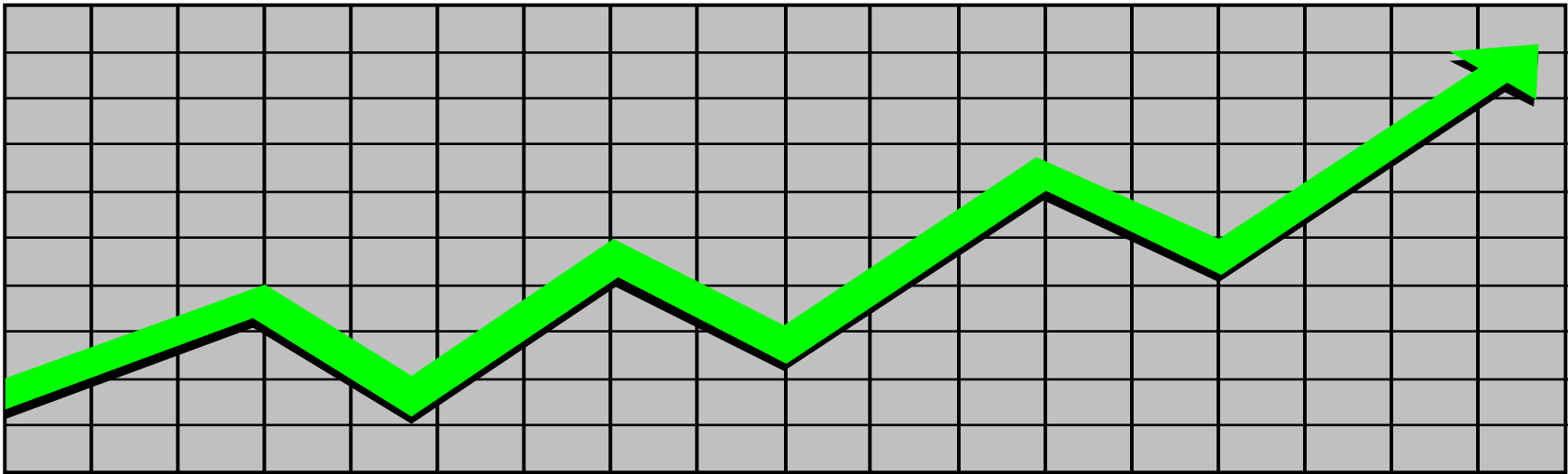
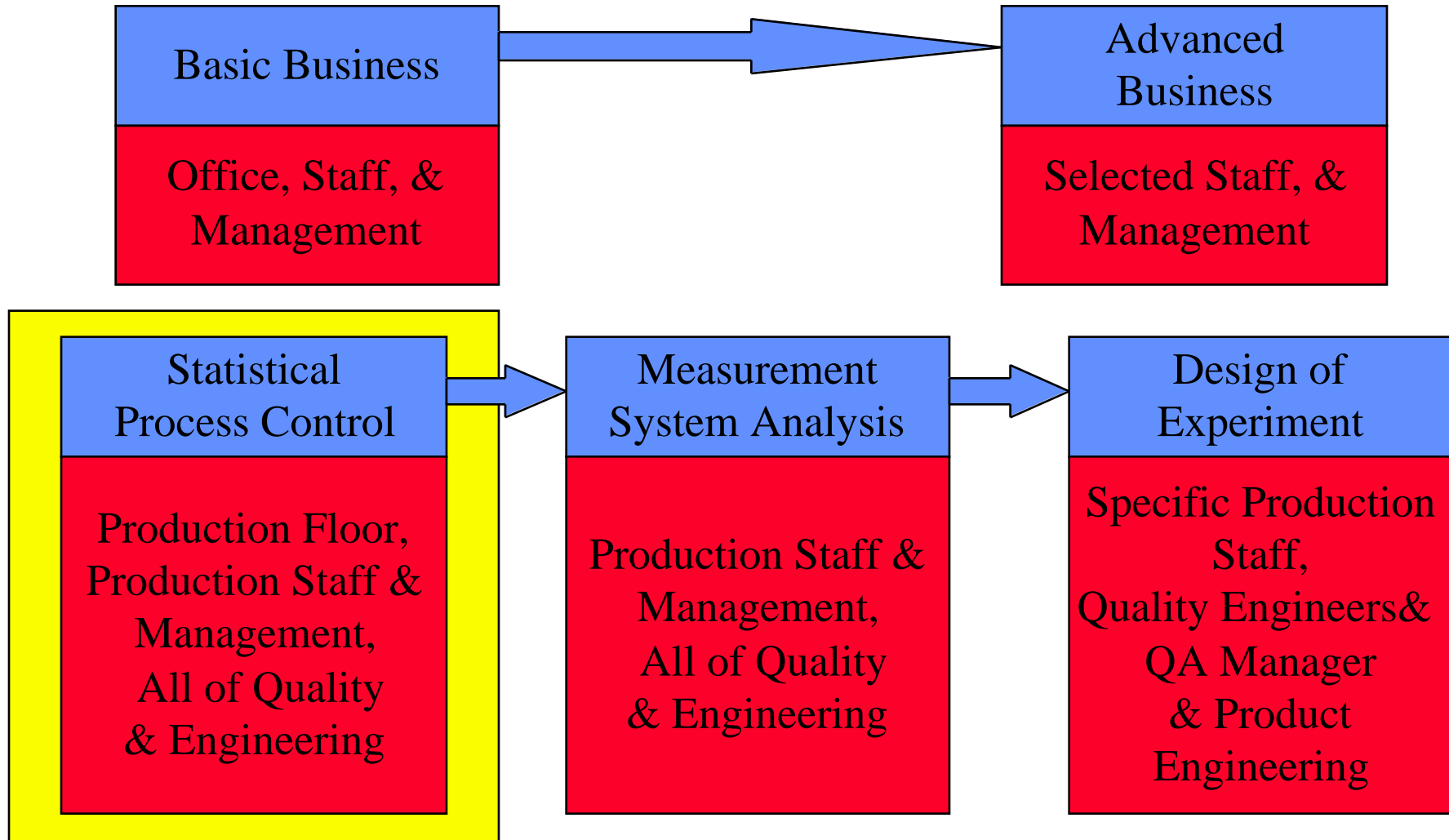


