# STAT 341 Probability and Statistics
# Fall 2018, MWF 10:00-10:50, Math 103

**Course Information**

- **Instructor**: David Patterson, Math 208, 243-6748, david.patterson@umontana.edu
- **Textbook:** Probability and Statistics for Computer Science, 2nd ed, by Michael Baron (1st edition OK)
- **Prerequisites:** M 172 (Calculus II) or M 162 (Applied Calculus)
- **Software:** Some assignments will require the use of R. R is a free program which can be downloaded from http://www.r-project.org/. It is also available in the Math 206 computer lab. R is a high-level statistical programming language which is especially good for doing simulations. That will be the primary use of R in this course.
- **Office Hours**: See Moodle page

**Catalog description**

Offered autumn and spring. Prereq., one of M 162, 172 or 182. Probability, probability models and simulation, random variables, density functions, special distributions, and a brief survey of estimation and hypothesis testing. Computer use integrated throughout.

**Learning Outcomes :**

1. To understand basic probability, counting and combinatorial methods, and Bayes' Theorem.
2. To understand and use the Law of Large Numbers and the Central Limit Theorem.
3. To learn about models for discrete and continuous random phenomena and to apply these models to real problems.
4. To learn to simulate random phenomena in R or other computer language.

**Important dates:**

- **Monday, September 3**: Labor Day, no classes.
- **Wed, September 5**: last day to add course by Cyberbear without consent of instructor.
- **Monday, September 17**: last day to drop course or change grading option by Cyberbear. A "W" will appear on transcript for courses dropped after this date.
- **Monday, October 29**: last day to drop course. Requires paper form signed by advisor and instructor. Changes after this date are only in exceptional circumstances.
- **Tuesday, November 6**: Election Day, no classes, VOTE!!
- **Monday, November 12:** Veteran's Day, no classes.
- **Wed-Fri, Nov. 21-23:** Thanksgiving break, no classes.
- **Friday, December 7**: last day of classes.
- **Thursday, December 13: 8:00-10:10 am:** Final exam. Final will not be given early.

**Grading (+/- grading will be used):**

- **Quizzes**: Group quizzes every Friday ; I will drop your 2 low scores. There are no makeups on quizzes.

- **Homework**: Homework will be a combination of on-line (WebWork) and hand-in. More details below.
- **Midterm Exams 1,2,3**: Tentative dates are **Wed, Sep 26**; **Wed, Oct. 24; Wed**, **Nov. 28**. There are no makeups as I allow you to drop one exam score if you take the final exam.
- **Final Exam (comprehensive): Thur, Dec. 13, 8:00-10:00.**
- **Final grades**: After the third midterm, I will give you a tentative letter grade based on 75% for the 3 midterms and 25% for homework/quizzes. I will use 90, 80, 70, 60 cutoffs. If that grade is acceptable to you, you don't have to take the final exam. If it's not, take the final exam. Your final grade will then be based on your two best midterms (50%), the final (25%) and homework/quizzes (25%). Taking the final cannot lower your grade from the tentative grade I assign after the third midterm.

**Incompletes**
Incompletes are given at the discretion of the instructor and are only considered in cases where the student has been in attendance and doing passing work up to three weeks before the end of the semester, and for reasons beyond the student's control and which are acceptable to the instructor, the student has been unable to complete the requirements of the course on time. Negligence and indifference are not acceptable reasons.

**Students with disabilities are welcome to discuss accommodations with me.**

**Academic Honesty**
All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary action by the University. All students need to be familiar with the Student Conduct Code. You can find it in the A-Z index on the UM home page.

**Homework**
There are two types of homework assignments:

- **Written assignments**. These are due at the beginning of class and are to be handed in as a hard copy. No late homework is accepted. If you cannot be in class, you may email me the homework by that time (please do not email me the homework if you will be in class). I will only accept emailed homework twice during the semester unless there are extenuating circumstances you have discussed with me.

  Most of the problems in the written homework cannot be solved by simply plugging into a formula given in the book. Often there will be multiple ways to solve a problem. As on the tests, answers by themselves are not adequate without indicating your reasoning. You are allowed and even encouraged to work with others on the homework as long as the solutions you present are your own. However, if you simply rely on me or others to direct you on every problem, then you will not improve your problem-solving skills.
- **Webwork assignments**. Some homework assignments will be on a web-based homework system called WebWork which will immediately tell you whether your each answer is correct or not. These problems will generally be of the more routine calculation type. Usually, there will be some required problems and then some optional no-credit problems so that you can get more practice if you feel you need it. It is

important that you know how to do these more routine problems, but it is up to you on how much practice you need.

**Topics will include many (but not necessarily all) of the following:**

The Law of Large Numbers for probabilities

Simulation in R

Sample spaces, events and probabilities

Conditional probability

Chance trees and Bayes' rule

The Monte Hall dilemma and related problems

Coincidences and rare events

Discrete random variables

Expected value and variance of discrete random variables

Law of Large Numbers for expected values

Discrete probability models: Bernoulli trials, binomial, geometric, negative binomial, and Poisson distributions

Poisson approximation of binomial distribution

Continuous probability models and probability density functions

Expected value and variance of continuous random variables

Continuous probability models: exponential and normal distributions

Expected value and variance of linear combinations of random variables

The square root law and the Central Limit Theorem

Normal approximation of the binomial distribution

Markov processes and Markov chains

Confidence intervals for simulations: proportions and means

Randomization tests