

2.3 Grouping Quantitative Data

Goals:

Numbers!

1. Group data into meaningful classes
2. Construct frequency distribution tables using classes
3. Construct histograms using classes
4. Construct dot plots
3. Construct stem and leaf diagrams

Study Ch. 2.3 #43(35), 48(40), 49(41),
53, 67-79(do only 1 histogram)

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

2.2 Grouping Data

Grouping Quantitative Data

Study Ch. 2.3 #43, 49, 53, 61, 67-79
(do only 1 histogram)

Energy Consumption (US Energy Information Administration):
50 Households in the South

Millions of BTUs

130	55	45	64	155	66	60	80	102	62
58	101	75	111	151	139	81	55	66	90
97	77	51	67	125	50	136	55	83	91
54	86	100	78	93	113	111	104	96	113
96	87	129	109	69	94	99	97	83	97

[See frequency table](#)



Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

2.2 Grouping Data

2.3 Grouping Quantitative Data

Frequency Distribution Tables

Classes: categories for grouping data

Frequency: Number of data items in a class

Relative Frequency: Ratio of Frequency of the class to the total number
or proportion of the observations in the class

Lower Cutpoint: smallest **value** of a class - quantitative

Upper Cutpoint: upper **boundary** of a class (up to but not included),
quantitative beginning of the next higher class

Midpoint: middle of a class, average of cutpoints

Width: difference between cutpoints

BTU	tally	freq	rel f	midpt
40 < 50				45
50 < 60				55
60 < 70				65
70 < 80				75
80 < 90				85
90 < 100				95
100 < 110				105
110 < 120				115
120 < 130				125
130 < 140				135
140 < 150				145
150 < 160				155
n=	50			

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

Terms

2.3 Grouping Quantitative Data

Create the Frequency Distribution Table

1. Decide on the **number of groups:** from **5 to 20**
(reveal relevant information)
2. Each **observation** is included in **only one class**.
3. **Equal widths**.

Energy Consumption (US Energy Information Administration):
50 Households in the South

Millions of BTUs

130	55	45	64	155	66	60	80	102	62
58	101	75	111	151	139	81	55	66	90
97	77	51	67	125	50	136	55	83	91
54	86	100	78	93	113	111	104	96	113
96	87	129	109	69	94	99	97	83	97

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

Frequency Distribution Table

2.3 Grouping Quantitative Data Energy Consumption (US Energy Information Administration):
50 Households in the South

Construct Frequency Distribution Table
include frequency, relative frequency, and midpoint

Millions of BTUs

130	55	45	64	155	66	60	80	102	62
58	101	75	111	151	139	81	55	66	90
97	77	51	67	125	50	136	55	83	91
54	86	100	78	93	113	111	104	96	113
96	87	129	109	69	94	99	97	83	97

BTU	tally	freq	rel f	midpt
40 < 50				45
50 < 60				55
60 < 70				65
70 < 80				75
80 < 90				85
90 < 100				95
100 < 110				105
110 < 120				115
120 < 130				125
130 < 140				135
140 < 150				145
150 < 160				155
n=	50			

return

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#) [Class Notes](#) [Homework](#)

Example

2.3 Grouping Quantitative Data Energy Consumption (US Energy Information Administration):
50 Households in the South

Construct Frequency Distribution Table
include frequency, relative frequency, and midpoint

Millions of BTUs

130	55	45	64	155	66	60	80	102	62
58	101	75	111	151	139	81	55	66	90
97	77	51	67	125	50	136	55	83	91
54	86	100	78	93	113	111	104	96	113
96	87	129	109	69	94	99	97	83	97

BTU	tally	freq	rel f	midpt
40 < 50		1	0.02	45
50 < 60		7	0.14	55
60 < 70		7	0.14	65
70 < 80		3	0.06	75
80 < 90		6	0.12	85
90 < 100		10	0.20	95
100 < 110		5	0.10	105
110 < 120		4	0.08	115
120 < 130		2	0.04	125
130 < 140		3	0.06	135
140 < 150		0	0.00	145
150 < 160		2	0.04	155
n=	50			

return

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#) [Class Notes](#) [Homework](#)

Example

2.3 Grouping Quantitative Data

Tables help us to organize the data, and reveal some of the distribution.

