STA 371G Outline
Spring 2017

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 Office Hours: Monday & Wednesday 3:30-5:00 PM. You are welcome to come by my office at other times.

Wednesday, January 18

Topics:

- Introduction

- Probability

- Random variables

Reading Assignments:
 You are recommended to read:
 Chapter 1 of OpenIntro Statistics, 3rd edition

Monday, January 23

Topics:

- Probability distributions

- Mean, variance and standard deviation of a random variable

Reading Assignments:
 If you are not familiar with the topics discussed in class, you are recommended to read:
 pp. 156-168, 189-195, of Data analysis and decision making, 4th edition
 or
 pp. 196-206, 225-231 of Data analysis and decision making, 3rd edition

 You are also recommended to read:
 pp. 1-14 of "1TopicSummary_ProbabilityConceptsAndNormalDistributions.pdf" (available in Canvas/files)

 To learn more about these topics, you may further read:
 Chapters 2.1, 2.2, 2.4, and 2.5 of OpenIntro Statistics, 3rd edition

Wednesday, January 25

- Mean, variance and standard deviation of a random variable

- Add a constant to a random variable

- Multiply a random variable by a constant

- Conditional, joint and marginal probabilities

Monday, January 30

- Conditional, joint and marginal probabilities

- Independent random variables, sum of independent random variables

Wednesday, February 1

- Continuous random variables

- Probability density function: area under the curve represents probability

- Standard normal distribution $Z \sim \mathcal{N}(0,1)$

- Normal distribution $X \sim \mathcal{N}(\mu, \sigma^2)$

- If $X \sim \mathcal{N}(\mu, \sigma^2)$, then $P(X < x) = P(\frac{X-u}{\sigma} < \frac{x-u}{\sigma}) = P(Z < \frac{x-u}{\sigma})$.

Reading Assignments:
To get familiar with the normal distribution, you are recommended to read:
pp. 211-215, 217-225 of Data analysis and decision making, 4th edition
or
pp. 247-250, 253-260 of Data analysis and decision making, 3rd edition

You are also recommended to read:
pp. 15-30 of "1TopicSummary_ProbabilityConceptsAndNormalDistributions.pdf" (available in Canvas/files)

You may further read:
Chapters 3.1.1, 3.1.2, 3.1.4 and 3.1.5 of OpenIntro Statistics, 3rd edition

Monday, February 6

- Standard normal calculations in Excel: NORMSDIST,
  or in R: pnorm (type "?pnorm" in R for help).

- Understand the meaning of the standard deviation σ in a normal distribution: $P(\mu - \sigma < X < \mu + \sigma) =$? and $P(\mu - 2\sigma < X < \mu + 2\sigma) =$?

- Normal calculations in Excel:
  NORMSDIST, NORMDIST
  NORMSINV, NORMINV
  or in R:
  pnorm, qnorm (type "?pnorm" and "?qnorm" in R for help).

- Standardizing a normal random variable $Z = \frac{X-\mu}{\sigma} \sim \mathcal{N}(0,1)$
  Interpretation: the value of Z is the number of standard deviations that X deviates towards the left (if $Z < 0$) or the right (if $Z > 0$) of the mean.

- Plot a normal distribution in Excel and R

Wednesday, February 8

- Example: Testing at ZTel, we will make an Excel spreadsheet for calculations

- Case study, Texas BBA Salary Statistics

- Expectation of a continuous random variable

- Population mean, variance, standard deviation

- Sample mean, sample variance, standard error of the sample mean

- Sampling distribution of the sample mean

Reading Assignments:
To learn more about estimation and sampling distribution, please read:
pp. 352-353, 366-371, 374, 388-395 of Data analysis and decision making, 4th edition
or
pp. 378-379, 393-398, 400-401, 422-430 of Data analysis and decision making, 3rd edition

You are also recommended to read:
"2TopicSummary_EstimationAndSamplingDistributions.pdf" (available in Canvas/files)

For this topic, you may further read:
Chapters 4.1, 4.2, 4.4 and 5.3 of OpenIntro Statistics, 3rd edition

Monday, February 13

- Sampling distribution of the sample mean

- Confidence interval

- Simple linear regression

- Linear prediction: $Y = b_0 + b_1 X$

- Least squares estimation of b_0 and b_1

- Examples: predict house price, baseball runs per game

- Using Excel and R to do the calculation

- Excel add-in: Palisade Decision Tools (including StatTools) for Windows, StatPlus:mac LE for Mac.

- Sample mean, variance, and standard deviation

- Sample covariance, sample correlation

- Linear relationship between X and Y

- $b_0 = \bar{y} - b_1 \bar{x}$, $b_1 = r_{xy} \times \frac{s_y}{s_x}$

Reading Assignments:
Chapters 7.1 and 7.2 of OpenIntro Statistics, 3rd edition
pp. 531-551 of Data analysis and decision making, 4th edition
or
pp. 562-584 of Data analysis and decision making, 3rd edition

Wednesday, February 15

- mean(e)=0, Corr(e, X)=0, Corr($e, \hat{Y}$)=0, Corr($\hat{Y}, X$)=1

- SST, SSR, SSE

- Coefficient of determination: $R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$

- $R^2 = r_{xy}^2$ measures the proportion of variation in Y explained by X.

- Statistical model for simple linear regression

- Statistical model for simple linear regression:
  $Y = \beta_0 + \beta_1 X + \epsilon$, $\epsilon \sim \mathcal{N}(0, \sigma^2)$
  $Y \sim \mathcal{N}(\beta_0 + \beta_1 X, \sigma^2)$

- Conditional distribution of Y given X

Reading Assignments:
PDF "Simple Linear Regression" posted in Canvas/files

Monday, February 20

- 95% prediction interval of Y given X: $\beta_0 + \beta_1 X \pm 2\sigma$

- Conditional and marginal distributions of Y

- Interpretation of ϵ and σ

- The error terms ϵ_i are independent, and identically distributed

- Least squares estimation and Gaussian maximum likelihood (optional)

- True line $\beta_0 + \beta_1 X$ and least squares line $b_0 + b_1 X$

- Case study: Waite First Securities, Milk and Money

Wednesday, February 22

- Topic summary for Midterm #1

- Discuss Practice Exam #1

- Common problems in homework assignments

Reading Assignments:
    "3TopicSummary_RegressionModelAndEstimation.pdf" (available in Canvas/files)
    "5TopicSummary_CorrelationAndCovariance.pdf" (available in Canvas/files)
    "6TopicSummary_ComputingAndInterpretingRSquare.pdf" (available in Canvas/files)
    "7TopicSummary_InterpretingAndEstimatingVarianceOfEpsilon.pdf" (available in Canvas/files)

Monday, February 27

- Midterm Exam #1, FAC 21, 7:00-10:00 pm