**1.** A fair coin is tossed three times, each time noting either heads or tails.

(A) What is the sample space?

{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

(B) What is the probability of getting exactly one tail? $\frac{3}{8}$

(C) What is the probability of getting a head on the first flip? H _ _ $\frac{4}{8} = \frac{1}{2}$

(D) What is the probability of getting at least one tail?

* also means $1 - P(\text{all heads}) = \frac{7}{8}$

$1 - \frac{7}{8}$

**2.** A single die is rolled twice, each time noting the number that came up.

| sum | ways |
|---|---|
| 3 | 2 |
| 5 | 4 |
| 7 | 6 |
| | 12 |

(A) Find the probability that the sum is odd and no more than 7.

odd sums: 3, 5, 7, ~~9~~, ~~11~~ $\frac{12}{36} = \frac{1}{3}$

(B) Find the probability that the sum is NOT 4.

$P(\text{not } 4) = 1 - P(4) = 1 - \frac{3}{36} = \frac{11}{12}$

(C) Find the probability that the sum is odd or prime.

odd: 3, 5, 7, 9, 11

prime: 2, 3, 5, 7, 9, 11

| sum | 2 | 3 | 5 | 7 | 9 | 11 |
|---|---|---|---|---|---|---|
| ways | 1 | 2 | 4 | 6 | 4 | 2 |

$\frac{19}{36}$

(D) Find the probability that the sum is less than 11.

(hint: there is an easy way and a hard way to do this – refer to part B)

$1 - P(\text{sum} \geq 11) = 1 - \frac{3}{36} = \frac{11}{12}$

**3.** A bag of marbles has 10 yellow, 6 green, and 3 blue. Two marbles are drawn at once.

(A) Find the probability of drawing two yellows. $\frac{{}_{10}C_2}{{}_{19}C_2} = \frac{45}{171} = \frac{5}{19}$

(B) Find the probability of drawing a green and a blue. $\frac{6 \cdot 3}{171} = \frac{18}{171} = \frac{2}{19}$

(C) Find the probability of drawing exactly one yellow. $\frac{10 \cdot 9}{171} = \frac{90}{171} = \frac{10}{19}$

(D) Find the probability of drawing a green and a black.

ZERO!

**4.** A standard deck of cards has 13 kinds (ace, 2, 3, ..., 10, J, Q, K) in each of four suits (hearts, diamonds, spades, and clubs). Five cards are drawn at random from a standard deck.

(A) Find the probability that three of them are kings.

$$\frac{{}_4C_3 \cdot {}_{48}C_2}{{}_{52}C_5} = \frac{(4)(1128)}{2,598,960} \approx \boxed{0.0017}$$

(B) Find the probability that all of them are hearts.

$$\frac{{}_{13}C_5}{{}_{52}C_5} = \frac{1287}{2,598,960} \approx \boxed{0.000495}$$

(C) Find the probability that three are aces and two are kings.

$$\frac{{}_4C_3 \cdot {}_4C_2}{2,598,960} = \frac{24}{2,598,960}$$

$$\boxed{9.23 \times 10^{-6}}$$

$$\boxed{0.00000923}$$