**Preview group1**

**Sources of error**

The word Error came from the experiment science. It represents the difference of amount between the dates you get from the experiments than it should be. The sources of error can be divided into four types, systematic error, stochastic error, absolute error and relative error. [1]

1. Systematic error

It means that when we do the measurement under the same conditions many times. The error statistics we get remain the same. Or when the conditions changed, the error statistics changed in a pattern.

1. instrument error

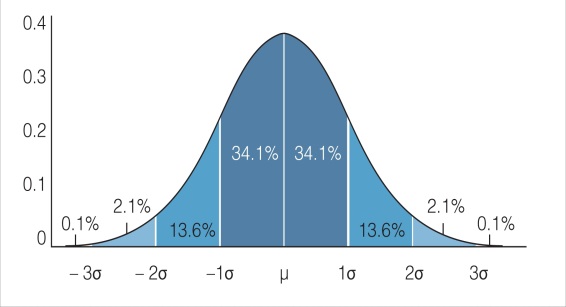
It is caused by the defects of the instrument itself or the wrong used by a person. [2]

1. Theoretical error

It is caused by the mistake of the way you measure things.

Ex. In thermal equilibrium experiments, we ignore the loss of the heat. So the result we get is not it really is. [3]

1. Personal error

It is caused by the person who takes the measure. It relies on the react speed, personal habit, and ext. [4]

1. Random error

Random error is something that you can’t expect. It also can’t be measured or corrected. But the positive and negative error can be neutralized when you do the measure more times.

Random error always shows in Normal distribution curve. [6]

Ex. Like the temperature, humidity, dust, and ext. [5]

**Caliper**

A caliper (British spelling also calliper.) is a device used to measure the distance between two opposite sides of an object. A caliper can be as simple as a compass with inward or outward-facing points. The tips of the caliper are adjusted to fit across the points to be measured, the caliper is then removed and the distance read by measuring between the tips with a measuring tool, such as a ruler.

### There are many types of calipers. Such as Inside caliper, outside caliper, divider caliper, odd leg caliper, vernier caliper, dial caliper, digital caliper and micrometer caliper.

### http://www.craftsmanspace.com/sites/default/files/free-knowledge-articles/vernier_caliper_parts.jpgIntroduction

### External jaw

### Internal jaw

### Sliding jaws

### Metric Vernier scale

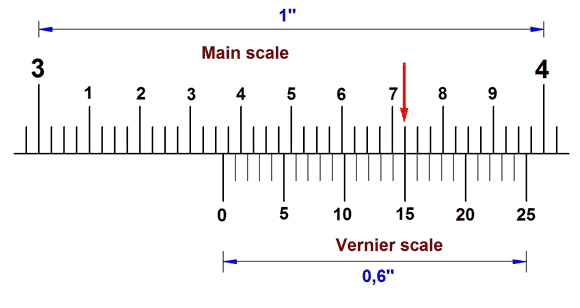
### Locking screw

### Main scale

### Depth gauge

### How to use

The main scale on the vernier is graduated and numbered in inches with each inch graduated and numbered in tenths (0,1in). Each tenth is divided into four giving 0,1in, divided by 4 = 0,025in. On the vernier scale 0.6 in is divided into 25 parts. Each of these has a length of 0.6 in divided by 25 = 0,024 in. The difference in length between a small division on the main scale and the vernier scale is 0,025- 0,024 = 0,001in.



First, read a measurement note the position of the zero line on the vernier scale in relation to the main scale. This is shown as 3.00 in plus 0,300 in plus 2\*0,025in which equals 3,35in.

Second, added the number of divisions from the zero line on the vernier scale to the line which is coincident with a line on the main scale, in this case 15 divisions which equals 0,015in the total reading is therefore:  
  
Main scale = 3,35in  
Vernier scale = 0,015in  
  
So the reading is 3,35in + 0,015 = 3,365in [7]

The source of the data

[1] http://zh.wikipedia.org/wiki/%E8%AF%AF%E5%B7%AE

[2] http://wiki.mbalib.com/zh-tw/%E7%B3%BB%E7%BB%9F%E8%AF%AF%E5%B7%AE

[3] http://wiki.mbalib.com/zh-tw/%E7%90%86%E8%AE%BA%E8%AF%AF%E5%B7%AE

[4] http://wiki.mbalib.com/zh-tw/%E4%B8%AA%E4%BA%BA%E8%AF%AF%E5%B7%AE

[5] http://wiki.mbalib.com/zh-tw/%E9%9A%8F%E6%9C%BA%E8%AF%AF%E5%B7%AE

[6] http://therionorteline.com/2012/11/16/american-politics-explained/

[7] http://www.craftsmanspace.com/knowledge/vernier-calipers.html

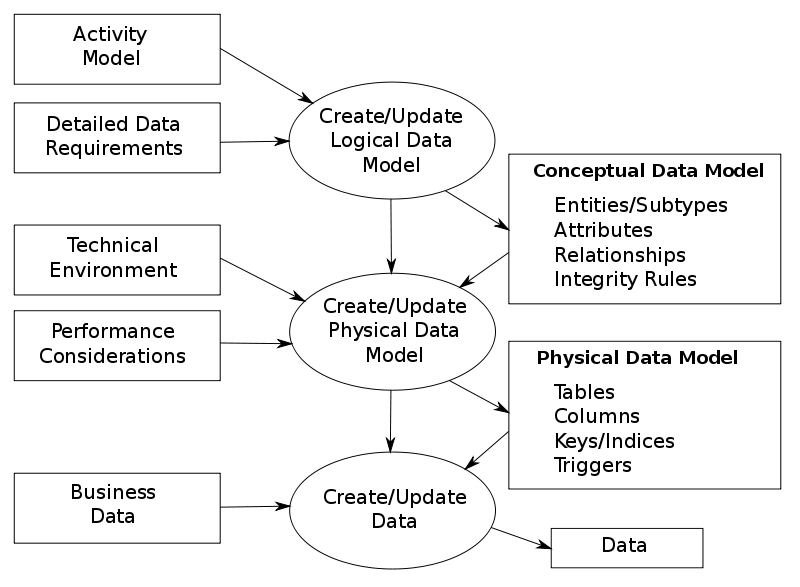
**Data analysis**

The data analysis is a way that we analyze the raw data we gained form the experiment and then organize them so that we can extract some useful information to apply to some application. It contains the process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision making.[1][2]

