

- Tim / Prof. / Prof. Chunley (he/him)
 - Moodle - announcements
 - Webpage (tchunley.mtholyoke.edu/m342)
 - notes, worksheets, homework, syllabus
 - updated daily
 - Homework (weekly)
 - submitted on Gradescope
 - due Fridays at 5 pm
 - Quizzes - (mostly) weekly on Fridays, 15 minutes
 - Exams - two during semester, one during finals
 - Participation - come to class, be a good community member, stay in touch when something goes wrong (eg. illness)
 - Office hours (tentative)
 - Mondays 4:00 - 5:00
 - Wednesdays 1:00 - 2:00
 - Fridays 11:00 - 12:00
- this week → 11:00 - 12:00
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drop in (Clapp 423),
no appointment necessary

§ 1.1 - 1.3 Introduction

Def A random experiment is a process with an uncertain outcome. For a given random experiment, the set of all possible outcomes is called the sample space, which could be a finite or infinite set. An event is a subset of the sample space.

Example Consider the random experiment of rolling two dice.

- ① List the outcomes in the sample space Ω . *omega*
- ② How many outcomes are there in the event A that the sum of the dice is 5? 6?
- ③ How many outcomes in the event B that at least one die lands on 1?

① We can make a table to list every outcome:

| | | die 2 | | | | | |
|-------|---|-------|-------|-------|-------|-------|-------|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| die 1 | 1 | (1,1) | (1,2) | (1,3) | (1,4) | (1,5) | (1,6) |
| | 2 | (2,1) | ... | | | | |
| | 3 | (3,1) | . | . | . | . | . |
| | 4 | (4,1) | : | : | : | : | : |
| | 5 | (5,1) | | | | | |
| | 6 | (6,1) | | | | | |

Or we can use set notation: *integers*

$$\Omega = \left\{ (x_1, x_2) : x_1, x_2 \in \mathbb{Z}, 1 \leq x_1 \leq 6, 1 \leq x_2 \leq 6 \right\}$$

"such that" *"in"*

$$\textcircled{2} \quad A = \{(1, 4), (4, 1), (2, 3), (3, 2)\}$$

$|A| = 4$ absolute value bars on a set mean "size of" or "number of elements in"

$$\textcircled{3} \quad B = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), \\ (2, 1), (3, 1), (4, 1), (5, 1), (6, 1)\}$$

$$|B| = 11.$$

Def Given a random experiment, a probability

function $P: \Omega \rightarrow [0, 1]$ is a function with the

following properties:

① for any outcome $\omega \in \Omega$, $P(\omega) \geq 0$ outcomes have non-negative probability

② $\sum_{\omega \in \Omega} P(\omega) = 1$ outcome probabilities sum to 1

③ for any event $A \subseteq \Omega$, $P(A) = \sum_{\omega \in A} P(\omega)$ probability of an event is the sum of its outcome probabilities

Remark When all outcomes in Ω are equally likely,

$$\textcircled{1} \quad P(\omega) = \frac{1}{|\Omega|} \quad \text{for any outcome } \omega \in \Omega$$

$$\textcircled{2} \quad P(A) = \frac{|A|}{|\Omega|} \quad \text{for any event } A \subseteq \Omega.$$

Example Let C be the event that the sum of two dice rolled is 6. Find $P(C)$.

$$\text{Note } C = \{(1, 5), (5, 1), (2, 4), (4, 2), (3, 3)\}.$$

$$\text{Therefore } P(C) = \frac{|C|}{|\Omega|} = \frac{5}{36}.$$