MONASH University

Information Technology

FIT1006
Business Information Analysis

Lecture 3
Graphical Presentation of (Quantitative) Data

Topics covered:

- Types of Data
- Tally & Frequency Table
- Stem and Leaf Plot
- Histogram
- Visualisation of Data.

❖ You can go through pie charts and column graphs in Excel on your own.

❖ We will cover multivariate data and time series later in the course.

Motivating problem…

- A grocery store wants you to analyse the amount spent by their customers. They also think there might be different types of customers. They have given you the sales history of 10 randomly sampled customers.

- Oh, you can't use a calculator or computer…

- We'll work on this in Lectures 4 & 5 also…

Introduction

- Different types of data allow us to perform different methods of analysis.
- The first step in analysing quantitative data should be to ‘see’ the data in order to observe the underlying pattern, or distribution, of the data.
- It is the distribution of the data which determines which statistical measures are appropriate.

https://flux.qa (Feed code: SJ6KGV)

Question 1

I dig up 10 worms in my back garden and measure their length. What type of data do I have?

A. Discrete
B. Continuous
C. Qualitative
D. Categorical
E. Something else!

https://flux.qa (Feed code: SJ6KGV)

Question 2

Students complete a survey ranking their satisfaction as high, medium or low. What type of data is that?

A. Discrete
B. Continuous
C. Qualitative
D. Categorical
E. Something else!

https://flux.qa (Feed code: SJ6KGV)

Question 3

Students complete a survey ranking their satisfaction on a scale 0, 1, 2, …, 10. What type of data is that?

A. Discrete
B. Continuous
C. Qualitative
D. Categorical
E. Something else!

Types of Data

- Quantitative
  - Discrete eg. 1, 2, 3...
  - Continuous eg. 3, 4.256, 3.999, 11.2, ...
  - *We can calculate summary numerical statistics*
- Ordinal
  - Qualitative eg. agree, neutral, disagree
  - Qualitative eg. Lecturer, Senior Lecturer, Professor
  - *We can calculate statistics based on rank*
- Nominal
  - Categorical eg, red, green, silver, ...
  - *We can calculate statistics based on counts*

Motivating Problem

- Data is from the Kaggle ‘Dunnhumby’s Shopper Challenge’ which recorded the amount spent and date of the transaction at a supermarket in the US over one year.
- See: http://www.kaggle.com/c/dunnhumbychallenge
- I have resampled ‘spend’ from the original data, using approx 20% of the original observations.
- We will analyse data for 10 groups of shoppers.

Sample Data

- The data below is for Customer #208

53, 16, 66, 10, 77, 25, 17, 44, 37, 25, 24, 62, 3, 50, 16, 18, 5, 31, 29

- What can you say about that customer?

Determining class intervals

- Some guidelines:
  - Class intervals should lie between possible observations.
  - Express cut-offs at one more decimal point accuracy than data.
  - For n data, $\sqrt{n}$ intervals is usually a good starting point.
  - Sturge's formula: classes = $1 + 3.3\log_{10}n$
  - Choose 'intuitive' intervals: 1, 2, 5, 10, 20, 50, 100 etc.
  - It is more usual to use equal sized intervals.

Sample Data – class intervals

53, 16, 66, 10, 77, 25, 17, 44, 37, 25, 24, 62, 3, 50, 16, 18, 5, 31, 29

19 observations

Smallest = 3

Largest = 77

Intervals ??

Intervals $= \sqrt{19} = 4.4$

Or using Sturge's

$K = 1 + 3.3 \log 19 = 5.2$ classes

$$\text{Intervals} = \frac{\text{Range}}{\text{No. of classes}}$$

$$= \frac{77 - 3}{5.2} = 14.2$$

✓ Intervals (ideally) = 5

Sample Data – Stem and leaf plot

53, 16, 66, 10, 77, 25, 17, 44, 37, 25, 24, 62, 3, 50, 16, 18, 5, 31, 29

	stem	leaf
2	0	3 5
7	1	0 6 6 7 8
(4)	2	4 5 5 9
8	3	1 7
6	4	4
5	5	0 3
3	6	2 6
1	7	7