Statistics



Statistical Process Control & Control Charting

Recommended Statistical Course Attendance

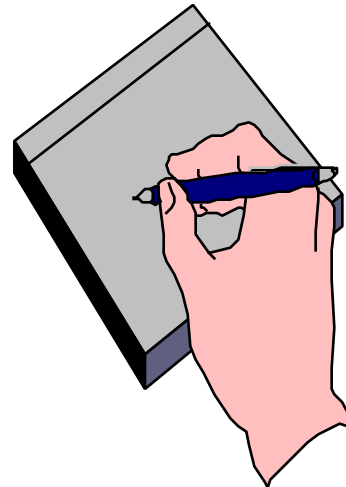
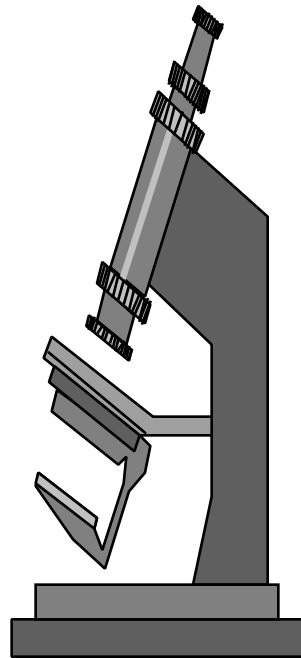
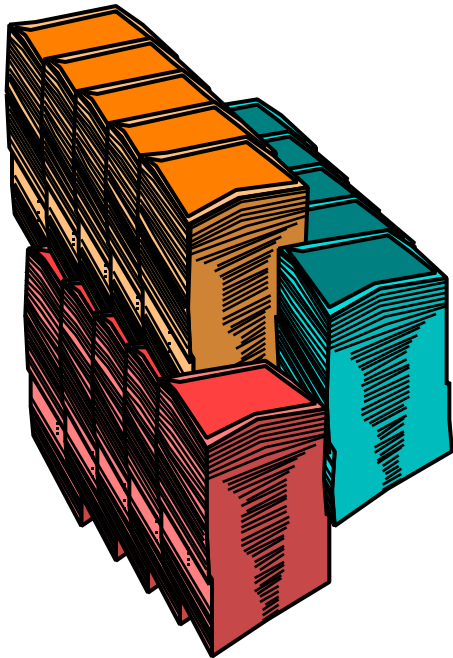


