" and "unordered" leaf

Introduction

- Define frequency table
- How to make a frequency table
- Define stem-and-leaf display
- How to make a stem-andleaf display



What is a Frequency Table?

Terms and Explanations

Frequency Tables

- Explain what a frequency table is, and why make one
 Define some terms
 Describe the steps in making a frequency and
 - relative frequency table



Image by Tomasz Sienicki

Remember Quantitative Data?



Qualitative data are categorical • Gender, race, diagnosis Quantitative data are numerical • Age, heart rate, blood pressure

Image by the US Navy.

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How to Organize All these Numbers?

- 60 patients were studied for the distance they needed to be transported in an ambulance.
 - The shortest transport (*minimum*) was 1 mile.
 - The longest transport (*maximum*) was 47 miles.
- It's hard to just look at a pile of numbers...how do we understand these data?



Photo by Ibagli

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 - Example: Between 30 and 40 miles.

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- Class width: How wide the class is.
 - Example: Upper class limit (40) minus lower class limit (30) = 10, then add 1 = 11.
 - Example: 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 = 11 numbers

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 - Example: Upper class limit (40) minus lower class limit (30) = 10, then add 1 = 11.
 - Example: 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 = 11 numbers
- Frequency: How many values from the data fall in the class.
 - Example: How many patients were transported 30 to 40 miles.

Decide on Classes

 Classes should be the same width





Decide on Classes

- Classes should be the same width
- Class width can be determined empirically
 - Example: Age 18-24, 25-34, 35-44, 45-54, 55-64, 65 and older
 - Should be based on the scientific literature



Photo by Alias 0591 from the Netherlands

Decide on Classes

- Classes should be the same width
- Class width can be determined empirically
 - Example: Age 18-24, 25-34, 35-44, 45-54, 55-64, 65 and older
 - Should be based on the scientific literature
- Can also be determined using a formula

Photo by Alias 0591 from the Netherlands



Class Width Formula

Formula

- Calculate this number: maximum – minimum.
- Divide this by the number of classes desired.
- Increase this to the next whole number

Example

- From the miles, 47 1 = 46.
- If we want 6 classes, 46/6
 = 7.7.
- We increase this up to 8

Simple Frequency Table

- A frequency table displays each *class* along with the *frequency* (number of data points) in each class.
 - Selecting arbitrary class limits can make the frequency table unbalanced.
- But not following the scientific literature can make your results non-comparable

Class Limits (Lower- Upper)	Frequency
<20 miles	41
21-29 miles	10
30-39 miles	4
40 or more miles	5
Total	60

Example for Frequency Table

Data Collection

- Glucose is measured in the blood and expressed in mg/100 ml.
- Glucose is a big molecule that should be cleared from the blood, especially if fasting.
- Blood glucose levels for a random sample of 70 women were recorded after a 12-hour fast.

Results

ml

- Minimum = 45 mg/100 ml
- Maximum = 109 mg/100
- Decided on 6 classes

Example for Frequency Table

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Results

Class Limits	Frequency
45 - 55	
56 - 66	
67 - 77	
78 - 88	
89 - 99	
100 - 110	
Total	70

Example for Frequency Table

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Results

Class Limits	Frequency
45 - 55	3
56 - 66	7
67 - 77	22
78 - 88	26
89 - 99	9
100 - 110	3
Total	70

Be Careful!

- Make sure that all the data points are accounted for only once in one of the classes.
- Make sure the classes cover all the data.
- Make sure the total of your classes adds up to the total data points!



Relative Frequency Table

- "Relative" = in relationship to the rest of the data.
- Frequency = f
- Total sample size = n
- Relative frequency = f/n
- Relative frequency is the proportion of the values that are in that class.

Relative Frequency Table

 Relative frequency is something very useful to put in a frequency table. See how easy it is to calculate - take each class frequency divided by total.

Class	Freq-	Relative
Limits	uency	Frequency
45 - 55	3	0.04
56 - 66	7	0.10
67 - 77	22	0.31
78 - 88	26	0.37
89 - 99	9	0.13
100 - 110	3	0.04
Total	70	1.00

Frequency Tables

- Frequency tables are necessary for organizing quantitative data.
- Class width must be selected, and lower and upper class limits determined
- Frequencies are then filled in.
- You can also include relative frequencies.



