Dice 2+

Foundations 12 – Introduction to Probability Part 1

Homework: Lesson #1 on Pg. 123: #1-11, Skip #5c

Ex 1

A six-sided die is rolled.

a) List all the possible outcomes (called the **Sample Space**) ← all

{1, 2, 3, 4, 5, 6}

b) List all the outcomes that result in a number bigger than 2 (called an **Event**) ← might not be all outcomes

{3, 4, 5, 6}

*(The book calls events a **subset** of the sample space)*

c) Assuming it's a far die (all outcomes equally likely), what is the **probability** that you roll a number bigger than 2?

Bigger than 2	Not Bigger than 2
3	1
4	2
5	
6	

{1, 2}

$\frac{4 \text{ outcomes bigger than 2}}{6 \text{ total outcomes}} = \frac{4}{6} = \frac{2}{3} = 0.666\ldots$

$= 66.666\ldots\% = 66.7\%$

If all events are equally likely: P(some event) = $\frac{\#\text{ of favorable outcomes}}{\text{total \# of outcomes}}$

For any event: 0% ≤ *P(any event)* ≤ 100% ← same

Or 0 ≤ *P(any event)* ≤ 1

d) List the **event** "a number that is not bigger than 2" then find the probability of rolling a number that is not bigger than 2

{1, 2}

$\frac{2 \text{ outcomes not bigger than 2}}{6 \text{ total}} = \frac{2}{6} = \frac{1}{3} = 0.333\ldots$

$= 33.3\%$

The events in b) and d) are called Complementary *events.* ← opposite, complement

We can write P(not bigger than 2) = P(bigger than 2)

P(bigger than 2) + P(not bigger than 2) = 100% *or* 1

e) List the **event** "a number bigger than 8" then find the probability of rolling a number bigger than 8

$\{\phi\} = \{\}$ ← nothing $\quad \frac{0}{6} = 0\%$

If P(some event) = 0% *we call the event* impossible

f) List the **event** "a number less than 7" then find the probability of rolling a number less than 7

$\{6,5,4,3,2,1\} \Rightarrow \frac{6}{6} = 100\%$

If P(some event) = 100% *we call the event* certain / Guaranteed

Ex 2

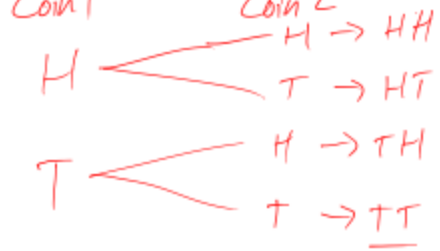
Jimmy flips two coins at the same time and wants to determine the probability of flipping both heads. He lists the **sample space** as {2 heads, 2 tails, 1 tail and 1 head}. Since only 1 of the three outcomes is favorable, he determines the probability to be $\frac{1}{3}$.

a) Explain why Jimmy's reasoning is not correct

Coin 1	Coin 2	
H	H	→ HH — 1
T	T	→ TT — 1
H	T	→ HT → 2
T	H	→ HT

Not all outcomes are equally likely

b) Use a **tree diagram** to find the probability for each outcome (2 heads, 2 tails or 1 head 1 tail)



$P(2 \text{ heads}) = \frac{1}{4} = 0.25 = 25\%$

$P(2 \text{ tails}) = \frac{1}{4} = 0.25 = 25\%$

$P(1T, 1H) = \frac{2}{4} = 0.5 = 50\%$

Ex 3

Instead of using tree diagrams, a table can be really helpful for listing out the **sample space** (all possible outcomes). An incomplete sample is shown on the side for two 6-sided dice.

a) Fill out the table to show the sample space

b) How many outcomes are in the sample space?

$\frac{6}{\text{Die 1}} \cdot \frac{6}{\text{Die 2}} = 36$

c) List the event:
"the same number appears on both dice"

{(1,1), (2,2), (3,3), (4,4) (5,5), (6,6)}

d) Find the probability that the same number appears on both dice

$\frac{6}{36} = \frac{1}{6} = 16.7\%$

e) Find the probability that different numbers appear on each die using the complement

$\frac{30}{36} = \frac{5}{6} = 83.3\%$

$100\% - 16.7\% = 83.3\%$

Die #1

Die #2	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,5	5,6
6	6,1	6,2	6,3	6,4	6,5	6,6

With your partner, pick 2 differently shaped dice from the bag and do a) to e).

D8, D20

b) $8 \cdot 20 = 160$

c) {(1,1), (2,2) ..., (8,8)}

d) $\frac{8}{160} = \frac{1}{20} = 5\%$

e) $100\% - 5\% = 95\%$

D10, D6

b) $6 \cdot 10 = 60$

c) {(1,1), (2,2), ... (6,6)}

d) $\frac{6}{60} = \frac{1}{10} = 10\%$

e) $100\% - 10\% = 90\%$