***Your APQP Team should attend as many classes as time will allow**

Basic Definitions

Statistics:

the science of collecting, analyzing, interpreting and presenting data.



A *Statistic* is a single characteristic taken from this process.

Universe, Populations & Samples



Universe:

the collection of all elements

Population:

the set of objects of interest



Sample:

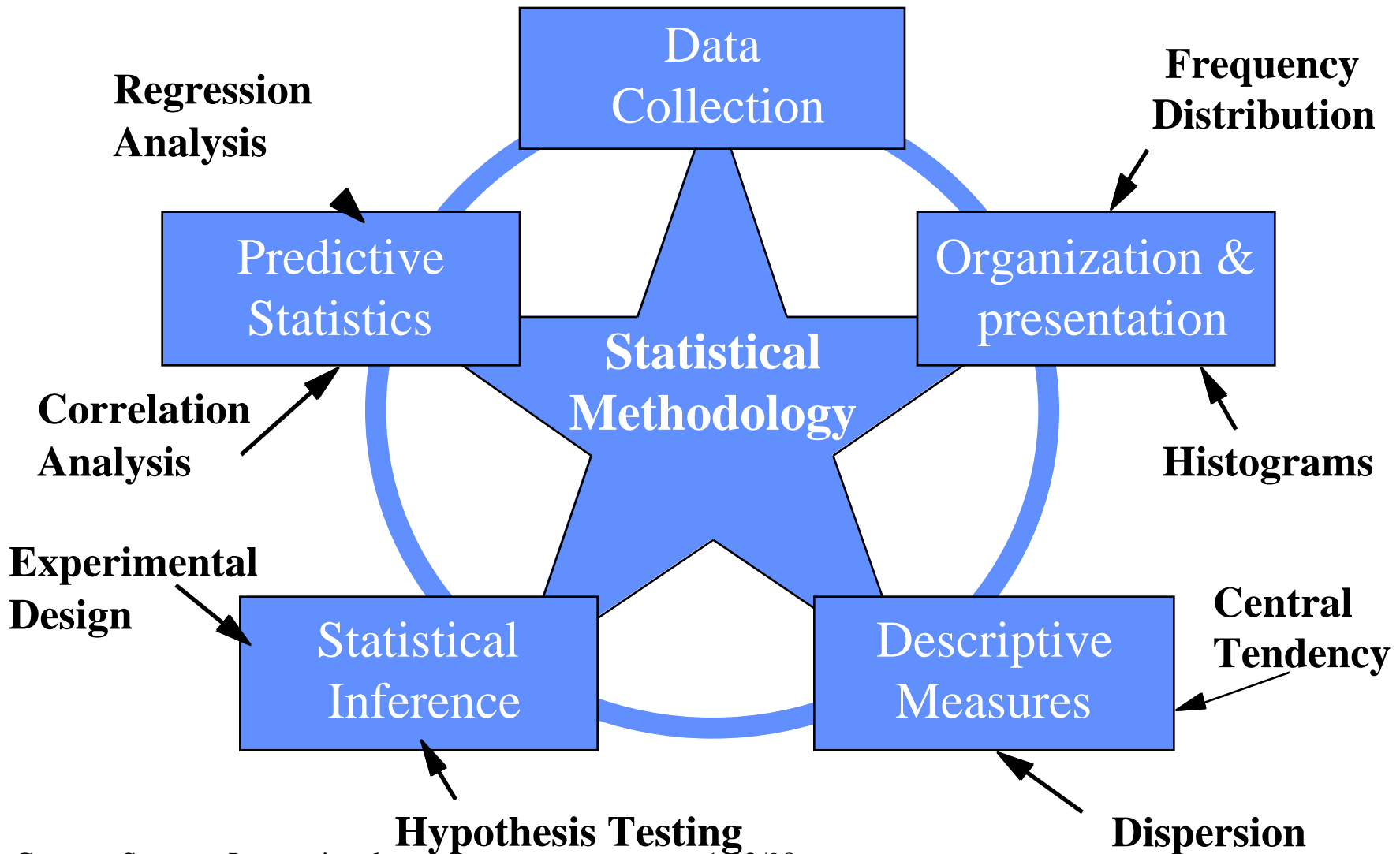
a subset of objects taken from the population