BTU	tally	freq	rel f	midpt
40 < 50		1	0.02	45
50 < 60		7	0.14	55
60 < 70		7	0.14	65
70 < 80		3	0.06	75
80 < 90		6	0.12	85
90 < 100		10	0.20	95
100 < 110		5	0.10	105
110 < 120		4	0.08	115
120 < 130		2	0.04	125
130 < 140		3	0.06	135
140 < 150		0	0.00	145
150 < 160		2	0.04	155
n=	50			

Can see that
highest frequency
is near the center

but remaining distribution
is not as apparent

Can we display the organized data in other ways to
help us understand more about the frequency distribution?

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

2.3 Graphs & Charts

2.3 Grouping Quantitative Data

Visual Displays of Data

1. Histograms
 2. Dot plots
 3. Stem & Leaf Diagrams
 4. Pie Charts & Bar Graphs
- quantitative
- qualitative

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

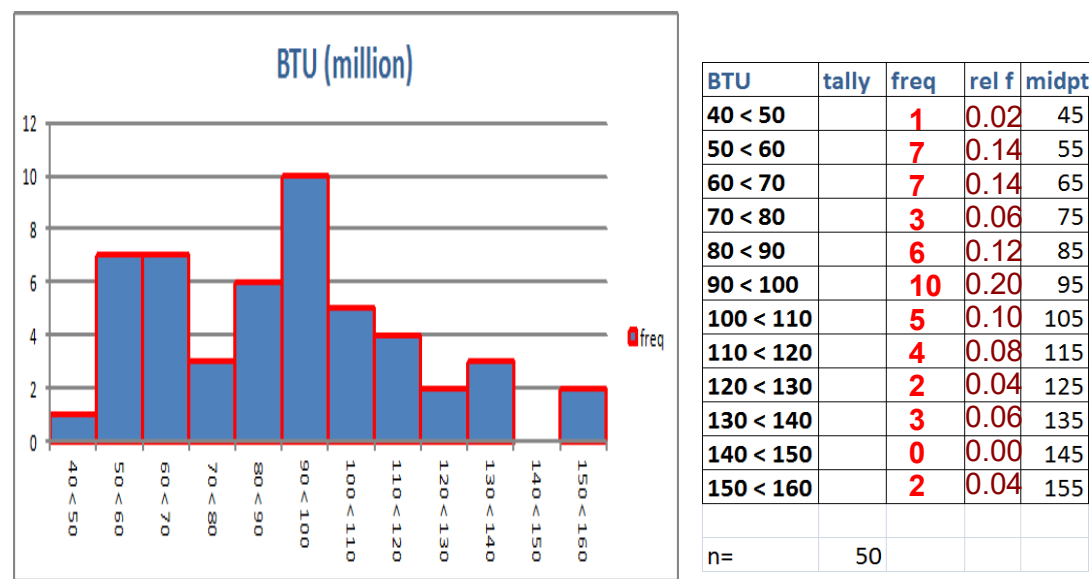
[Class Notes](#)

[Homework](#)

