

# MA376 Lesson 1

*Clark*

## Contact Information

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## Course Overview

*Mathematical* Statistics

- Review of Probability
- Common density functions, operations involving density functions
- Functions of Random Variables (what is a random variable?)
- Parameter estimation techniques
- Evaluation of estimation techniques
- Properties of point estimators
- Hypothesis testing

## Set Notation

A picture:

$$S = \{s_1, s_2, s_3, s_4\}$$

We can write:  $s_1 \in S$

$$A = \{s_1, s_3\}$$

We can write:

$$B = \{s_2, s_4\}$$

$$A \cup B =$$

$$A \cap B =$$

Oftentimes Venn Diagrams help us understand what is going on. For example, DeMorgan's Laws state:

$$\overline{A \cap B} = \overline{A} \cup \overline{B}$$

$$\overline{A \cup B} = \overline{A} \cap \overline{B}$$

picture:

## Problem 2.7 in WMS

Now. None of this has anything to do with probability or statistics. Set theory is a tool, like Calculus is a tool, that can potentially help us. But let's go back to probability theory. We are going to define a **Probability Space** which consists of three things. A sample space, a list of events we are potentially interested in, and probabilities of those events occurring. We will start with **Discrete** outcomes.

Sample space:  $S = \{\text{Roll a 1, Roll a 2, Roll a 3, Roll a 4, Roll a 5, Roll a 6}\}$

Allowable events (technically must be a  $\sigma$ -Algebra )

What are some events we might be interested in? For any events,  $A$  and  $B$ , what can we say about  $A \cup B$ ? What about  $\overline{A}$ ?

Simple events vs. compound events.

## Probability

Last part of our probability space. What is probability?

Technically a probability is a set function that *measures* an event. Let's look at **Definition 2.6**.

One way to assign a probability to a discrete sample space is to use relative frequency of each simple event.

Let's put this all together:

Now, we have our discrete sample space, a way to come up with events of interest (any set  $A \subset S$ ), and a way to assign probabilities to  $A$ .

## **Admin**

Introductions

Homework

Next Lesson

**Start with 2.18 in WMS**