Random Sample:

all possible samples of the same size have an equal chance of occurring.

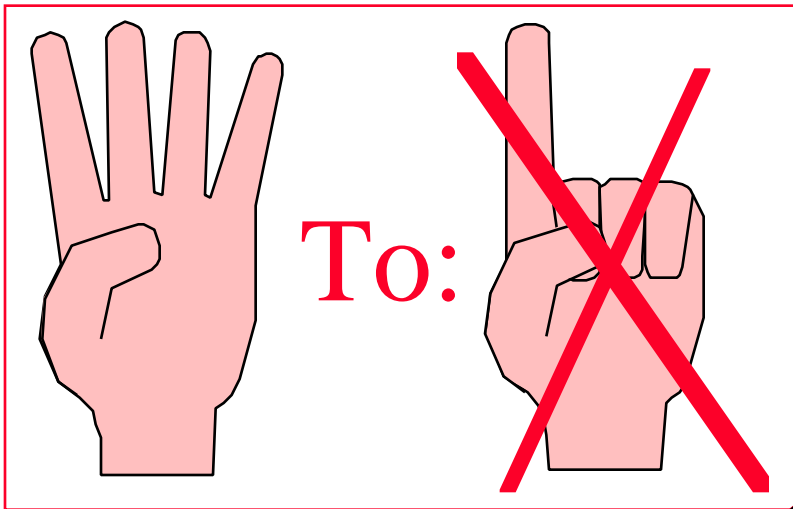
Statistical Methodology

Statistical methods are procedures for drawing conclusions about populations utilizing information provided by random samples.



Classification of Statistics:

◆ **Descriptive statistics:** the methodology of efficiently collecting, organizing, and describing data.



◆ **Inductive Statistics:** the process of drawing conclusions about unknown characteristics of a population usually based from a sample taken from the population

◆ **Predictive Statistics:** the process of predicting future values based on historical data.