Photo by Robert Weißenberg

What is a Stem and Leaf?

Terms and Explanations

Stem-and-leaf

- What is a stem and leaf plot?
 - How is a stem and leaf plot made?
- Why not just make a frequency table?

2	0
3	025
4	11378
5	133467889
6	024559
7	147
8	8
9	
10	2

Image by Joxemai

 In a stem and leaf, there is always a "stem"

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Leaves are then added to the stem as we tally up the length of the leaves.



- In a stem and leaf, there is always a "stem"
 Leaves are then added to the stem as we tally up the length of the leaves.
- Making one will help you understand the terminology.



Example: Days since Referral

- Data from 42 patients who visited a primary care clinic and were
 referred to mental health were collected.
- The number of days between the referral and their first mental health appointment was collected.



Behavioral Health Treatment Services Locator

Find alcohol and drug abuse treatment or mental health treatment facilities and programs around the country at <u>findtreatment.samhsa.gov</u>.



30	27	12	42	35	47
38	36	27	35	22	17
29	3	21	0	38	32
41	33	26	45	18	43
18	32	31	32	19	21
33	31	28	29	51	12
32	18	21	26	71	105

30	27	12	42	35	47	
38	36	27	35	22	17	
29	3	21	0	38	32	
41	33	26	45	18	43	
18	32	31	32	19	21	
33	31	28	29	51	12	
32	18	21	26	71	105	

Dava aines referral

3

0



Building the Stem and Leaf Days since referral





30	27	12	42	35	47
38	36	27	35	22	17
29	3	21	0	38	32
41	33	26	45	18	43
18	32	31	32	19	21
33	31	28	29	51	12
32	18	21	26	71	105

Fast Forward

30271242354738362735221729321038324133264518431832313219213331282951123218212671105						
38362735221729321038324133264518431832313219213331282951123218212671105	30	27	12	42	35	47
29321038324133264518431832313219213331282951123218212671105	38	36	27	35	22	17
4133264518431832313219213331282951123218212671105	29	3	21	0	38	32
1832313219213331282951123218212671105	41	33	26	45	18	43
3331282951123218212671105	18	32	31	32	19	21
32 18 21 26 71 105	33	31	28	29	51	12
	32	18	21	26	71	105

Days since referral

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2 7
 2 7 7 2 9
 3 0 5 8 6 5
 4 2 7

3

Days since referral

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	Later, when we get to 51,	Days since referral					
)	3 0 we will need to add a 5 to the stem.	30	27	12	42	35	47
	27	38	36	27	35	22	17
-	77291	29	3	21	0	38	32
	05865	41	33	26	45	18	43
	27	18	32	31	32	19	21
		33	31	28	29	(51)	12
		32	18	21	26	71	105
				NOK			



0 3 0

5

6

8

9

- 2 7 At 105, the "10" is the stem.
- 2 7 7 2 9 1
- 3 0 5 8 6 5

3 0 5 8 6 9 4 2 7

Days since referral

		-			
30	27	12	42	35	47
38	36	27	35	22	17
29	3	21	0	38	32
41	33	26	45	18	43
18	32	31	32	19	21
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Organizing Quantitative Data

Frequency Table

- 1. Need to set up classes, class widths
- 2. Need to count frequencies in each class
- 3. Lots of pre-calculations

Stem and Leaf

Do not need to set up classes or class widths
 No need to count. Can tally the data as you go through the list.
 Quicker to do

Good Idea!

• Leaf is "unordered" if numbers out of order.

0 3 1 2 7 2 7 7 2 9 3 0 5 8 6 5

27

4

Good Idea!

- Leaf is "unordered" if numbers out of order.
 After making unordered version,
 - order the leaves.

Good Idea!

- Leaf is "unordered" if numbers out of order.
- After making unordered version, order the leaves.
- Then it is easier to count them up for your frequency table – no matter what classes
- Or, make each "leaf" a "class"

Stem-and-Leaf

- A stem and leaf is another way to organize quantitative data.
- A stem and leaf is easier to make than a frequency table and requires less preparation
- Can help you put data in order to create a frequency table



Photo by Harry Rose from South West Rocks, Australia

Conclusion

- Frequency tables and stem-and-leaf displays organize data Stem-and-leaf may help make a frequency table Purpose is to reveal "distribution" - next
 - lecture



Painting by Paul Monnier