Discrete and Continuous Models
Sections 12.5, 12.6
Lecture 24

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Outline

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Discrete Probability Models

Definition (Discrete Probability Model)

A probability model is discrete, or finite, if the sample space has only a finite number of outcomes.

- Each outcome in the sample space has a positive probability.
- We can fully describe the model by listing each outcome together with its probability.
- This is called a discrete probability distribution.

Example

Example (Discrete Probability Model)

- Let the procedure be to toss four coins and count how many landed heads.
- The probability distribution is

No. of heads	0	1	2	3	4
Probability	1/16	4/16	6/16	4/16	1/16

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No. of heads	0	1	2	3	4
Probability	1/16	4/16	6/16	4/16	1/16

- Find P(exactly 2 heads)? Ans: 6/16
- Find P(at least 2 heads)? Ans: 11/16
- Find P(at most 2 heads)? Ans: 11/16
- Find P(either all heads or all tails)? Ans: 2/16

Example

Example (Two Dice)

- Suppose we roll a pair of dice and observe the sum of the two numbers.
- Find the probability distribution of the sum.

Outline

Continuous Probability Models

Definition (Continuous Probability Model)

A probability model is continuous if the sample space consists of an interval of real numbers (or any continuum).

- Each outcome in the sample space is one of infinitely many possible outcomes.
- The only events that we consider are intervals of real numbers, i.e., ranges of value.
- The continuous probability distribution is usually represented by a graph or a mathematical function called the density curve.

Continuous Probability Models

- Two common continuous probability distributions are the normal distribution and the uniform distribution.

Uniform Distribution

Definition (Uniform Distribution)

A uniform distribution is a probability distribution in which all possible values are equally likely.

- The sample space of a uniform probability model must be a finite interval.
- A consequence is that the graph of the density curve is a horizontal line over the interval.
- As with any density curve, area under the curve represents probability.
- The height of the graph is the reciprocal of the width of the interval.

Example

Example (Uniform Distribution)

- Suppose that a traffic light stays green for exactly 30 seconds before turning yellow.
- As you approach the light, it is green, but you do not know how long it has been green.
- What is the probability that it will stay green for at least 10 more seconds?
- Draw the density curve, label both axes, and use it to find the probability.

Normal Probability Model

Example (Normal Distribution)

- Suppose that the scores on the math portion of the SAT are normally distributed with mean $\mu = 512$ and standard deviation $\sigma = 106$.
- Draw the density curve for the probability distribution.
- What is the probability that a randomly selected score is over 600?

Outline

Assignment

Assignment

- Read Sections 12.5, 12.6.
- Apply Your Knowledge: 12, 14, 15, 16, 17.
- Check Your Skills: 24, 25, 26.
- Exercises 48c, 49, 51, 52, 53.