<1>Inspecting: To analyze the data we gained whether it does not match the reality or it’s wrong.

<2>Data cleaning: After inspecting the data, we should clean the false data or some data which are much far from other data. Data cleaning, or the data scrubbing, is to detect the data we don’t need, we can use some ways such of the average. [3]

<3>Transforming: With the data which has been arranged, we should transform them into another form such as the tabulation.

<4>Modelling data: To create a data model for an information system by some modeling techniques. It provides a structure for data used within information systems by providing specific definition and format. [4]

The data analysis has many kinds, including the data mining, descriptive statistics, exploratory data analysis (EDA), and confirmatory data analysis (CDA).The data mining focuses on modeling and knowledge discovery for predictive rather than descriptive purposes. EDA focuses on discovering new features in the data and CDA on confirming or falsifying existing hypotheses.[1]

The simplified diagram of modelling

Resources:

[1]: http://en.wikipedia.org/wiki/Data\_analysis

[2]: http://www.wisegeek.com/what-is-data-analysis.htm

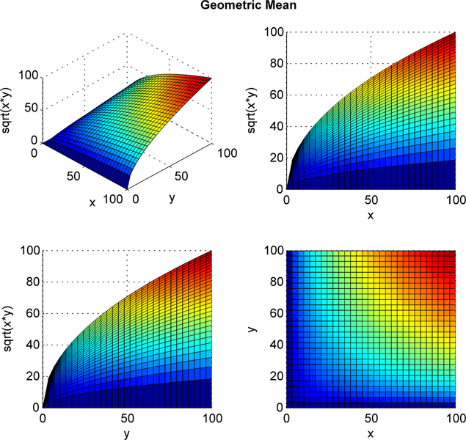
[3]: http://en.wikipedia.org/wiki/Data\_cleaning

[4]: http://en.wikipedia.org/wiki/Data\_modeling

**Mean and variance of single-quantity measurements**

Mean is usually used to show the generation level of the objects you observed. It refer to a central value of a discrete set of numbers. If the data set were based on a series of observations which are obtained by sampling from a statistical population, the mean is termed the sample mean. There are a kind of mean, including arithmetic mean, geometric mean, harmonic mean, quadratic mean.[1]

Arithmetic mean: We can use the equation to represent its definition. It is defined that the sum of a set of data is divided by the number of data and the quotient.[2][3]

Geometric mean: We can use the equation to represent its definition. The geometric mean is defined as the xth root (where x is the count of numbers) of the product of the numbers. This is often used to compare different items. [4]

Harmonic mean: We can use the equation H = \left(\frac{1}{n} \cdot \sum_{ i = 1 }^n x_i^{-1} \right)^{-1} = \frac{1}{\frac{1}{n} \cdot \left(\frac{ 1 }{ x_1 } + \frac{ 1 }{ x_2 } + \cdots + \frac{ 1 }{ x_n }\right)} = \frac{ n }{ \frac{ 1 }{ x_1 } + \frac{ 1 }{ x_2 } + \cdots + \frac{ 1 }{ x_n } }. to represent its definition. The harmonic mean, which is also called subcontrary mean, is defined as the number of items divided by the sum of the reciprocals of the numbers. This is used to calculate for the velocity. [5]

Quadratic mean: We can use the equation M = \sqrt{\sum_{i=1}^n x_i^2 \over n} = \sqrt{x_1^2 + x_2^2 + \cdots + x_n^2 \over n} to represent its definition.

The quadratic mean, which is also called root mean square (RMS), can be calculated for a series of discrete values or for a continuously varying [function](http://en.wikipedia.org/wiki/Function_(mathematics)). [6]

The variance of a random variable is that it describes the number of discrete levels. The basic equation equaling of the variance is \ operatorname {VAR}（X）= \ operatorname {E} \左右[（X  -  \畝）^ 2 \]。 .

If it is continuous, then the equation will change to\ operatorname {VAR}（X）= \西格瑪^ 2 = \（\畝）^ 2 \，F（x）的\ DX \ = \詮釋x ^ 2 \，F（x）的\ DX \  -  \畝^ 2.

If not, the equation will be

\ operatorname {VAR}（X）= \ sum_ {i = 1}的n次方P_I \ CDOT（x_i的 -  \畝）^ 2 = \ sum_ {i = 1} ^ N（P_I \ CDOT的x_i ^ 2） -  \畝^ 2

[7]

Resources:

[1] http://en.wikipedia.org/wiki/Mean

[2] http://en.wikipedia.org/wiki/Arithmetic\_mean

[3] http://www.stat.nuk.edu.tw/prost/content2/statics\_4.htm

[4] http://en.wikipedia.org/wiki/Geometric\_mean

[5] http://en.wikipedia.org/wiki/Harmonic\_mean

[6] http://en.wikipedia.org/wiki/Root\_mean\_square

[7] http://en.wikipedia.org/wiki/Variance