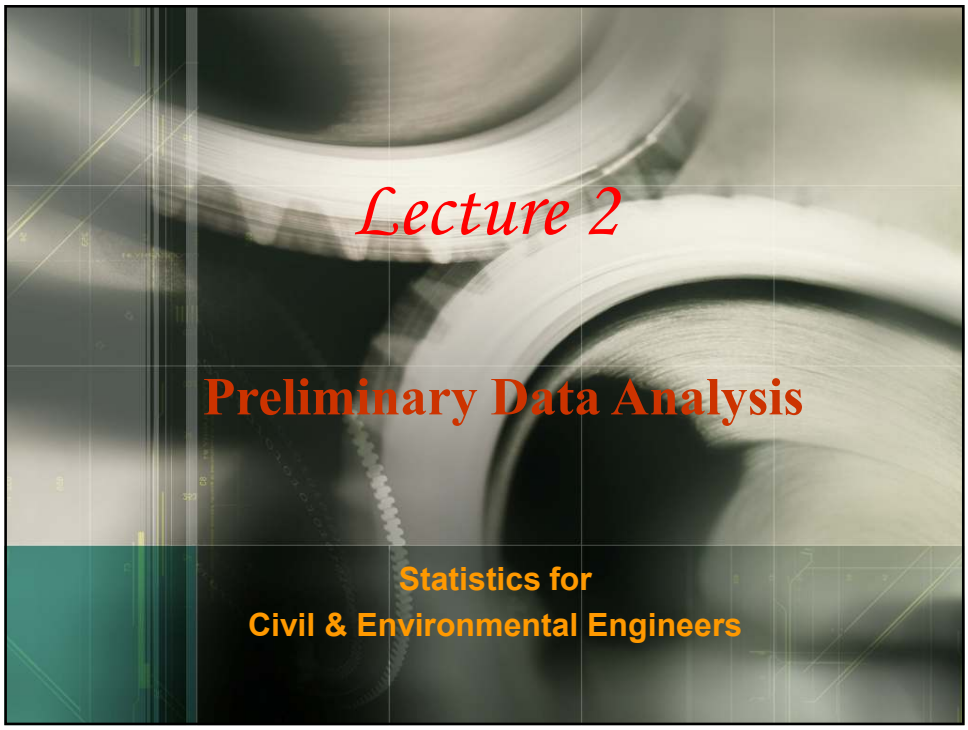


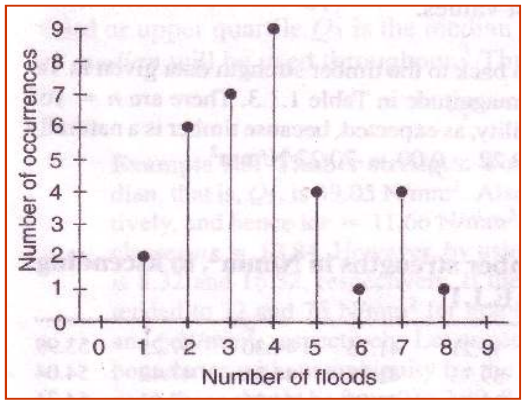
Random Variables

- **Definition**
  a variable whose possible values are numerical outcomes of a random phenomenon
- **Continuous vs. Discrete**
  - *Continuous variable* can have any value on a continuous scale between two limits
  - *Discrete variable* can only assume countable isolated numbers
- **Distributions**
  Random variables are classified by the form that their values can possibly take.
  The pattern of variability is called a *distribution*
- **Quantiles**
  A value which divides a set of data into equal proportions
  The 100-quantiles = The 10-quantiles =
  The 4-quantiles = The 3-quantiles =

((ex: The 1st quartile of {3, 6, 7, 8, 8, 10, 13, 15, 16, 20} is " ".))

Graphical Representation

- **Line Diagram or Bar Chart**



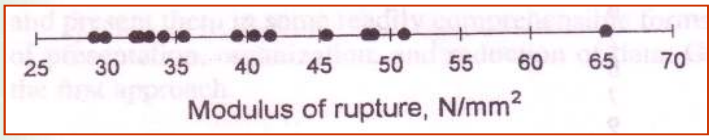
Line diagram for flood occurrences in the Magra River at Calamazza Genoa and Pisa in morthwestern Italy

Graphical Representation

- **Dot Diagram**

The first 15 items of modulus of rupture data measuring timber strengths in N/mm² ranked in increasing order

