

Assignment 1: Introduction to Probability

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Dobrow Chapter 1

1.6

- (a) $\{X + Y = 4\}$ solution: $\{13, 22, 31\}$
- (b) $\{X + Y = 9\}$ solution: $\{45, 36, 63, 54\}$
- (c) $\{Y = 3\}$ solution (assuming that X value does not matter): $\{13, 23, 33, 43, 53, 63\}$
- (d) $\{X = Y\}$ solution: $\{11, 22, 33, 44, 55, 66\}$
- (e) $\{X > 2Y\}$ solution: $\{31, 52\}$

1.8

If a couple plans on having children until they have 1 girl or 6 boys, the sample space or Ω would be the following (G = Girl, B = Boy):

$\{G\}$

$\{BG\}$

$\{BBG\}$

$\{BBBG\}$

$\{BBBBG\}$

$\{BBBBBG\}$

$\{BBBBBB\}$

A reasonable random variable for having a girl is 0.5, $P(G) = 0.5$. The same probability can be associated with a boy, $P(B) = 0.5$. This random variable was selected because the outcomes of gender is 1 of 2 possibilities.

1.10

In order for the random experiment with three possible outcomes a, b, and c, with $P(a) = p$, $P(b) = p^2$, and $P(c) = p$ then the three probabilities when added together must = 1.

A possible probability for the $p = 27/64$.

1.16

A license plate can be two, three, four, or five letters long and taken from the alphabets A to Z. All letters are possible, including repeats.

(A) The probability of the plate A-R-R is:

$$(1/26) * (1/26) * (1/26) * (1/4) = 0.00001422394$$

The $1/4$ is also multiplied because the plate probability has to be taken into account. There is a .25 percentage chance that the three letter plate is chosen.

(B) The probability that the four letter plate is chosen is $1/4$ or .25. The reason for this is that there are four types of lengths for license plates that can be chosen.

(C) Probability of a plate being a palindrome depends on the exact requirements of the palindrome. If looking for a three letter plate and a palindrome such as DAD, the probability could be as follows:

$$(1/26) * (1/26) * (1/26) * (1/4) = 0.00001422394$$

$$(1/4) = \text{selecting the correct plate } (1/26) = \text{chances of selecting letters}$$

If looking for a four letter plate and palindrome such as CIVIC, the probability would be as follows:

$$(1/4) * (1/26) * (1/26) * (1/26) * (1/26) = 0.0000005470$$

(D) The probability of the plate having one R is $1/26$ no matter the type of plate being selected.

1.22

$$P(A \cup B) = 0.6 \text{ and } P(A \cup B^c) = 0.8$$

$$P(A \cup B^c) = [1 - P(A \cup B)] + P(A)$$

$$0.8 = [1 - 0.6] + P(A)$$

$$0.8 = 0.4 + P(A)$$

$$P(A) = 0.4$$

1.37

Random Integer between 1 and 5000 divisible by 4,7,10

$$P(D4 \cup D7 \cup D10) = P(D4) + P(D7) + P(D10) - P(D4D7) - P(D4D10) - P(D7D10) + P(D4D7D10)$$

$$P(D4) = [5000/4]/5000 \quad P(D7) = [5000/7]/5000 \quad P(D10) = [5000/10]/5000 \quad P(D4D7) = [5000/28]/5000$$

$$P(D4D10) = [5000/40]/5000 \quad P(D7D10) = [5000/70]/5000 \quad P(D4D7D10) = [5000/280]/5000$$

$$P(D4 \cup D7 \cup D10) = 0.40$$

1.44