

### Homework 4.5: Independence

1. Two dice, one red and one green, are rolled. Define the events

$A$ : the red die lands on a 3, 4, or 5

$B$ : the sum of the two dice is 9

- Compute  $P(A | B)$ .
- Compute  $P(B | A)$ .
- Are  $A$  and  $B$  independent events? Justify your answer.

2. Recall that three events  $A$ ,  $B$ , and  $C$  are *independent* if

$$\begin{aligned} P(A \cap B) &= P(A) \cdot P(B) \\ P(B \cap C) &= P(B) \cdot P(C) \\ P(A \cap C) &= P(A) \cdot P(C) \end{aligned} \tag{1}$$

and

$$P(A \cap B \cap C) = P(A) \cdot P(B) \cdot P(C) \tag{2}$$

- (a) Two dice, one red and one green, are rolled. Define the events

$A$ : the red die lands on a 1, 2, or 3

$B$ : the red die lands on a 3, 4, or 5

$C$ : the sum of the two dice is 9

Do these three events satisfy (1)? Do they satisfy (2)?

- (b) A roulette wheel has thirty-six numbers colored red or black according to the pattern indicated below:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
R	R	R	R	R	B	B	B	B	R	R	R	R	B	B	B	B	B
36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19

Define the events

$A$ : red number appears

$B$ : even number appears

$C$ : number is less than or equal to 18

Do these three events satisfy (1)? Do they satisfy (2)?