Practice problems for Set Theory

Problem 1. An experiment involves tossing a pair of dice, 1 green and 1 red, and recording the numbers that come up.

(a) If x equals the outcome on the green die and y the outcome on the red die, describe the sample space S by listing the elements (x,y);

(b) list all the elements corresponding to the event A that the sum is greater than 8;

(c) list all the elements corresponding to the event B that a 2 occurs on either die;

(d) list all the elements corresponding to the event C that a number greater than 4 comes up on the green die;

(e) list all the elements corresponding to the event $A \cap C$;

(f) list all the elements corresponding to the event $A \cap B$;

(g) list all the elements corresponding to the event $B \cap C$;

(h) construct a Venn diagram to illustrate the intersections and unions of events A, B and C;

(i) list all the elements corresponding to the event D that a number less than 3 occurs on the die;

(j) list all the elements corresponding to the event E that 2 **tails** occur;

(k) list all the elements corresponding to the event A';

(l) list all the elements corresponding to the event $A' \cap B$;

(m) list all the elements corresponding to the event $A \cup B$.

Problem 2. Which of the following pairs of events are *mutually exclusive*?

(a) A basketball team reaching the third quarter winning and loosing the match.

(b) A poker player getting a flush (all cards in the same suit) and 3 of a kind on the same 5-card hand.

(c) A mother giving birth to a baby girl and a set of twin daughters on the same day.

(d) A chess player loosing the last game and winning the match.

Problem 3. Suppose that a family is leaving on a summer vacation in their camper and that M is the event that they will experience mechanical problems, T is the event that they will receive a ticket for committing a traffic violation, and$V$ is the event that they will arrive at a campsite with no vacancies. Referring to the Venn diagram of Figure 1.1, state in words the events represented by the following regions:

(a) region 5;

(b) region 3;

(c) regions 1 and 2 together;

(d) regions 4 and 7 together;

(e) region 3, 6, 7, and 8 together.

List the numbers of the regions that represent the following events:

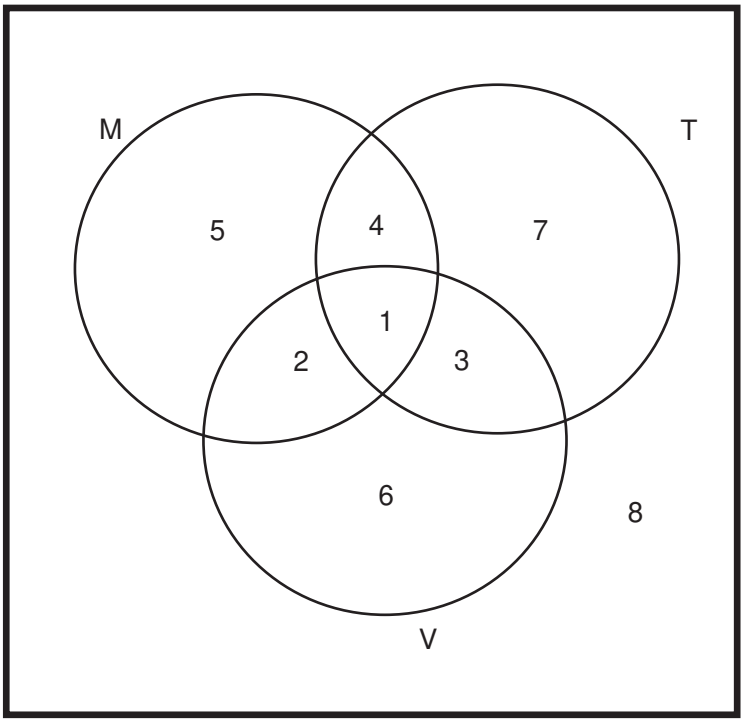

Figure 1: *Venn diagram for Problem 3.*

(f) The family will experience no mechanical problems and commit no traffic violation but will arrive at a campsite with no vacancies.

(g) The family will experience both mechanical problems and trouble in locating a campsite with a vacancy, but will not receive a ticket for a traffic violation.

(h) The family will either have mechanical trouble or arrive at a campsite with no vacancies but will not receive a ticket for committing a traffic violation.

(i) The family will not arrive at a campsite with no vacancies.