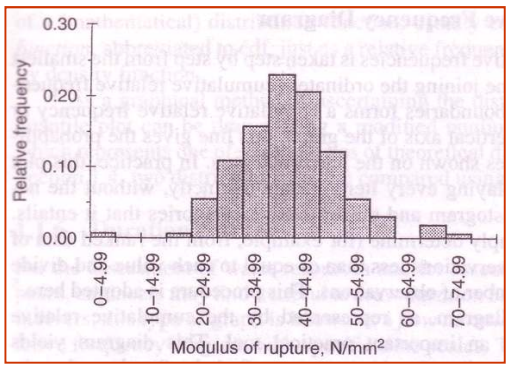
29.11	29.93	32.02	32.40	33.06	34.12	35.58	39.34
40.53	41.64	45.54	48.37	48.78	50.98	65.35	



Dot diagram for a sample of timber strength

Graphical Representation

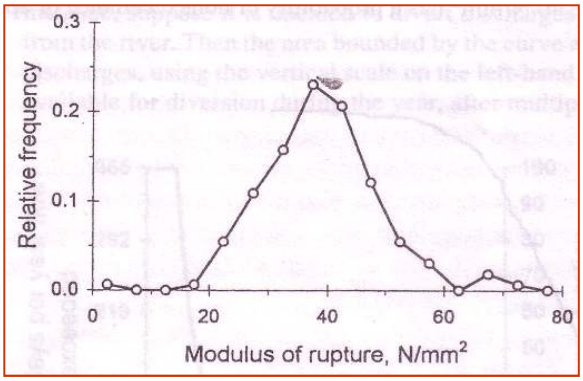
- **Histogram**



Histogram for timber strength data with class width of 5 N/mm²

Graphical Representation

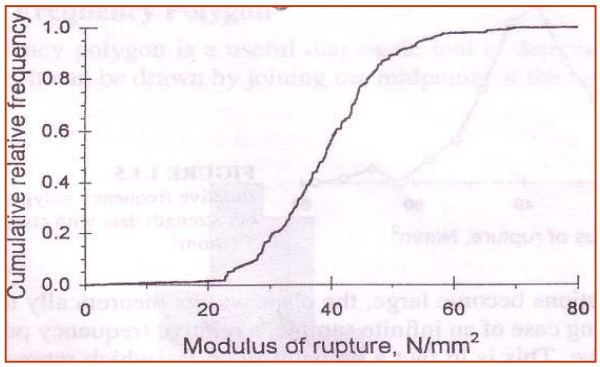
- **Frequency Polygon**



Relative frequency polygon for timber strength data with class with of 5 N/mm²

Graphical Representation

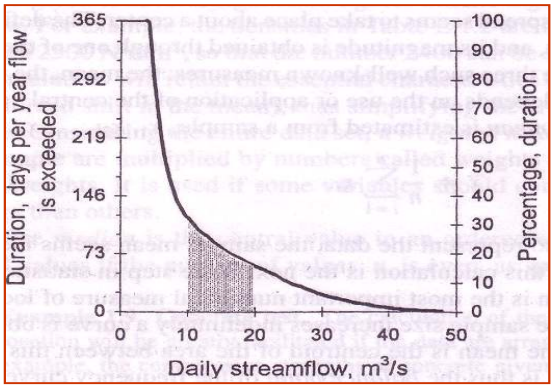
- **Cumulative Relative Frequency Diagram (Q-Plot)**



Cumulative relative frequency diagram for timber strength data

Graphical Representation

- **Duration Curve**



Flow duration curve of Dora Riparia River at Salbertrand
In the Alpine region of Italy

Graphical Representation

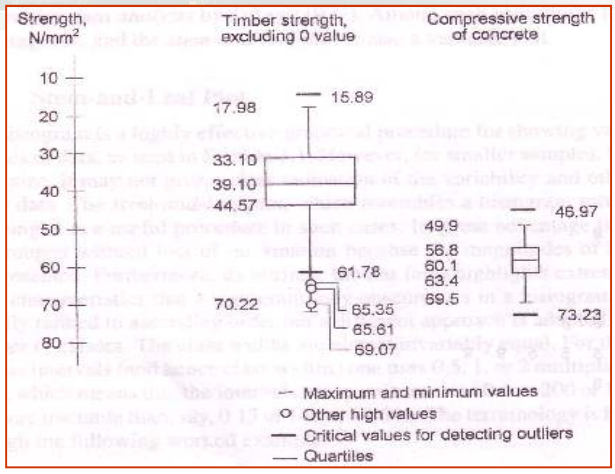
❖ Stem-and-Leaf Plot

1	49	9
2	50	7
2	51	
3	52	5
5	53	2 4
7	54	4 6
8	55	8
11	56	3 7 9
13	57	8 9
15	58	8 9
19	59	0 6 8 8
7)	60	0 2 5 5 5 9 9
14	61	1 5 9
11	62	
11	63	3 4
9	64	9 9
7	65	7
6	66	
6	67	2 3
4	68	1 3 9
1	69	5

