భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
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Biostatistics BT2023

Lecture 5: Measure of central tendency

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16 August 2022

Computer virus

How powerful computer and the program that runs these computers !

Just a few lines code can effect our lives in so many ways.

Examples

Story of Stuxnet

Power grid failure in Mumbai

GitHub is a website for developers and programmers to collaboratively work on code

Biostatistics : The journal

Among the important scientific developments of the 20th century is the explosive growth in statistical reasoning and methods for application to studies of human health.

Examples include developments in likelihood methods for inference, epidemiologic statistics, clinical trials, survival analysis, and statistical genetics.

Substantive problems in public health and biomedical research have fueled the development of statistical methods, which in turn have improved our ability to draw valid inferences from data.

The objective of Biostatistics is to advance statistical science and its application to problems of human health and disease, with the ultimate goal of advancing the public's health.

Biostatistics is an online only journal publishing papers that develop innovative statistical methods with applications to the understanding of human health and disease, including basic biomedical sciences.

Papers should focus on methods and applications.

Introduction of original methodology should be grounded in substantive problems; there is the opportunity to present extensive analyses of data on the journal's website as supplementary material.

Authors are strongly encouraged to submit code supporting their publications. Authors should submit a link to a Github repository and to a specific example of the code on a code archiving service such as Figshare or Zenodo.

Reference: Oxford university press

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Goal

Advancing health science research, education, and practice by turning data into knowledge and addressing the greatest public health issues of the 21st century.

Biostatistics department of Harvard university

https://www.hsph.harvard.edu/biostatistics/department-research/

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Measure of central tendency

Example: the average height of the students in class

Arithmetical mean

$$\bar{x} = \sum_{i=1}^{n} x_i$$

Arithmetical mean of a grouped data

$$\bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i} = \frac{\sum_{i=1}^{n} f_i x_i}{N}$$

Arithmetical mean by transformation

$y = ax$; $\langle y \rangle = a\langle x \rangle$

$y = a + x$; $\langle y \rangle = a + \langle x \rangle$

$y = a + cx$; $\langle y \rangle = a + c\langle x \rangle$

We can use above transformation to calculate mean by what is called “step deviation method”

$$\bar{x} = a + \frac{\sum_{i=1}^{n} f_i d_i}{\sum_{i=1}^{n} f_i}$$

$$d = x - a$$

$$\bar{x} = 70 + \frac{1}{8} = 70.125$$

a = provisional mean

x	d
45	-25
50	-20
60	-10
67	-3
74	4
80	10
90	20
95	25

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Mean for continuous data

Class Interval	0 - 8	8 - 16	16 - 24	24 - 32	32 - 40	40 - 48
Frequency	10	20	14	16	18	22

Class Intervals	Class Mark (m_i)	Frequency (f_i)	$d_i = m_i - a = m_i - 28$	$d_i' = \frac{d_i}{l} = \frac{d_i}{8}$	$d_i'f_i$
0 - 8	4	10	-24	-3	-30
8 - 16	12	20	-16	-2	-40
16 - 24	20	14	-8	-1	-14
24 - 32	28	16	0	0	0
32 - 40	36	18	8	1	18
40 - 48	44	22	16	2	44
		$\sum f_i = 100$			$\sum d_i'f_i = -22$

$$\bar{x} = a + l \times \frac{\sum_{i=1}^{n} f_i d_i'}{\sum_{i=1}^{n} f_i}$$

$$d_i' = d_i / l$$

$$28 + 8 \times \frac{-22}{100} = 26.24$$

Its approximation since we don't know the raw data

a = provisional mean
l = common size of class interval

Ref : https://www.math-only-math.com/

Median

Arrange the data (n) in the ascending order

$$Median = \left[\frac{N+1}{2}\right]^{th} term$$ N= odd

$$Median = \frac{\frac{N}{2}^{th} + (\frac{N}{2}+1)^{th} terms}{2}$$ N= even

45. 50. 56 57 74 80 90 95

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Mode

The highest frequency data point in the data set

Mark obtained 7 8 9 3 4 7 7 7 9 5 Mode = 4

Mode of Grouped Data = L + W[(Fm – F1)/((Fm-F1) + (Fm – F2))]