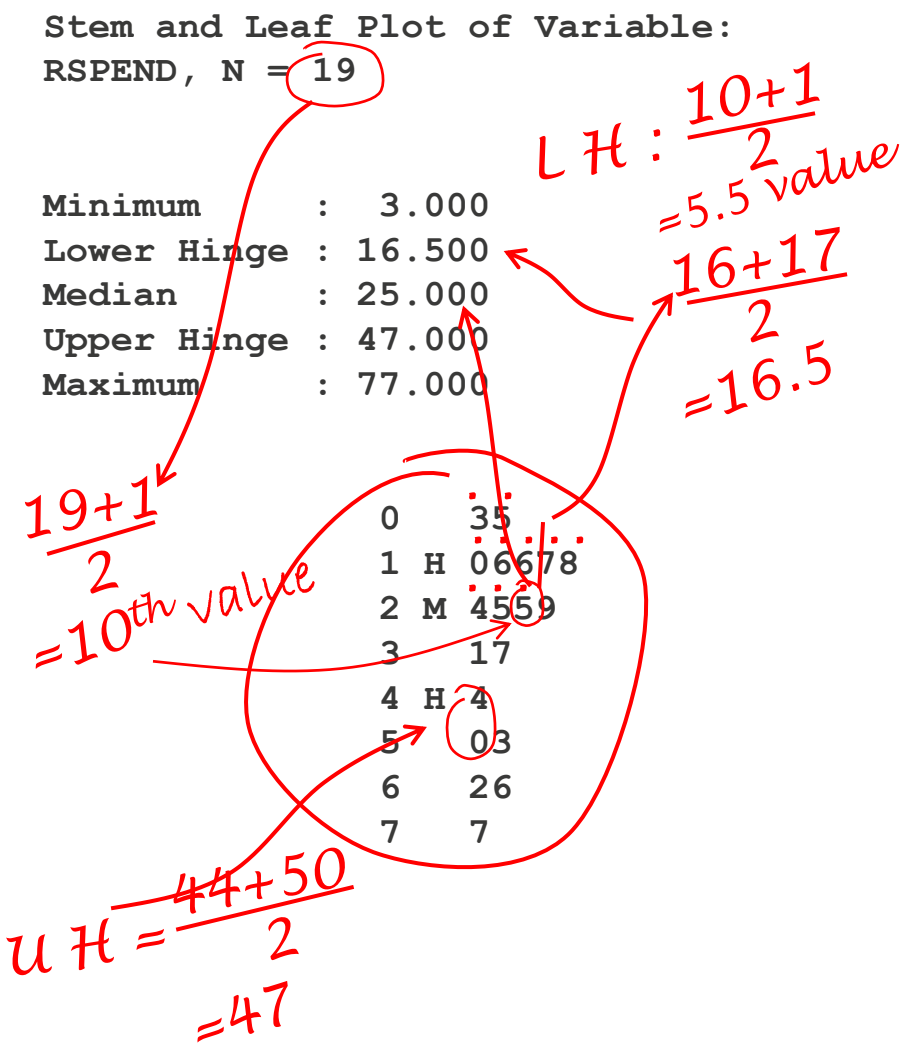
Sample Data – Stem and leaf plot

53, 16, 66, 10, 77, 25,

17, 44, 37, 25, 24, 62,

3, 50, 16, 18, 5, 31, 29.

- Output from SYSTAT on the RHS
- What can you say about that customer?



