Random Variables

MATH 3342

Section 3.1

Example

- A quality inspector examines four mp3 players and rates each as either **acceptable** or **unacceptable**.

- You record the sequence of ratings.
- You record the number of units rated **acceptable**.

Random Variables

- Given a sample space *S* of some random process:
- A **random variable (RV)** is any rule that associates a number with each outcome in *S*.

- In mathematical terms:
- A **RV** is a function whose domain is the sample space and whose range is the set of real numbers

Notation

- A RV is usually denoted by Uppercase Letters
  – Such as X or Y

- Use a lowercase letter to denote a particular value a RV takes

- X(s)=x
  – Indicates that x is the value associated with the outcome s by RV X

Example

- A quality inspector examines four mp3 players and rates each as either **acceptable** or **unacceptable**.

- First, you record the sequence of ratings.
- Define the random variable X by recording the number of units rated **acceptable**.

- Define the random variable Y by recording the number of units it takes to observe an **unacceptable** unit.

Example

- A polling organization uses a random number dialer to conduct a short survey by randomly calling phone numbers within a given area code.

- Define an appropriate RV X to denote whether or not a person who answers completes the survey.

Bernoulli Random Variables

- Any random variable whose only possible values are 0 and 1.

Example

- A polling organization uses a random number dialer to conduct a short survey by randomly calling phone numbers within a given area code.

- Define a RV Y to denote the number calls needed for a person to complete the survey.

Example

- The quality control branch of a furniture company randomly selects a computer desk at random to test how much weight can be placed on it before it breaks.

- Define a RV X to describe the outcome of this test.

Two types of Random Variables

- Discrete
  – The remainder of Ch. 3
- Continuous
  – Ch. 4

Discrete Random Variables

- An RV whose possible values either:

- Constitute a finite set OR
- Can be listed in an infinite **ordered** sequence

Continuous Random Variables

- An RV for which ***both*** of the following are satisfied:

- The set of possible values consists of either:
  - All numbers in a single interval on the number line OR
  - All numbers in a disjoint union of such intervals

- No possible value of the RV has positive probability
  - i.e. P(X=c) = 0 for any possible value of c