Range	Frequency
1-10	2
11-20	7
21-30	10
31-40	3
41-50	1

L = 21

W = 9

F =10

F1 = 7

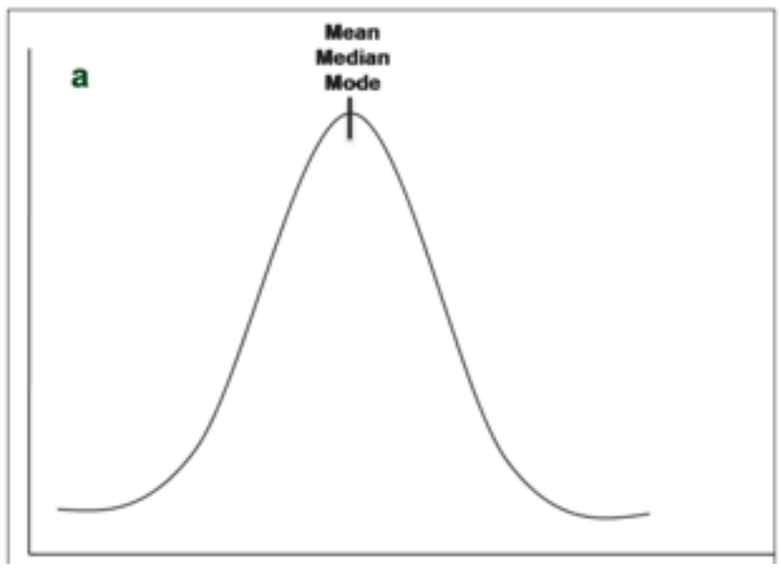
F2 = 3

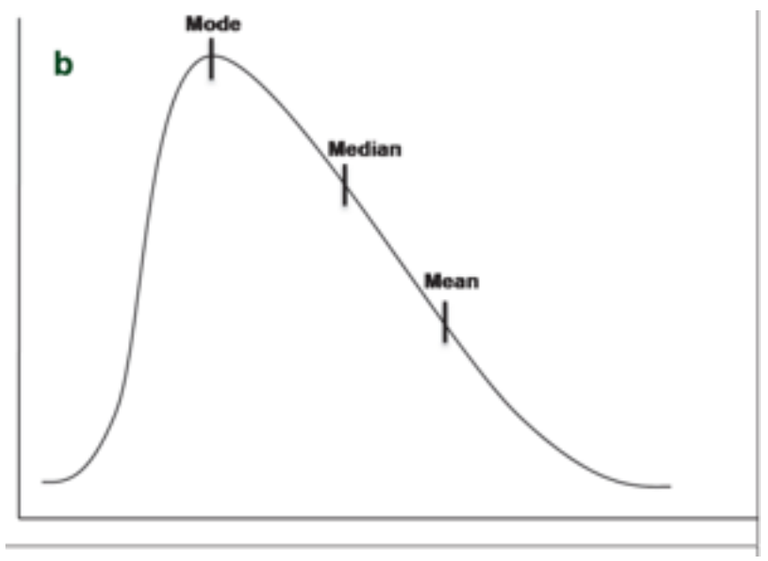
Mode = 24

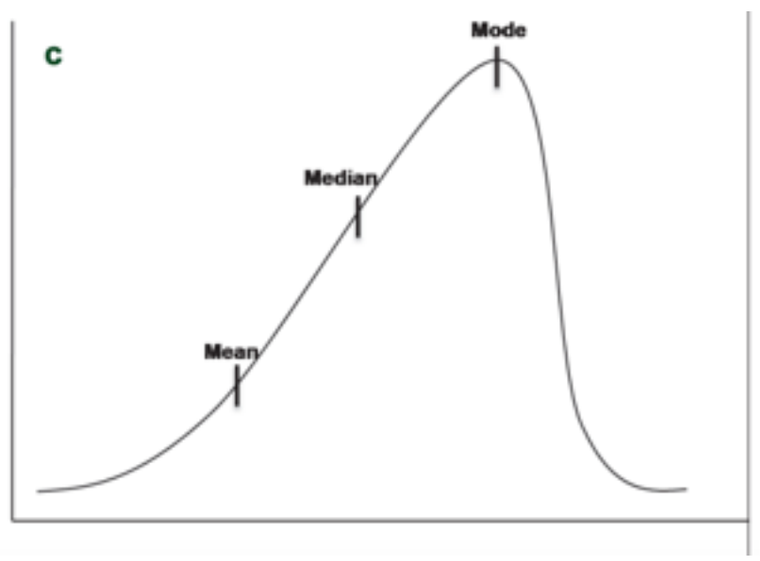
Relationship between mean mode and median