Sample Data – Histogram

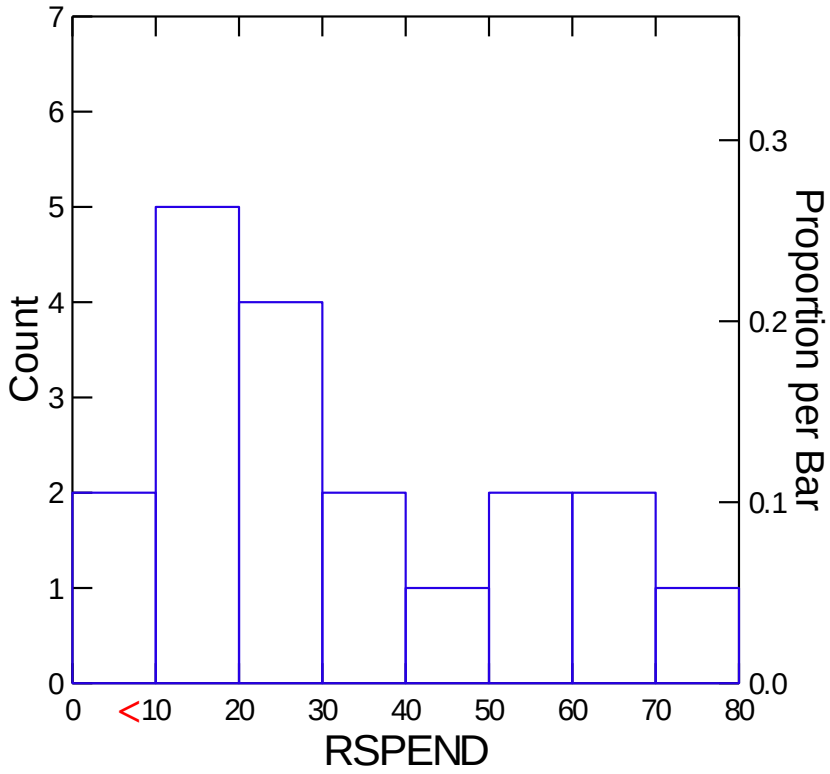
53, 16, 66, 10, 77, 25,

17, 44, 37, 25, 24, 62,

3, 50, 16, 18, 5, 31, 29.

- Output from SYSTAT on the RHS

```
 0   35
 1 H 06678
 2 M 4559
 3   17
 4 H 4
 5   03
 6   26
 7
```



Sample Data – Dotplot

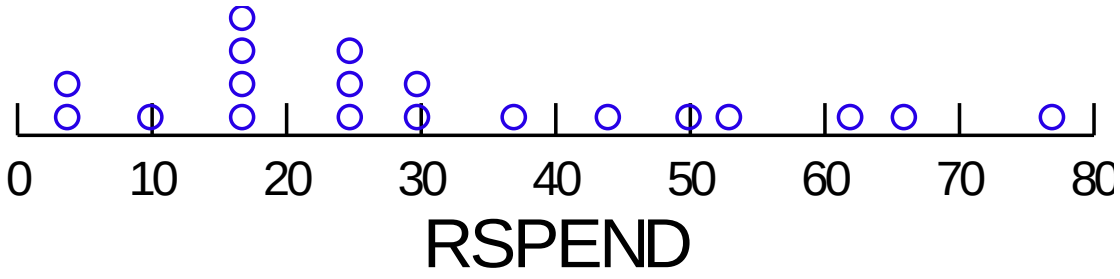
53, 16, 66, 10, 77, 25,

17, 44, 37, 25, 24, 62,

3, 50, 16, 18, 5, 31, 29.

```
0   35
1 H 06678
2 M 4559
3   17
4 H 4
5   03
6   26
7   7
```

- Output from SYSTAT



Motivating Problem

- Working in groups of 3, each group will draw a stem and leaf plot for one of the 10 customers. Your customer is based on the first letter of your last name indicated in the worksheet.

- Describe the shape of the distribution of data.

Motivating Problem – SYSTAT

```
ID40(0), N = 13

  0   267
  1 M 3447
  2
  3   9
  4 H 05
  5   4
  6   13

ID79(1), N = 10

  0 H 01233
  0 M 7
  1 H 11
  1   5
  2   3

ID119(2), N = 21

  0   22223
  0 H 68
  1
  1   6
  2 M 000012
  2   6
  3 H 002
  3
  4   1
  4   5
  5
  5   5
```

```
DI123(3), N = 20

  0   25
  1 H 013468
  2 M 12
  3   337
  4
  5
  6   2
  7 H 045
  8
  9   4
 10   1
 11   4

ID134(4), N = 66

  0   022
  0   56677789
  1 H 0112234
  1   555566788889
  2 M 111223344
  2   556678
  3   22
  3 H 58999
  4   0114
  4   68
  5   0014
  5
  6
  6
  7   2
* * * Outside Values * * *
  9   69
 12   1
```

```
ID140(5), N = 32

  0   134699
  1 H 129
  2   3
  3   4
  4   27
  5 M 224467
  6   235
  7 H 33
  8   26
  9   04
 10   357
 11   4

ID148(6), N = 49

  0   111
  0   22
  0   4455555
  0 H 6666667777
  0 M 8899
  1   00
  1   2233
  1   4
  1   7
  1   8
  2 H 001
  2   223
  2   4
  2   6
  2   899
  3
  3   2
* * * Outside Values * * *
  4   6
  9   6
```

```
ID149(7), N = 11

  0   45
  1   4
  2 H 89
  3 M 6
  4   0
  5 H 44
  6   9
  7   7

ID168(8), N = 29

  0   24
  0   6779
  1 H 444
  1   66688
  2 M 0122
  2   9
  3 H 0004
  3   6
  4   3
  4
  5   44
* * * Outside Values * * *
  6   8
 14   1

ID177(9), N = 10

  4   9
  5
  6 M 1334
  7   3
  8   1
  9 H 6
 10   79
```