2.3 Graphs & Charts

2.3 Grouping Quantitative Data

Histogram: Graphical Display of **Frequency** Distribution

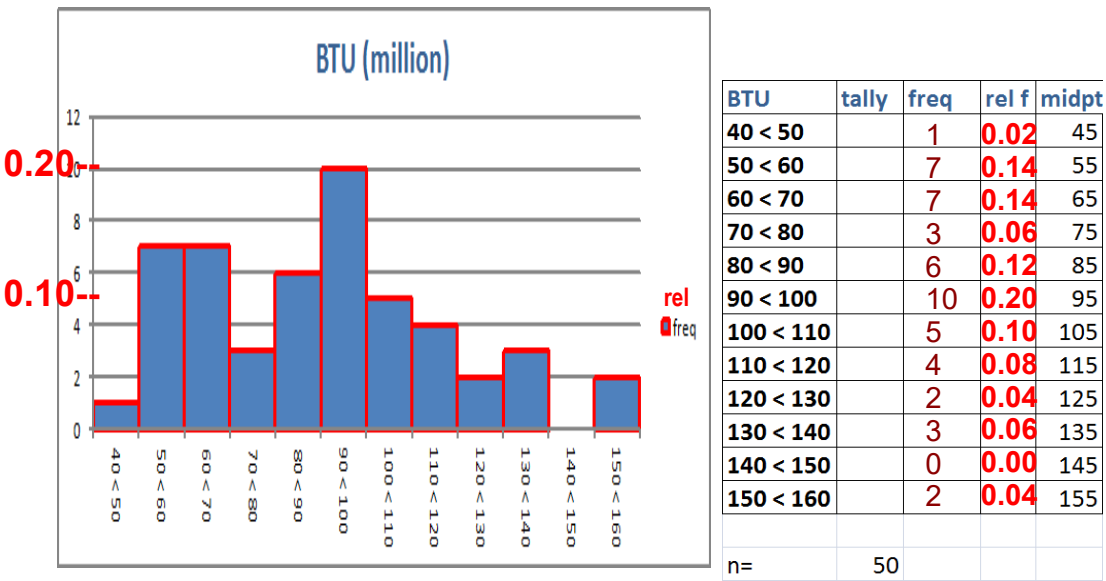


Class Notes: Prof. G. Battaly, Westchester Community College, NY

Histogram

2.3 Grouping Quantitative Data

Histogram: Graphical Display of **Relative Frequency** Distribution

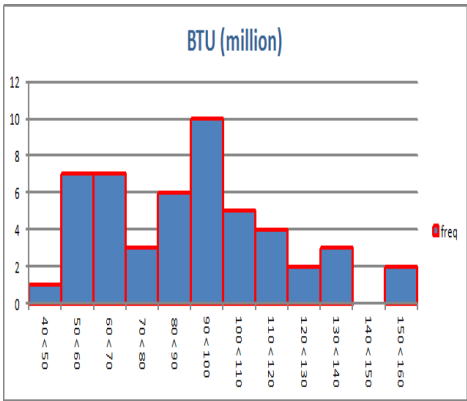


Class Notes: Prof. G. Battaly, Westchester Community College, NY

Histogram

2.3 Grouping Quantitative Data

Histogram: Graphical Display of Frequency Distribution or Relative Frequency Distribution



BTU	tally	freq	rel f	midpt
40 < 50		1	0.02	45
50 < 60		7	0.14	55
60 < 70		7	0.14	65
70 < 80		3	0.06	75
80 < 90		6	0.12	85
90 < 100		10	0.20	95
100 < 110		5	0.10	105
110 < 120		4	0.08	115
120 < 130		2	0.04	125
130 < 140		3	0.06	135
140 < 150		0	0.00	145
150 < 160		2	0.04	155

How is a histogram different from a bar graph?

Type	Bars	Data
Histogram	Attached	Continuous
Bar graph	Separate	Qualitative, Discrete

Class Notes: Prof. G. Battaly, Westchester Community College, NY

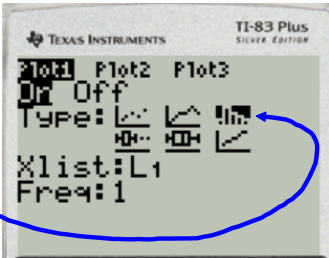
- Statistics Home Page
- Class Notes
- Homework

Histogram

2.3 Organizing Quantitative Data

Histogram by Calculator

1. STAT / EDIT, enter data in L1 (or other)
2. 2nd StatPlot / Plot 1 (or other)
3. Select ON
4. Type: histogram (top right)
5. xList: L1 (or other)
6. ZOOM/ STAT
7. To adjust histogram to problem specs, use WINDOW options:
 - a) Xscl to change class width
 - b) Xmin and Xmax



eg: to use histogram for classes of width = 10,
use Xmin = 40, Xmax = 160, and Xscl = 10

Millions of BTUs									
130	55	45	64	155	66	60	80	102	62
58	101	75	111	151	139	81	55	66	90
97	77	51	67	125	50	136	55	83	91
54	86	100	78	93	113	111	104	96	113
96	87	129	109	69	94	99	97	83	97

Class Notes: Prof. G. Battaly, Westchester Community College, NY

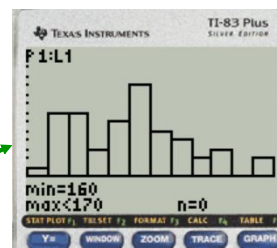
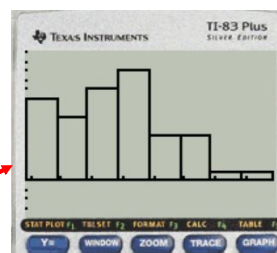
- Statistics Home Page
- Class Notes
- Homework

histogram by Calculator

2.3 Organizing Quantitative Data

Histogram by Calculator

1. STAT / EDIT, enter data in L1 (or other)
 2. 2nd StatPlot / Plot 1 (or other)
 3. Select ON
 4. Type: histogram (top right)
 5. xList: L1 (or other)
 6. ZOOM/ STAT
 7. To adjust histogram to problem specs, use WINDOW options:
 - a) Xscl to change class width
 - b) Xmin and Xmax
- eg: to use histogram for classes of width 10,
use Xmin = 40, Xmax = 160, and Xscl = 10



Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)
[Class Notes](#)
[Homework](#)

histogram by Calculator

2.3 Organizing Quantitative Data

66	65	66
63	66	66
60	73	72
60	61	69
73	63	74
67	66	66
66	70	70
60	64	66
72	62	64
60	72	

Construct a frequency distribution table and the Histogram that represents this data.

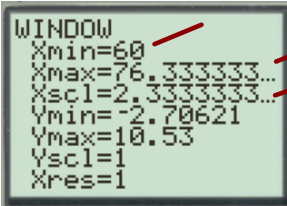
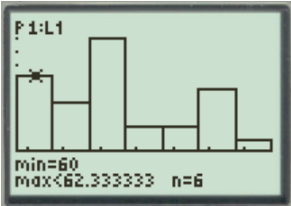
Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)
[Class Notes](#)
[Homework](#)

Jan 22-5:34 PM

2.3 Organizing Quantitative Data

66	65	66
63	66	66
60	73	72
60	61	69
73	63	74
67	66	66
66	70	70
60	64	66
72	62	64
60	72	

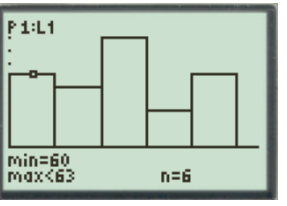
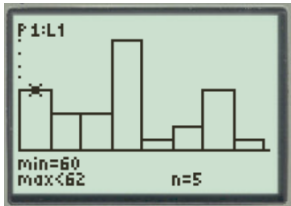


Histogram from calculator puts data into window from min=60 to max=76.333, with width=2.333

This is perfectly acceptable since height is a continuous variable, and 7 classes is between 5 and 20.

But, if you prefer to have a width that is an integer, to match with manual frequency distribution table with classes, change the width in the window to 2 or 3.

Width = 2, 8 classes Width = 3, 5 classes



Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

Jan 22-5:34 PM

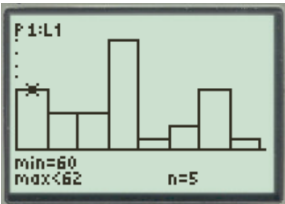
2.3 Organizing Quantitative Data

66	65	66
63	66	66
60	73	72
60	61	69
73	63	74
67	66	66
66	70	70
60	64	66
72	62	64
60	72	

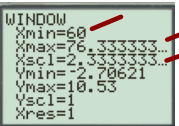
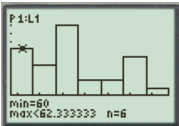
The complete problem includes a distribution table

Class	f
60<62	5
62<64	3
64<66	3
66<68	9
68<70	1
70<72	2
72<74	5
74<76	1

Width = 2, 8 classes



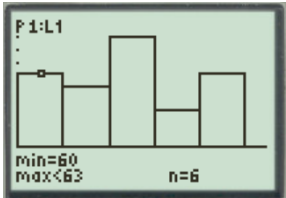
If using the calculator from the start, can sort data to do the frequency count, or simply change width in the window, and copy down the values from trace results



Histogram from calculator puts data into window from min=60 to max=76.333, with width=2.333
This is perfectly acceptable since height is a continuous variable, and 7 classes is between 5 and 20.

But, if you prefer to have a width that is an integer, to match with manual frequency distribution table with classes, change the width in the window to 2 or 3.

Width = 3, 5 classes



Bottom line: To do histogram, need a distribution table.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

Jan 22-5:34 PM

2.3 Organizing Quantitative Data

Dotplot:

68

74

69

68

64

66

58

63

73

76

Dotplot: Display of Data similar to histogram but does not require a frequency table.

Dotplot: Do manually, or using some software. But, Not done by calculator, unless tweeked.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

Dotplot

2.3 Organizing Quantitative Data

Dotplot:

68

74

69

68

64

66

58

63

73

76

Dotplot: Display of Data similar to histogram but does not require a frequency table.

