TamStat
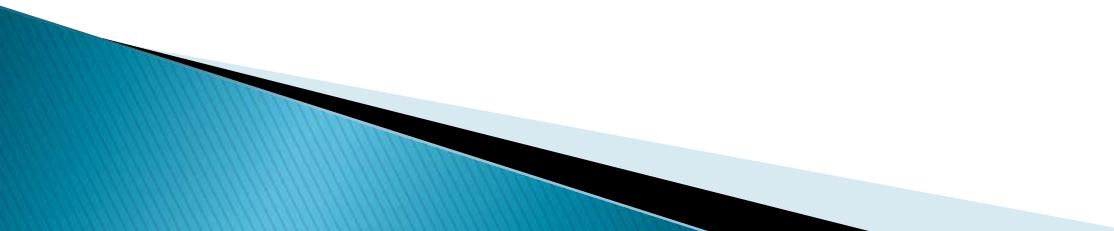# A Statistical Package

Stephen M. Mansour, PhD
Jerry M. Brennan, PhD
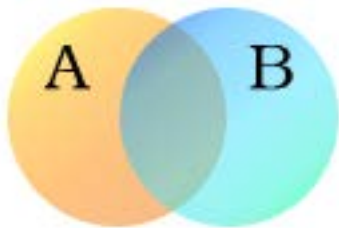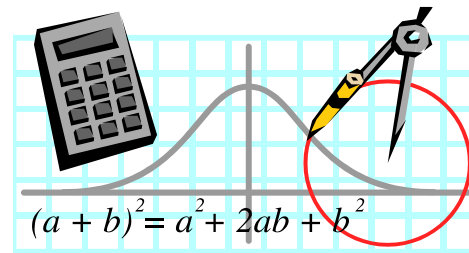Dyalog 2015 Sicily

Motivation

- TamStat can be used for a one or two-semester statistics course
  - More material can be covered; less emphasis on calculations
- TamStat combines features of Statistical programs such as Minitab and Simulation programs such as Crystal Ball
  - Front-end to R using R-Connect
- TamStat's unique syntax results from the natural use of arrays and operators in Statistics.

Statistics deals primarily with four types of functions:

- Summary Functions
  - Descriptive Statistics
- Probability Distributions
  - Theoretical Models
- Relations
- Logic

$(a + b)^2 = a^2 + 2ab + b^2$

A Statistical Problem

- A movie theater has 130 searts
- Movie attendance averages 100 people with a standard deviation of 20.
- What is the probability the theatre will have to turn people away?
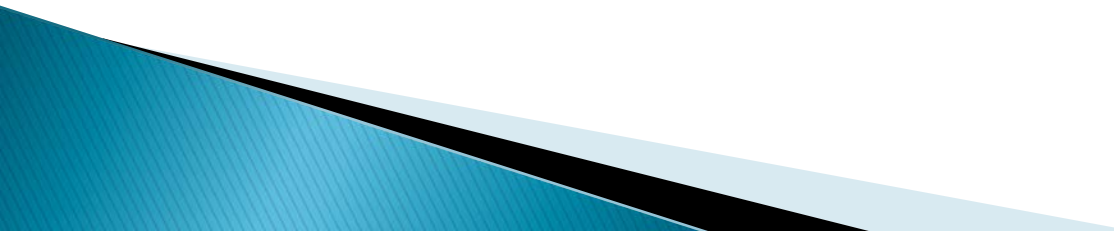
Other Programs vs. TamStat

Excel: `=1-NORM.DIST(130,100,20,TRUE)`

R: `> pnorm(130,100,20,lower.tail=FALSE)`

TamStat:

```
100 20   normal  probability   >    130
---↓--   --↓---  ----↓------   ↓    ↓
  Left   Left      Dyadic    Right Right
  Arg   Operand   Operator    Oper Arg
```

New Features in TamStat

- User Guide and Reference Card
- Excel Import function
- Optional R interface
- 3 Versions Available

Documentation

- User Guide – 70 pages .pdf or hard copy
- Reference Card – Foldout; uses similar notation to Dyalog reference card

Import function

Reads data from Excel .csv file into a namespace

```
    D←import 'C:\[path]\file.csv'
    variables D
    Car  Eyes  Family  Height  Sex
ShoeSize  State Weight
    mode D.State
PA
    median D.Height
70
```

R Interface

```
 normal←{
  ⍺⍺ Mean
  ⍺⍺ Standard Deviation
  ⍺⍺ [0=Density, 1=Distribution, ¯1=Inverse]
      ⎕ML←3 ◇ ⎕IO←0 ◇ ⍺←0 1 ◇ m s c←3↑⍺
     ω≡'Type':'Continuous'
      'Mean' 'Median' 'Mode'∊˜⊂ω:m
     ω≡'Variance':s*2
      'Skewness' 'Kurtosis'∊˜⊂ω:0
      str←'pdqr'[1 0 ¯1 ¯2⍳c],'norm(ω,ω,ω)'
      #.R_Available:+#.∆r.x str ω m s
      sden←{m s←⍺ ◇ (÷s×(○2)*÷2)×*-0.5×(s÷˜ω-m)*2}
      ...
 }
```

Bayesian Statistics

Let us first set the prior probabilities: P(Cancer), P(No Cancer)

```
    PRIOR←0.03 0.97
```

Now let us set the conditional probabilities:
 P(Positive|Cancer) , P(Postive|No Cancer)

```
    COND←0.9 0.02
```

Now let find the Bayesian probabilities:
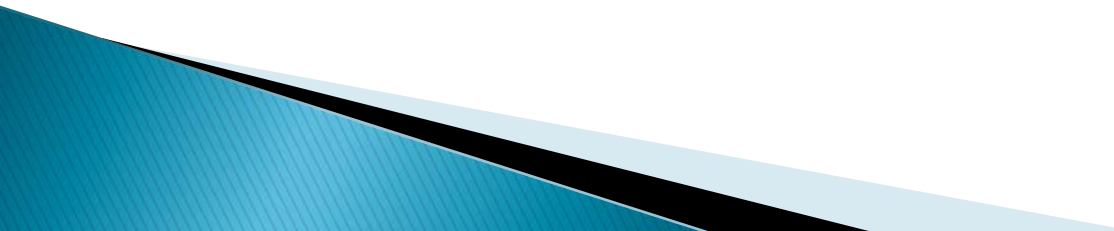
```
    bayes←×÷+.×        ⍝ Use a fork!
```

P(Cancer|Positive),P(No Cancer|Positive)

```
    PRIOR bayes COND
0.589 0.4181
```

Thus in conclusion we find that if the test is positive, the probability of cancer is 58.19%.

TamStat Versions

- Dyalog Workspace for APL users
- Standalone App for students and non-APL users (ASCII input)
- Web App similar to TryAPL using MiServer for casual users (Jerry Brennan)
- Computer program for professional users. (in development).

Tam Stat App

- Uses ASCII symbols
  - Assignment **<-**
  - Less than or Equals **<=**
  - Not Equals **<>**
  - Greater than or equals **>=**
- Single .exe file, bound executable
- Choice of Fonts

Web Application

- Similar to TryAPL
- Uses MiServer
- Jerry Brennan will demonstrate