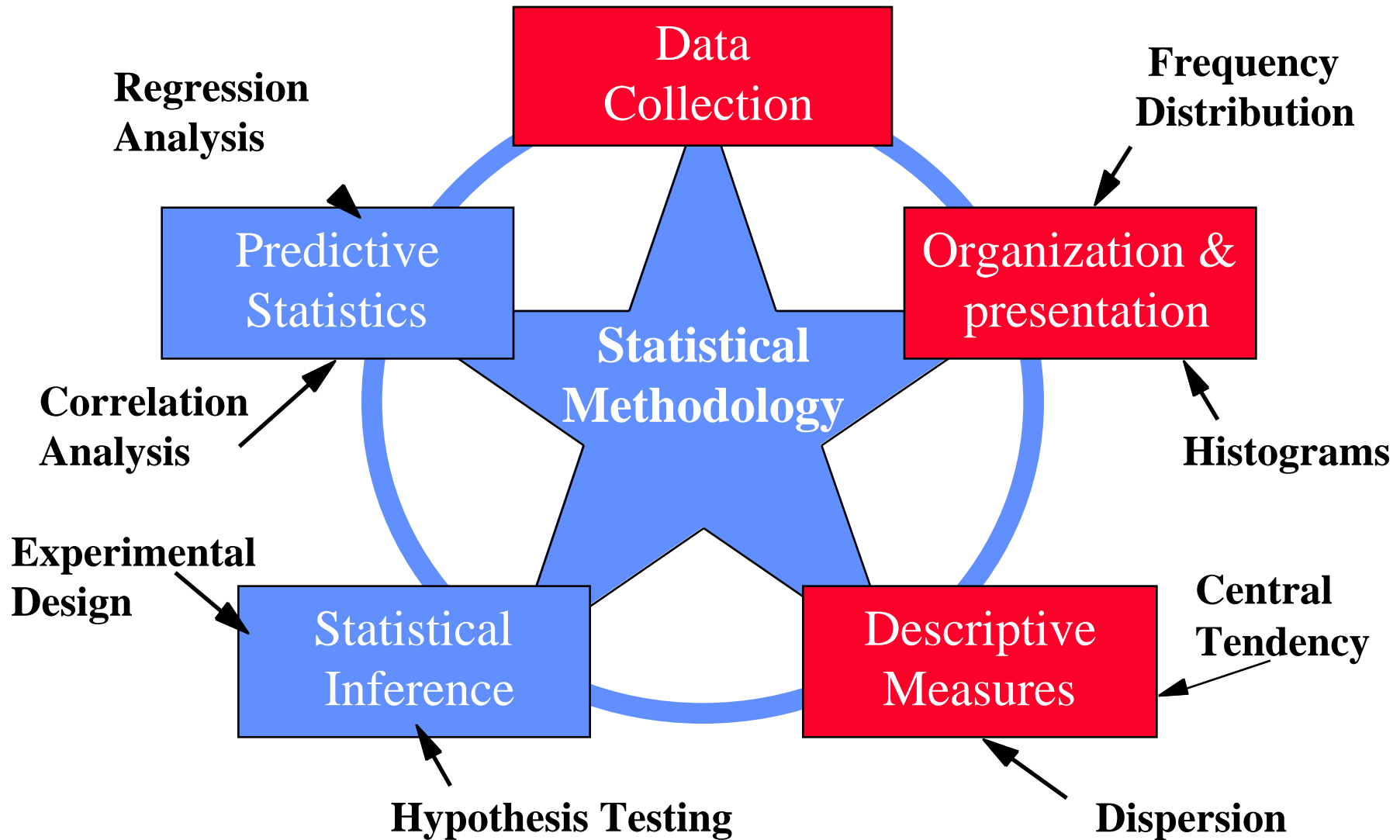
Tomorrow we will produce 5000 parts, based off of last weeks production of : 5250; 5500; 4500; 4750; 5000

Four Levels of Measurements

- ◆ **Nominal:** Objects are classified into simple attributable categories with no quantitative difference between them, (Yes/No, Good/Bad).
- ◆ **Ordinal:** Objects are able to be arranged, ranked, or ordered into a meaningful attributable arrangement with no real measurement. (Yellow/Blue/Green, Square/Round/Triangle)
- ◆ **Interval:** observations are able to be ranked into exact differences between any two observations, measurements with no natural origin or zero, 80 degrees is not twice as hot as 40 degrees. A one unit scale change corresponds to a one unit change on the object being studied.
- ◆ **Ratio:** contains all the properties of interval but has a natural origin. Having a natural origin allows 25 to be half of 50.

