

8.2 Classical Probability

If all outcomes are equally likely,
then the probability of E happening is:

$$P(E) = \frac{n(E)}{n_{\text{total}}}$$

Annotations:

- Probability of E happening (points to $P(E)$)
- # of ways E can happen (points to $n(E)$)
- total # of possible outcomes (points to n_{total})

Ex: Roll a fair die. Find the probability that the roll is greater than 2.

fair: all rolls are equally likely
We say one die, two or more dice.

All possible outcomes: 1, 2, 3, 4, 5, 6

$$P(\text{roll is greater than 2}) = \frac{4}{6} = \frac{2}{3}$$

FACT

$$P(A) = 1 - P(\text{not } A)$$

$$P(A) = 1 - P(\bar{A})$$

Why? The probabilities of A and \bar{A} sum to 100%.

Ex. Roll two fair 4-sided dice.
Find the probability that:

a) the rolls sum to 3 or less

All possible outcomes: Die #1 \ Die #2

1
2
3
4

	1	2	3	4
1	11	12	13	14
2	21	22	23	24
3	31	32	33	34
4	41	42	43	44

$$\boxed{\frac{3}{16}}$$

b) the rolls sum to greater than 3

$$\begin{aligned} & 1 - P(\text{rolls sum to 3 or less}) \\ &= 1 - \frac{3}{16} \\ &= \frac{13}{16} \end{aligned}$$

c) the rolls sum to 5

$$\frac{4}{16}$$

d) at least one roll is a 2.

$$\frac{7}{16}$$

Ex: Three people (call them A, B, C) stand in a row. Find the probability that:

a) C is on the left

All possible outcomes:

ABC, ACB, BAC, BCA, CAB, CBA

$$\frac{2}{6}$$

b) A is not on the right

$$\frac{4}{6}$$

Ex: Students are surveyed:

	Like Coffee	Dislike Coffee
Like Spicy Food	13	5
Dislike Spicy	2	4

Find the probability that a random student:

a) likes coffee

Total # of students = 24

$$\frac{15}{24}$$

b) dislikes spicy food

$$\frac{6}{24}$$

c) likes spicy and dislikes coffee

$$\frac{5}{24}$$

d) likes spicy or likes coffee

$$\frac{13+5+2}{24} = \frac{20}{24}$$

Ex: In a class of 45 students, 26 have jobs and 17 have cars. Of those who don't have a car, 10 have jobs.

a) Fill in the table:

	J	\bar{J}
C		
\bar{C}		

	J	\bar{J}
C		
\bar{C}	10	

	J	\bar{J}
C	16	
\bar{C}	10	

	J	\bar{J}
C	16	1
\bar{C}	10	

	J	\bar{J}
C	16	1
\bar{C}	10	18

b) $P(\text{car but not job})?$

$$\frac{1}{45}$$

c) $P(\text{car or job})?$

$$\frac{16+10+1}{45} = \frac{27}{45}$$