

Notes for ECE 30200 - Probabilistic Methods in Electrical and Computer Engineering

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These are lecture notes for Fall 2025 ECE 30200 by professor Mary Comer at Purdue. Modify, use, and distribute as you please.

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Modelling Random Experiments

Examples:

- Flip a coin
- Rolling dice
- Generate a bit from a random binary source
- Generate a sequence of n bits from a random binary source
- Count packets arriving at a router
- Measure the voltage at a point in a circuit

All of these examples could be at a fixed time, or over an interval of time.

There is a very precise framework that can be used to model any random experiment.

Overview:

- The outcome that occurs each time a random experiment is run is not known in advance, but **the set of all possible outcomes is assumed to be known**.
- Subsets of the set of all possible outcomes are called events.
- Probabilities are assigned to events, not outcomes, using a probability measure.

We need to use set theory to work with these sets.

Set Theory

A set is an **unordered** collection of elements denoted by $\{ \}$.

Example:

$$\{1, 2, 3\} = \{3, 2, 1\} = \{2, 1, 3, 1\}$$

Notation:

- $w \in A$ means w is in set A
- $w \notin A$ means w is not in set A