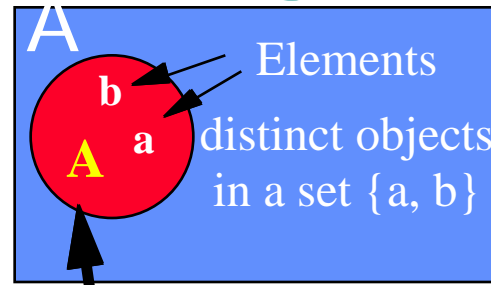
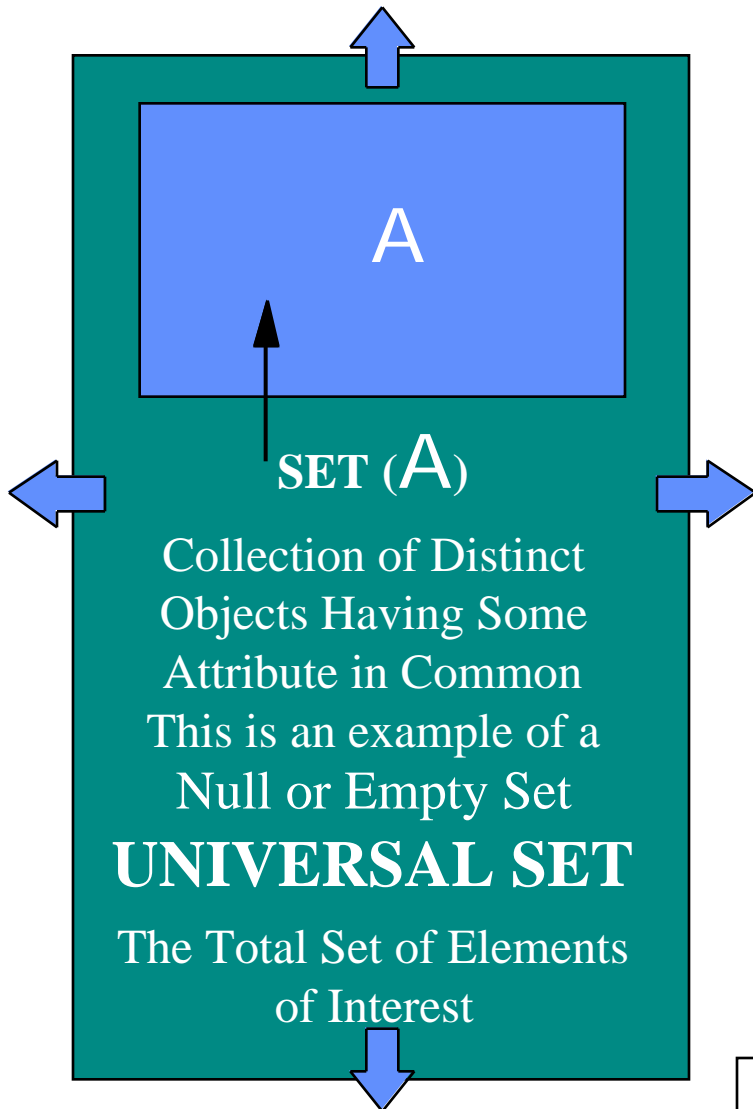
Note that each successive level has all the properties of the previous.