Dotplot: Do manually, or using some software. But, Not done by calculator.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

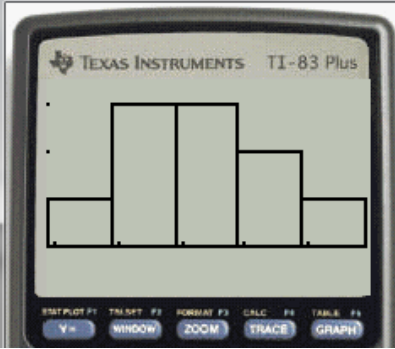
[Homework](#)

Dotplot

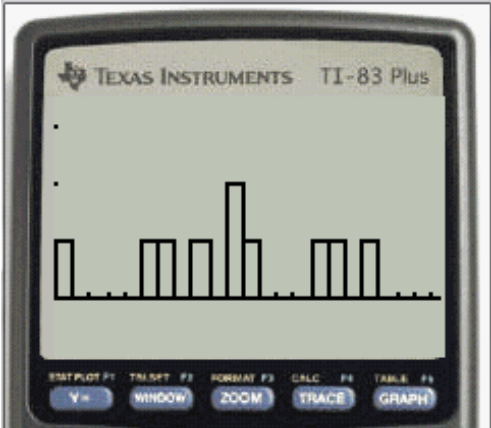
On Calculator: Can simulate using histogram, but NOT REQUIRED:
Dotplot:
Enter data and Stat Plot to Graph.
Change Xscl to 1 and graph

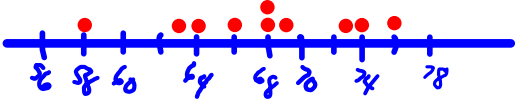
68
74
69
68
64
66
58
63
73
76

No change in Xscl: cannot compare to dotplot



Change Xscl to 1: Compare to Dotplot





Compares to Dot Plot

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)[Class Notes](#)[Homework](#)

Dotplot

2.3 Organizing Quantitative Data

Stem & Leaf Diagram:

Use when have numbers in form xxx..x|R
where R is the right most single digit.

68
74
69
68
64
66
58
63
73
76

Start with 1st digit:

5
6
7

Not enough classes to be meaningful.

Use each digit twice:
Changes class width from 10 to 5

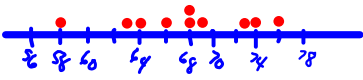
5
5
6
6
7
7

Get 6 classes

50 to 54
55 to 59
60 to 64
65 to 69
70 to 74
75 to 79

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)[Class Notes](#)[Homework](#)



Dotplot

© G. Battaly 2019

10

2.3 Organizing Quantitative Data

Stem & Leaf Diagram:

Use when have numbers in form xxx..x|R
where R is the right most single digit.

68
74
69
68
64
66
58
63
73
76

Start with 1st digit: 5 | 8
6 | 8 9 8 4 6 3
7 | 4 3 6

Not enough classes to be meaningful.

Use each digit twice:
Changes class width
from 10 to 5

Get possible 6 classes
actually 5 classes

5 |
5 | 8
6 | 4 3
6 | 8 9 8 6
7 | 4 3
7 | 6

stem & leaf

Not ordered:
64 before 63

Class Notes: Prof. G. Battaly, Westchester Community College, NY

Statistics Home Page

Class Notes

Homework

Dotplot

2.3 Organizing Quantitative Data

Stem & Leaf Diagram:

Use when have numbers in form xxx..x|R
where R is the right most single digit.

68
74
69
68
64
66
58
63
73
76

Use each digit twice:
Changes class width
from 10 to 5

Get possible 6 classes
actually 5 classes

5 |
5 | 8
6 | 3 4
6 | 6 8 8 9
7 | 3 4
7 | 6

ORDERED
Stem & Leaf
Diagram

Can be used to find the
middle value.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

Statistics Home Page

Class Notes

Homework

Dotplot

2.3 Organizing Quantitative Data

COMPARE to HISTOGRAM

Stem & Leaf Diagram

5 5 6 6 7 7

8 4 6 8 4 7

3 3 9 3 6 6

Use each digit twice:

Changes class width

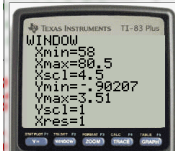
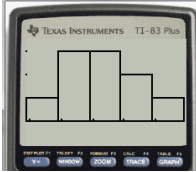
from 10 to 5

Get possible 6 classes

actually 5 classes

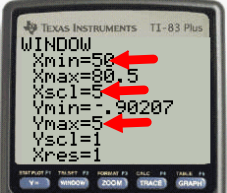
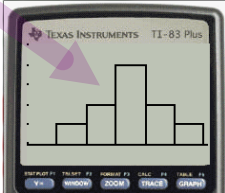
Histogram from Calculator

no changes from auto



Histogram from Calculator

WITH CHANGES



Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

Dotplot

2.3 Organizing Quantitative Data

Construct a Stem & Leaf Diagram for the following heights:

Heights (in)

62	67	68
70	65	65
67	72	72
63	69	68
67	65	74
64	71	69
70	65	73
65	68	

Max = _____

Min = _____

subtract = _____

How many lines?

(Want 5 to 20.)

What width?

ORDERED

Stem & Leaf

Diagram

Can be used to find the

middle value.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[Statistics Home Page](#)

[Class Notes](#)

[Homework](#)

Dotplot

© G. Battaly 2019

12

2.3 Organizing Quantitative Data

Heights (in)

62	67	68
70	65	65
67	72	72
63	69	68
67	65	74
64	71	69
70	65	73
65	68	

Max=74, Min=62
74-62=12
If use 2/line have 6 lines
 $5 < 6 < 25$

ORDERED
Stem & Leaf
Diagram

Can be used to find the
middle value.

Stem & Leaf Diagram:

Use when have numbers in form xxx..x|R
where R is the right most single digit.

Use class width of 2.
Get 7 classes

62 6
64 6
66 6
68 6
70 7
72 7
74 7

Use class width of 3.
Get 5 classes

62 6
65 6
68 6
71 7
74 7

Both work. Pick the one you want.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

Statistics Home Page

Class Notes

Homework

Dotplot

2.3 Organizing Quantitative Data

Heights (in)

62	67	68
70	65	65
67	72	72
63	69	68
67	65	74
64	71	69
70	65	73
65	68	

Stem & Leaf Diagram:

Use when have numbers in form xxx..x|R
where R is the right most single digit.

Use class width of 2:

62 6 | 2 3
64 6 | 4 5 5 5 5
66 6 | 7 7 7
68 6 | 9 8 8 8 9
70 7 | 0 0 1
72 7 | 2 2 3
74 7 | 4

Use class width of 3.
Get 5 classes

62 6 | 2 3 4
65 6 | 5 5 5 5 5 7 7 7
68 6 | 9 8 8 8 9 0 0
71 7 | 1 2 2 3
74 7 | 4

Is this ordered? Can you find the middle height?

No. 69 before 68

Need to sort or order first.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

Statistics Home Page

Class Notes

Homework

Dotplot

2.3 Organizing Quantitative Data

Stem & Leaf Diagram:

Use when have numbers in form xxx..x|R
where R is the right most single digit.

ORDERED Stem & Leaf Diagram

Data is sequenced.

62

6

2 3

64

6

4 5 5 5 5 5

66

6

7 7 7

68

6

8 8 8 9 9

70

7

0 0 1

72

7

2 2 3

74

7

4

62

6

2 3 4

65

6

5 5 5 5 5 7 7 7

68

6

8 8 8 9 9 0 0

71

7

1 2 2 3

74

7

4

Heights (in)

62	67	68
70	65	65
67	72	72
63	69	68
67	65	74
64	71	69
70	65	73
65	68	

Can find the middle height.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

Statistics Home Page

Class Notes

Homework

Dotplot

2.3 Organizing Quantitative Data

Histogram: Graphical Display of Frequency Distribution

or Relative Frequency Distribution

histogram video

Height (in) of Stat students, 2012 and 2013

77	71	65	70	63
72	76	62	69	67
66	67	72	70	64
65	61	67	67	58
62	68	69	66	60
63	63	71	69	63
69	67	76	63	71
61	65	65	66	69
70	70	69	66	
68	63	67	71	

Height (in) of Stat Students, 2012 & 2013

Key : 3|| means 3, 1

Class Notes: Prof. G. Battaly, Westchester Community College, NY

Statistics Home Page

Class Notes

Homework

Histogram