

1. (10pts) A retiree counts vehicles passing on a road by his house over several Tuesday afternoons. He obtains the following results:

Vehicle	car	SUV	minivan
In-state	35	45	21
Out-of-state	12	13	17

If a random vehicle is observed on a Tuesday afternoon, what is the empirical probability that it is
a) an SUV? b) an in-state vehicle?
c) an out-of-state car? d) not a car?

total = 143

a) $\frac{45+13}{143} = \frac{58}{143}$ b) $\frac{35+45+21}{143} = \frac{101}{143}$ c) $\frac{12+13}{143} = \frac{25}{143}$ d) $1 - \frac{35+12}{143}$
 $= 1 - \frac{47}{143} = \frac{143-47}{143} = \frac{96}{143}$

2. (20pts) Write the probabilities and odds against and in favor of the following events (show any work needed below):

Event	probability	odds against	odds in favor
a) Getting a head on a coin toss	$\frac{1}{2}$	1:1	1:1
b) Drawing an even-number-card from a deck of cards	$\frac{20}{52} = \frac{5}{13}$	32:20 = 8:5	5:8
c) Drawing a red face card from a deck of cards	$\frac{6}{52} = \frac{3}{26}$	46:6 = 23:3	3:23
d) Getting at most one head on three coin tosses	$\frac{4}{8} = \frac{1}{2}$	4:4 = 1:1	1:1
e) Getting sum divisible by 4 on a roll of two dice	$\frac{9}{36} = \frac{1}{4}$	27:9 = 3:1	1:3

b) 2, 4, 6, 8, 10 five in each suit
5 · 4 = 20

doesn't happen: 32 outcomes

happens: 20 "

c) 12 red faces in a deck
 doesn't happen: 40 } outcomes
 happens: 12 }

d) HHH TTH
 HHT THT ✓
 HTH TTH ✓
 HTT TTT ✓

doesn't happen: 4 outcomes
 happens: 4

e) Get 4, 8, 12
 T T T
 1,3 2,6 6,6
 2,2 3,5
 3,1 4,4
 5,3
 6,2

doesn't happen: 27 outcomes
 happens: 9

3. (4pts) The odds in favor of an ice storm in January are 2-to-11.

- a) What is the probability an ice storm occurs in January?
 b) What is the probability there is no ice storm in January?

$$P(\text{ice storm}) = \frac{2}{13}$$

$$P(\text{no ice storm}) = \frac{11}{13}$$

4. (4pts) 15% of all weddings happen in June.

- a) What are the odds against a random wedding taking place in June?
 b) What are the odds in favor of a random wedding taking place in June?

happens: 15 a) 85:15 = 17:3
 doesn't: 85 b) 3:17

5. (12pts) Two dice are rolled. What is the probability that

- a) you got sum 1 or 11?
 b) you got sum in range 4-6 or both of the numbers are even?
 c) at least one of the numbers is different from 3 or 5.

a) $P(\text{sum 1 or sum 11}) = P(\text{sum 1}) + P(\text{sum 11}) = 0 + \frac{2}{36} = \frac{1}{18}$
 mutually excl.

b) $P(\text{sum is 4-6 or both even}) = P(\text{sum is 4-6}) + P(\text{both even}) - P(\text{sum is 4-6 AND both even})$
 $= \frac{12}{36} + \frac{9}{36} - \frac{3}{36} = \frac{18}{36} = \frac{1}{2}$

4	5	6
1,3	1,4	1,5
2,2	2,3	2,4
3,2	3,3	3,4
	4,1	4,2
		5,1

↑ ↑
even even
3,3

3 (dotted outcomes of both)

c) $P(\text{at least one is not 3 or 5}) = 1 - P(\text{both are 3 or 5}) = 1 - \frac{4}{36} = \frac{36-4}{36} = \frac{32}{36} = \frac{8}{9}$
 ↑ ↑
 not 3 nor 5
 4 possibilities each

6. (10pts) In a certain big city, 65% of all companies have done business with a partner in Asia or Europe, 45% have done business with an Asian partner and 35% have done it with a European partner. What is the probability that a randomly chosen company from this city

- a) has done business both with an Asian and a European partner?
 b) has not done business with either an Asian or a European partner?

a) $P(\text{Asian p. or European p.}) = P(\text{Asian p.}) + P(\text{Euro. p.}) - P(\text{Asian and Euro.})$
 $0.65 = 0.45 + 0.35 - P(\text{Asian and Euro.})$
 $0.65 = 0.8 - P$
 $P(\text{Asian and Euro.}) = 0.8 - 0.65 = 0.15$

b) $P(\text{not (Asian or Euro.)}) = 1 - P(\text{Asian or Euro.}) = 1 - 0.65 = 0.35$