

# Stat 328 Course Outline Summer 2001

## Session #1

- What is Statistics?
- Basic Descriptive Statistics
  - Graphs for Quantitative Data
    - Histograms (shape, location, spread)
    - Stem Plots
    - Time Plots (trends)
  - Numerical Measures for Quantitative Data
    - Mean, Median
    - Quartiles, 5-Number Summaries, Boxplots
    - Standard Deviation
- "Normal" Distributions/Models
- Producing Data
  - Observational Studies and Experiments
  - "Random Sampling" in Observational Studies

## Session #2

- Modeling Randomness/Chance
- Rules of Probability
  - Applications to Finite Sample Spaces
  - Applications to Continuous Models
- (Mean and Variance for Random Variables ... Section 2.3 of Dielman)
- "Sampling Distributions"
  - Simulation
  - Theory for  $\bar{x}$ 
    - Law of Large Numbers
    - Mean and Standard Deviation for  $\bar{x}$
    - Central Limit Theorem

## Session #3

- Confidence Intervals for a Mean from the Sampling Distribution of  $\bar{x}$
- (Prediction Intervals for Another  $x$  ... Class Notes)
- Significance Tests for a Mean from the Sampling Distribution of  $\bar{x}$

#### Session #4

- Real Inference for a Mean
- (Real Prediction Intervals for Another  $x$  ... Class Notes)
- Real Inference for a Difference in Means

#### Session #5

- Finish Simple Real Inference for Means
- Business Process Improvement and Six Sigma
- Shewhart Control Charts
- Descriptive Statistics for  $(x,y)$  Data
  - Least Squares Line
  - Sample Correlation,  $r$

#### Session #6

- More Descriptive Statistics for  $(x,y)$  Data
  - Coefficient of Determination  $R^2$
- Normal SLR Model
- Estimates in the SLR Model
  - $b_0$ ,  $b_1$  and  $s_e$
- Inference in the SLR Model
  - Confidence Intervals for  $b_1$

#### Session #7

- More Inference in the SLR Model
  - Confidence Intervals for  $m_{y|x}$
  - Prediction Intervals for  $y_{\text{new}}$
  - $t$  tests for  $m_{y|x}$  and  $b_1$
  - $F$  tests for  $b_1$  and ANOVA
- Descriptive Statistics for  $(x_1, x_2, \dots, x_k, y)$  Data
  - Least Squares Coefficients  $b_0, b_1, b_2, \dots, b_k$
  - $R^2$

## Session #8

- Normal MLR Model
- Inference in the MLR Model
  - Confidence Intervals for the  $\mathbf{b}_j$
  - Confidence Intervals for  $\mathbf{m}_{y|x_1, x_2, \dots, x_k}$
  - Prediction Intervals for  $y_{\text{new}}$
  - $t$  tests for the  $\mathbf{b}_j$
  - $F$  tests for  $H_0: \mathbf{b}_1 = \mathbf{b}_2 = \dots = \mathbf{b}_k = 0$  and ANOVA

## Session #9

- More Inference in the MLR Model
  - Partial  $F$  tests for  $H_0: \mathbf{b}_{l+1} = \mathbf{b}_{l+2} = \dots = \mathbf{b}_k = 0$  and ANOVA
  - Multicollinearity
  - Inference for Linear Combinations,  $L$ , of the  $\mathbf{b}_j$
  - Time Series Ideas and Regression
- Transforming Old and Building New Predictors
- Regression Diagnostics
  - Residual Plotting

## Session #10

- More Regression Diagnostics
  - More on Residual Plotting
  - Standardized Residuals
  - Deleted Residuals and  $PRESS$
  - Partial Residuals and JMP "Leverage Plots"
  - "Leverage Values"  $h_{ii}$  (JMP "hats")
  - Cook's D
- Dummy/Indicator Variables

## Session #11

- Model Comparison Criteria
  - $R^2$ ,  $MSE$ , Mallow's  $C_p$ , Akaike's  $AIC$
  - $PRESS$
- Model Search Algorithms
  - All Possible Regressions
  - Forward, Backward, and Step-wise Selection