Department of Mathematics
College of William & Mary

MATH 451/551

Chapter 2. Introduction

2.1 Random Experiments, Sample Spaces, and Events

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Random Experiment

Random Experiment

A *random experiment* is one in which the outcome is subject to chance. Every possible outcome can typically be described prior to the execution of the random experiment.

Associated with a random experiment is the set of all possible outcomes to that experiment. For example,

- when a quarterbacl throws a pass in football, there are three possible ourcomes: a complete pass, an incomplete pass, and an interception;
- when a gambler bets on “red" in roulette, there are two possible outcomes: winning and losing;
- when a backgrammon player rolls a pair of dice, there are 11 different sums that are possible: 2, 3, . . ., 12.

Sample Space

Sample Space

The set of all possible ooutcomes too oa random experiment is called the **sample space** and is denoted by S.

Random Experiment	Sample Space
Roll a die and observe up face	
Roll two dice and observe the product of the up faces	
Roll a red die and a green die and observe the difference beween the red up face and the green up face	
Roll three dice and observe the sum of the up faces	
Toss a coin twice and observe the sequence of H's and T's	
Toss a coin twice and observe the number of H's	

Remarks

- The sample space: in the above examples have one common attribute: they all correspond to sets that are known as **finite sets**. Each samples space has a finite number of elements.
- A set that is not finite is known as an **infinite set**. Furthermore, a set is denumerable if its elements can be placed in a one-to-one correspondence with the natural numbers.

- A set is **countable** if it is either finite or denumerable.
- A set is **uncountable** if it is not countable.

Event

Event

An **event** is any collection of possible outcomes of an experiment, that is, any subset of S (includes S itself). Let the **event** A be a subset of the sample space S. If an outcome to a random experiment is in A then event A has occurred.

- A random experiment has multiple events.
- The event with the smallest number of outcomes is the empty set Φ, which never occurs.

Set Theory	Probability
universal set	sample space
elements	outcomes of a random experiment
subsets	events

Example 1

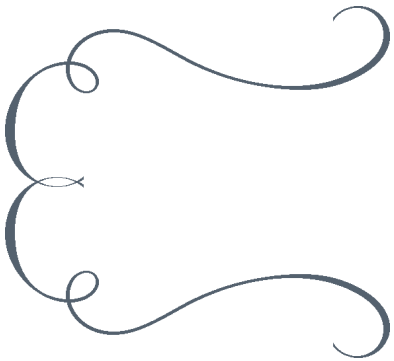
Observe the top card drawn on a 52-card deck. Define the events:

A : 4, 5, or 6 of ♡ B : any red card

C : any queen D : jack of ♣

Drew a Venn diagram that relates these events to one another.

Thank You



THANK YOU!