If the frequency distribution is symmetrical, mean mode and median will be the same

Mode = 3 median - 2 mean







When to use mean or median

Mean is generally considered the best measure of central tendency

Mean is not the actual measurement

When you have outliers or the distribution is skewed, its better to use Median.

Mode is preferred if the data is taken on nominal scale.

142, 124, 121, 151, 132, 134

Suppose your machine got a problem and the final reading is 1000.

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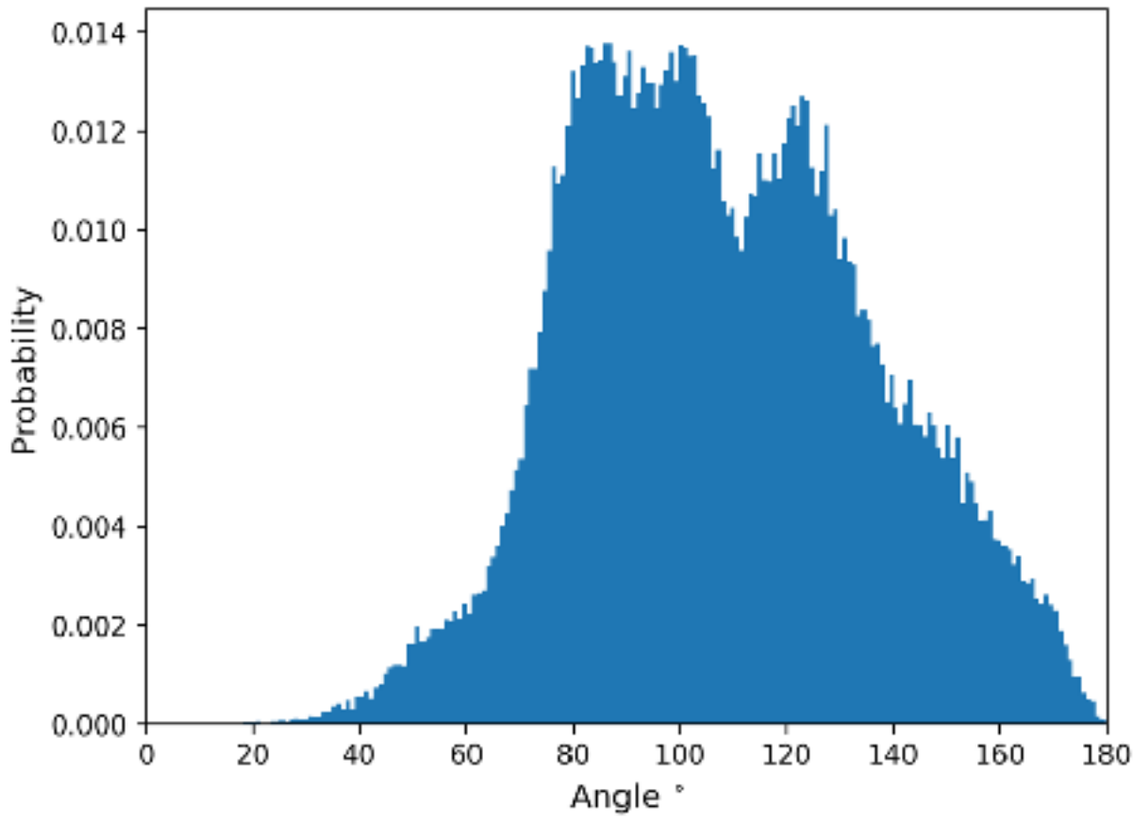
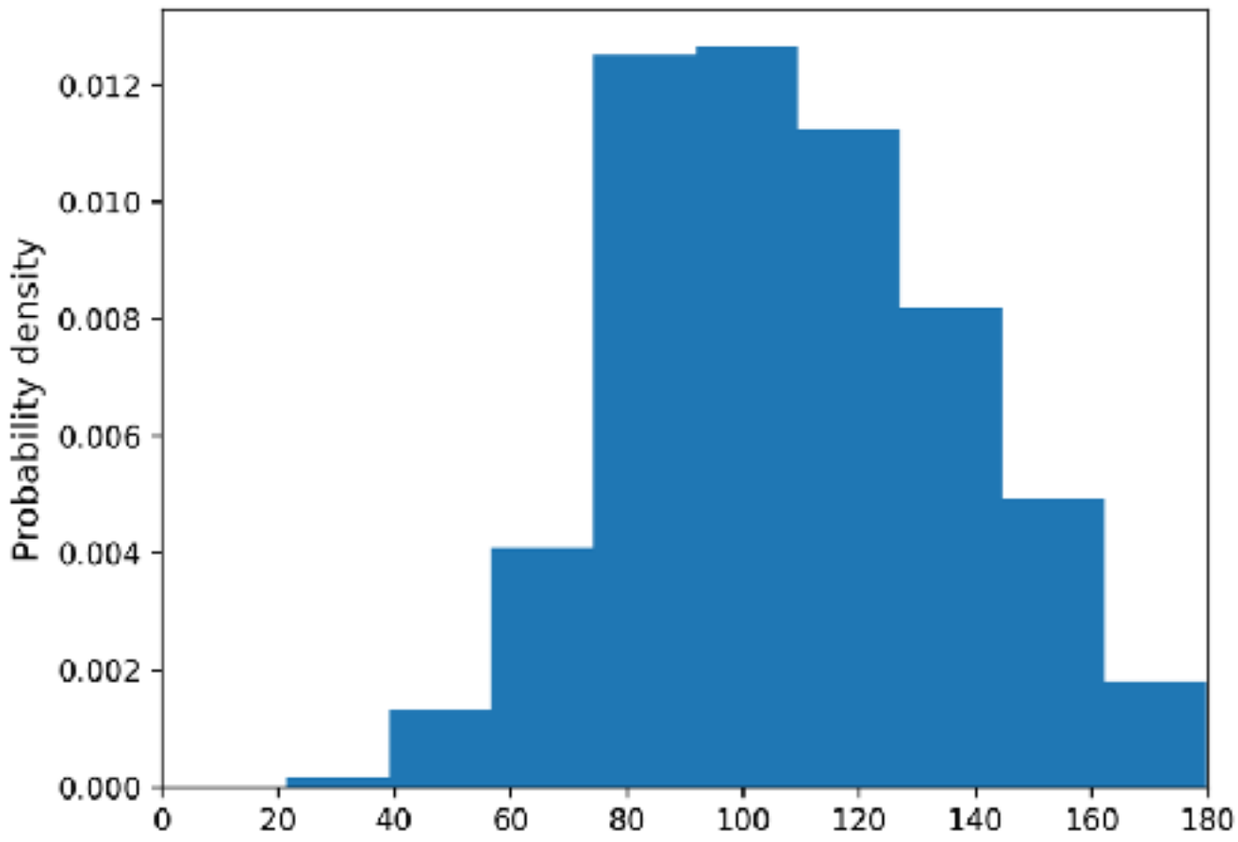
Histogram

Plot of the probability distribution





How to chose the bin

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Useful commands in data analysis bioinformatics

SED

```
sed -e 's/\(.*\)/\L\1/'
```

pr mts

```
pr -mts' ' col1.dat col2.dat >combine.dat
```

grep

```
grep -A1 'blah' logfile
```

Awk

column to row

```
awk 'BEGIN { ORS = " " } { print }' id2.dat
```

row to column

```
awk '{for (i=1;i<=NF;i++) print $i}' 2.dat >22.dat
```

Introduction to “github”

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Next Class

2:30 PM Friday, 25 August 2022

Measure of dispersions