Stem-and-leaf plot for compressive strengths of concrete

Graphical Representation

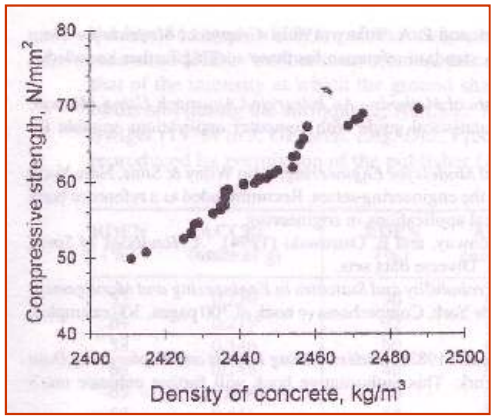
❖ Box Plot



Box plots for timbers strength and compressive strength of concrete data

Graphical Representation

- **Q-Q Plot**



Q-Q plot of concrete test data

Numerical Summaries of Data

- **Measures of Central Tendency**
  - **arithmetic mean:**

    $\mu_x = E(X)$

    $\bar{x} =$

    ((note)) E(a+bX)=

    E(X+Y)=

  - **others: median, mode, geometric mean, weighted mean**

Numerical Summaries of Data

- **Measures of Dispersion**
  - **variance**

    Var(X)= σ^2 =

    s_X^2 =

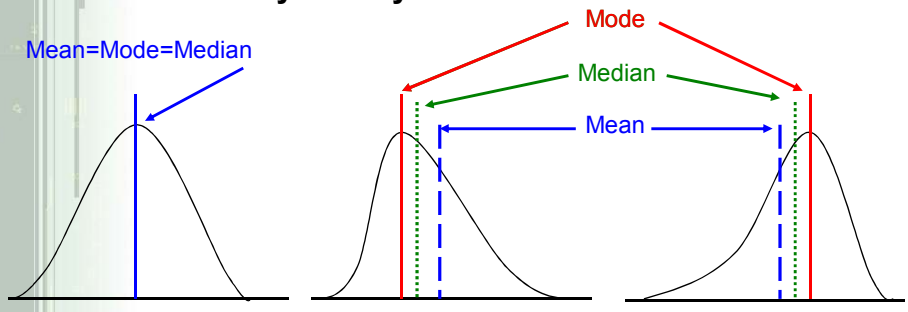
    ((note)) Var(a+bX)=

    Var(X±Y)=

  - **others: standard deviation, coefficient of variation, range**

Numerical Summaries of Data

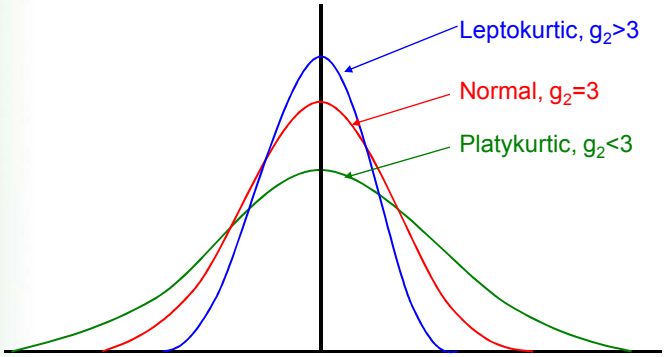
- **Measures of Asymmetry: Skewness Coefficient**



γ = **g_1 =**

Numerical Summaries of Data

- **Measures of Peakness: Kurtosis**



κ = g_2 =

Numerical Summaries of Data

- **Covariance and the Correlation Coefficient**
  - **covariance**

    Cov(X, Y) = σ_{XY} =

    $s_{X,Y}$ =

    ((note)) Cov(aX+b, cY+d)=
  - **correlation coefficient**

    Corr(X, Y) = ρ_{XY} =

    $r_{X,Y}$ =

    ((note) Corr(aX+b, cY+d)=

Assignment 1

Chapter 1

Problems

1.1 / 1.3 / 1.6 / 1.8 / 1.12 / 1.19 / 1.21 / 1.23

Due date: September 10th, 2009 & Quiz