

**Statistics 512 Design and Analysis of Experiments**  
**MWF 11:15 - 12:05**  
**220 Thomas Building**

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**Instructor:** Ephraim Hanks  
Office: W-250 Millenium Science Complex  
email: hanks@psu.edu  
Office Hours: Tuesdays 1:00-2:00pm or by appointment

**Textbook:** *Design of Experiments: an Introduction Based on Linear Models* by Max Morris

**Course Goals:**

The goal of this course is to introduce the student to the theory and application of designing experiments and analyzing data collected from designed experiments. This course follows STAT 511: Regression, and students are expected to have mastered the material in that class. At the end of this course successful students will be able to do the following:

1. Find optimal designs for prediction and estimation under a wide range of scenarios.
2. Correctly identify and analyze data coming from a wide range of designs, which may include blocking, factorial designs, nested factors, random effects, and more.
3. Use principles of survey sampling to design and analyze survey studies.
4. Demonstrate a mastery of linear algebra and multivariate normal theory to analyze experimental data.

**Tentative Outline:**

1. Linear algebra, and the linear model
2. Principles of design: causal inference, randomization, and replication
3. One-way ANOVA – optimal designs for different criteria,
4. Factorial and Nested designs
5. Multivariate normal theory and Random Effects
6. Multiple comparisons, (Tukey, Sheffe, false discovery rate, ...)
7. Causal inference from observational data
8. Survey Sampling
9. Optimal design for computer experiments

**Computing:** We will use the R statistical computing environment for all computation in this class.

<b>Grading:</b>	Homework:	25%
	Midterm 1	25%
	Midterm 2	25%
	Final Exam	25%

Midterm 2 may be substituted for a project.

Course grades will be assigned according to the following cutoffs. If the grades are curved, a higher grade may be assigned, but you will not receive a lower grade than listed here.

A	[93,100]	C+	[77,80)
A-	[90,93)	C	[73,77)
B+	[87,90)	C-	[70,73)
B	[83,87)	D	[60,70)
B-	[80,83)	F	[0,60)

### **Exams:**

The midterm exam dates will be given at least a week before the exam. The comprehensive final exam date will be set by the registrar's office. No make-up exams will be given. In the case of a University approved conflict, an arrangement will be made with the instructor. The instructor may substitute a project for one of the midterms.

### **Homework:**

Homework will be posted on Canvas. You will be responsible to download the homeworks. **No late homework will be accepted.** Homework can be worked on in groups, but each student must submit homework individually.

### **Academic Integrity:**

All University policies regarding academic integrity apply to this course. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating of information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. All exam answers must be your own, and you must not provide any assistance to other students during exams.

### **Disability Services:**

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at <http://equity.psu.edu/ods/>. In order to receive consideration for course accommodations, you must contact ODS and provide documentation. If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible.