Math 140: Tuesday, Oct 1, Day 11 Notes

Agenda for Tuesday, Oct 1,2024	
Chapter 3 Probability	**1**
Group Quiz 3	**1**

Coming up

- ! Turn in **Written HW 3** by end of today (upload in Canvas or hand in class)
- Office Hour **today 1-2:15pm** in C162

Probability Basic Concepts

Experiment: is an action where the results are random

Example 1. Examples of experiments:

- tossing a coin
- rolling a die

Outcome: is a single result from performing the experiment once. ex: outcomes for tossing a coin H, T

Sample Space:

- is a list of all possible outcomes.
- is denoted with S

$S = \{$ all possible outcomes $\}$

ex: $S = \{H, T\}$, $n(S) = 2$

- the size of the sample space is $n(S)$

$n(A)=6$

A - rolling a even number $A=\{2T, 2H, 4T, 4T, 6T, 6H\}$

Example 2. What is the sample space for Rolling a 6-sided die and flipping a coin?

$S = \{1T, 1H, 2T, 2H, 3T, 3H, 4T, 4H, 5T, 5H, 6T, 6H\}$

$n(S) = 12$

Event is a subset (smaller list) of the sample space

* **Example 3.** Rolling a number less than three and tails

$E = \{1T, 2T\}$ $\quad n(E) = 2$

There are two basic ways to calculate probabilities: theoretical probability and empirical probability.

Classical (Theoretical) Probability is used when the outcomes are equally likely

$$P(E) = \frac{n(E)}{n(S)}$$

$n(E)$ → number of favorable outcomes to event E

probability of event E

ex: $P(E) = \frac{n(E)}{n(S)} = \frac{2}{12} = \frac{1}{6}$

- fraction
- decimal
- percentage

$\frac{1}{6} = 0.16666 = 0.167$

Rounding Rule for probability:

- use three significant digits

ex: $0.0000306\overline{6}$

0.0000307

Example 4. Classical probability Experiment: Rolling a fair 12 sided die.

$S = \{1, 2, 3, \ldots, 11, 12\}$, $n(S) = 12$ (12 outcomes)

- Event A: rolling a prime number $A = \{2, 3, 5, 7, 11\}$; $n(A) = 5$
- Event B: rolling a number divisible by 5 $B = \{5, 10\}$, $n(B) = 2$
- Event C: rolling a number greater than 4 which is divisible by 3

$C = \{6, 9, 12\}$ $n(C) = 3$

Find the following probabilities.

* $P(A) = \frac{n(A)}{n(S)} = \frac{5}{12}$
* $P(B) = \frac{n(B)}{n(S)} = \frac{2}{12} = \frac{1}{6}$
* $P(C) = \frac{3}{12} = \frac{n(C)}{n(S)} = \frac{1}{4}$

Empirical (Experimental) Probability

Example 5. Julia made a die for a game. It had 5 faces, labeled 1-5. Because of the shape of the die, it was biased in favor of rolling a 3. She experimented to estimate how likely it was for a 3 to be rolled. Julia rolled the die 100 times, and the number of times she rolled a 3 was 45.

Example 6. Empirical Probability: Choosing a student from a survey

	Accounting	Non Accounting
Freshman	20	50
Soph	14	56

1. What is the probability of choosing a student who is majoring in accounting?

2. What is the probability of choosing a student who is a sophmore?

3. What is the probability of choosing a student who is not majoring in accounting?

Properties of Probability

1. For any event A, $\mathbf{0 \leq P(A) \leq 1}$. That is, the probability of any event is always a number between 0 and 1.
2. The probability of any event A is equal to the sum of the probabilities of the individual outcomes in A.
3. The sum of the probabilities of all outcomes in S must equal 1. This is true whethe S consists of equally likely outcomes.