STA 371G Outline
Fall 2019

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Office Hours: Monday & Wednesday 3:30-4:30 PM. You are welcome to come by my office at other times.

Wednesday, August 28

Topics:

- Introduction
- Probability
- Random variables
- Probability distributions

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

Wednesday, September 4

Topics:

- Mean, variance and standard deviation of a random variable
- Add a constant to a random variable
- Multiply a random variable by a constant
- Independent random variables, sum of independent random variables

Reading Assignments:
If you are not familiar with the topics discussed in class, you are recommended to read:
pp. 140-142, 740-741 Business Analytics: Business Analytics: Data analysis and decision making, 6th edition
or
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

Monday, September 9

- Measure uncertainty with probability
- Frequency probability and subjective probability
- Probability, lotteries and betting odds
- Payoff tables
- Payoffs and Losses
- Nonprobabilistic criteria for decision making: maximin, maximax, and minimax loss

Wednesday, September 11

- Probabilistic criteria for decision making: expected payoff, expected loss
- Utility functions
- Conditional probability and conditional bets or conditional reference contracts
- Conditional, joint and marginal probabilities
- Bayes' theorem

Reading Assignments:
Chapter 6 of Business Analytics: Data analysis and decision making, 6th edition
or
Chapter 6 of Data analysis and decision making, 4th edition
or
Chapter 7 of Data analysis and decision making, 3rd edition

Monday, September 16

- Decision trees, risk profile, sensitivity analysis
- Risk profile, sensitivity analysis

Reading Assignments:

Chapter 6 of Business Analytics: Data analysis and decision making, 6th edition
or
Chapter 6 of Data analysis and decision making, 4th edition
or
Chapter 7 of Data analysis and decision making, 3rd edition

Wednesday, September 18

- The value of information
- Expected value of perfect information (EVPI)
- Expected value of sample information (EVSI)
- Expected value of sample information (EVSI)
- Case study: Freemark Abbey Winery

Monday, September 23

- Continuous random variables
- Probability density function: area under the curve represents probability
- Standard normal distribution $Z \sim \mathcal{N}(0, 1)$
- Normal distribution $X \sim \mathcal{N}(\mu, \sigma^2)$

Reading Assignments:

To get familiar with the normal distribution, you are recommended to read:

pp. 167-171, 174-182 of Business Analytics: Data analysis and decision making, 6th edition
or
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

Wednesday, September 25

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

- 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

Monday, September 30

- 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. 280-281, 292-297, 299, 312-318 of Business Analytics: Data analysis and decision making, 6th edition

or

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

Wednesday, October 2

- Please install R and Rstudio on your laptop and bring it to class
- Simulation using Excel and R
- Simulate random numbers from a discrete distribution
- Find the sample mean and variance, compare them with the true mean and variance
- Simulate the sampling distribution of the sample mean
- Uniform random numbers, flip a coin, toss a die, flip two coins, toss two dice, law of large numbers
- Estimate π with Monte Carlo simulation
- Simulate normal random numbers $X \sim \mathcal{N}(\mu, \sigma^2)$.
- Find $P(X < x)$ and $P(X <?) = p$ using simulation
- Demonstrate Central Limit Theorem using simulation
- Simulation of weekly demand

Reading Assignments:

Chapters 4.4 (4.5-4.7 not found), pp 740-741 of Business Analytics: Data analysis and decision making, 6th edition

or

Chapters 4.4–4.8 of Data analysis and decision making, 4th edition

or

Chapters 5.4–5.8 of Data analysis and decision making, 3rd edition