

# STA 371G Outline

## Spring 2014

**Professor:** Mingyuan Zhou

Office: CBA 6.462

Phone: 512-232-6763

Email: mingyuan.zhou@mcombs.utexas.edu

Office Hours: Tuesday Thursday 3:30-4:30 PM. You are welcome to come by my office at other times, but to make sure that I will be there then, you may first call my office, send me an email, or talk to me before or after class to make an appointment.

### Tuesday, January 14

#### Topics:

- Introduction
- Probability
- Random variables
- Probability distributions
- Mean, variance and standard deviation of a random variable

### Thursday, January 16

#### Topics:

- Add a constant to a random variable
- Multiply a random variable by a constant
- Conditional, joint and marginal probabilities
- Independent random variables, sum of independent random variables
- Continuous random variables
- Probability density function: area under the curve represents probability
- Standard normal distribution  $Z \sim \mathcal{N}(0, 1)$
- Standard normal calculations in Excel: NORMSDIST, or in R: pnorm (type “?pnorm” in R for help).

**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

To learn more about these topics, you may further read:

Chapters 2.1, 2.2, 2.4, and 2.5 of OpenIntro Statistics, 2nd edition

**Tuesday, January 21**

- Normal distribution  $X \sim \mathcal{N}(\mu, \sigma^2)$
- Understand the meaning of the standard deviation  $\sigma$  in a normal distribution:  $P(\mu - \sigma < X < \mu + \sigma) = ?$  and  $P(\mu - 2\sigma < X < \mu + 2\sigma) = ?$
- Standardizing a normal random variable  $Z = \frac{X - \mu}{\sigma}$   
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.
- Normal calculations in Excel:  
NORMSDIST, NORMDIST  
NORMSINV, NORMINV  
or in R:  
pnorm, qnorm (type “?pnorm” and “?qnorm” in R for help).
- Plot a normal distribution in Excel and R
- Example: Testing at ZTel, we will make an Excel spreadsheet for calculations

**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 may further read:

Chapters 3.1.1, 3.1.2, 3.1.4 and 3.1.5 of OpenIntro Statistics, 2nd edition

**Thursday, January 23**

- Binomial distribution. Examples: the number of “Heads” in 100 coin flips, the number of votes for Republican in 1000 voters
- The normal approximation to the binomial
- Introduction to Monte Carlo simulation

- Uniform random variables: `RAND()` in Excel, `runif` in R
- Flip a coin, toss a die, repeat 1 million times
- Law of Large Numbers
- Sum of two dice
- Example: simulation of market return (using Excel)

**Reading Assignments:**

To learn the binomial distribution and its normal approximation, please read:  
pp. 233-239 of Data analysis and decision making, 4th edition  
or  
pp. 268-273 of Data analysis and decision making, 3rd edition

For this topic, you may further read:  
Chapters 3.4.1 and 3.4.2 of OpenIntro Statistics, 2nd edition