Describe the different types of customers…

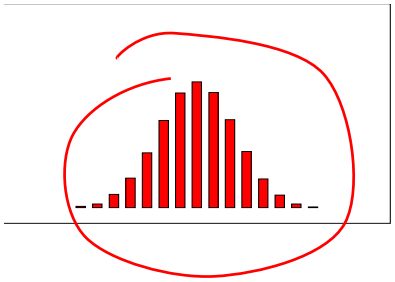
Visualising Data

- Why do we want to ‘see’ our data?
  - Visual inspection is the fastest way to get an overview of data.
  - Visual inspection enables a description of the distribution of the data to be made.
  - The distribution of data determines which statistics are appropriate.
  - To make comparisons between data from different groups.

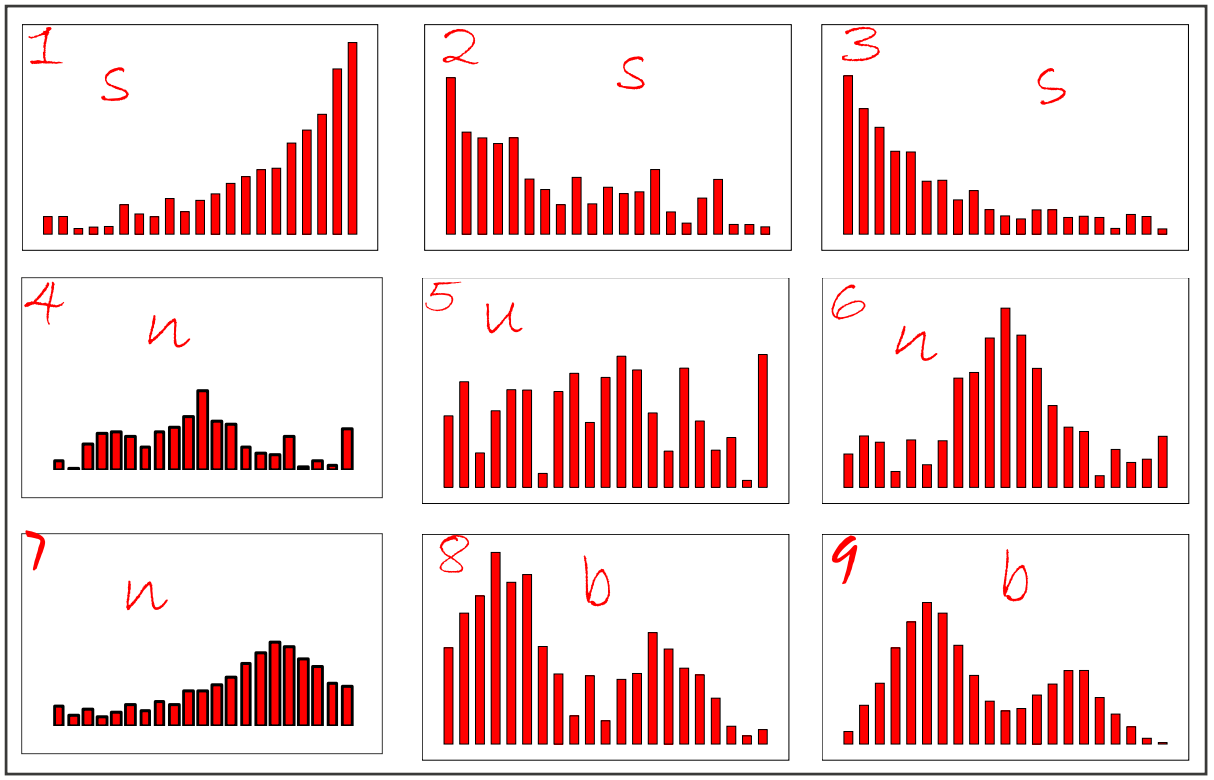
Comparing Distributions

Histograms of some other distributions

Normal Dist.



Some ***skewed, bimodal, and uniform*** distributions



Key Ideas

- You should be able to construct a tally, histogram, cumulative frequency plot and stem and leaf plot of a data set.
- You should be able to calculate an appropriate class interval, determine cut-offs and mid-points.
- Get into the habit of always visualising a data set before you undertake any analysis.

Reading/Questions (Selvanathan)

- Reading: Graphical Descriptive Methods
  - 7th Ed. Sections 2.1, 3.1, 4.1
- Questions: Graphical Descriptive Methods
  - 7th Ed. 2.4, 2.5, 2.9, 4.4, 4.5, 4.6, 4.10.
- Tutorial 2 Questions.