SPC is Concerned With:



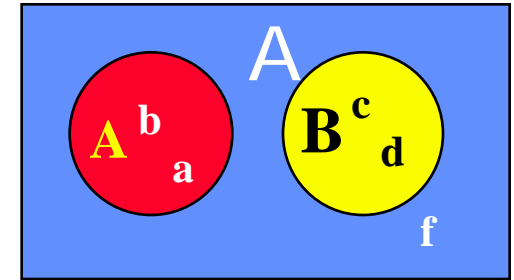
Data Collection

Venn Diagrams



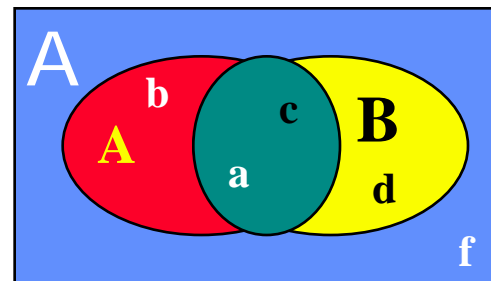
SUBSET (A)

portion of the set defined in some unambiguous way



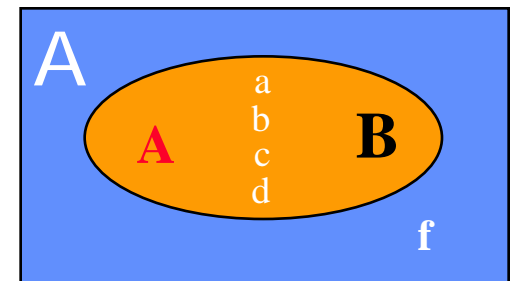
MUTUALLY EXCLUSIVE

Subsets A & B have no elements in common



Intersect ($A \cap B$)

Common Elements of sets {a,c}



Union ($A \cup B$)

Component Elements of sets {a,b,c,d}

Complement ($'$) is the inverse of the specific set called out
Complement of set **A** is **A'** or $\{ \emptyset \}$ subset $A' = \{c,d,f\}$

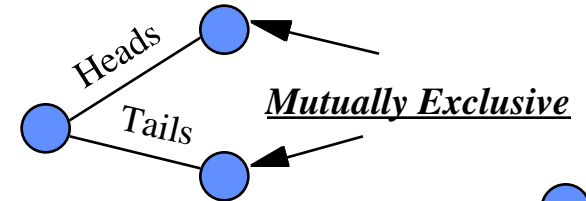
Events

A *Sample Space* (S) is the set of all possible outcomes.

An *Event* is any subset of a sample space.

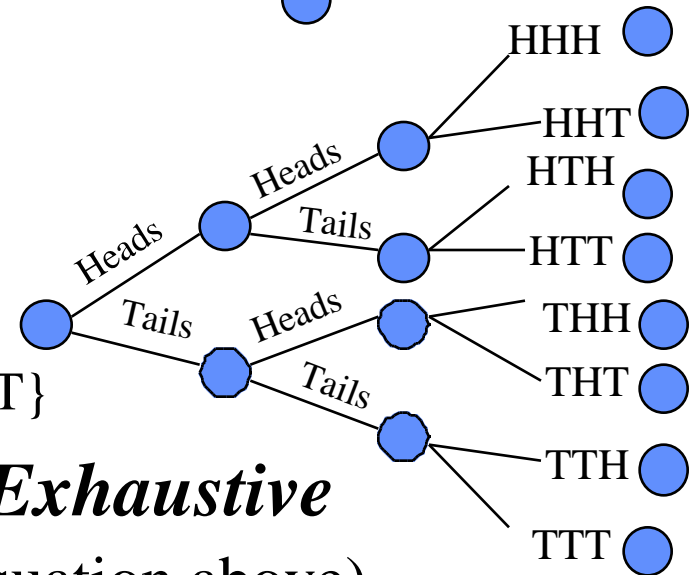


A *Simple Event* is any subset of the sample space to include a single outcome. $S = \{H, T\}$



A *Compound Event* is any subset of the sample space which consists of two or more simple events.

$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$



A set of Events is said to be *Collectively Exhaustive* if all simple events are included, (like the equation above).

Putting it all Together

- ◆ When gathering data for a process, we must realize that

Organizing Data

Presenting Data

Descriptive Measurement

Statistical Process Control