

**INSTRUCTION: ATTEMPT ALL QUESTIONS****TIME: 2 AND ½ HOURS**

1. Draw Venn diagrams for  $P \cap Q$ ,  $P \cap \tilde{Q}$ ,  $\tilde{P} \cap Q$ ,  $\tilde{P} \cap \tilde{Q}$ .
2. Give a step-by-step construction of the diagram for  $(\tilde{P} - Q) \cup (P \cap \tilde{Q})$ .
3. Venn diagrams are also useful when three subsets are given. Construct such a diagram, given the subsets  $P$ ,  $Q$ , and  $R$ . Identify each of the eight resulting areas in terms of  $P$ ,  $Q$ , and  $R$ .
4. In testing blood, three types of antigens are looked for: A, B, and Rh. Every person is classified doubly. He or she is Rh positive if he or she has the Rh antigen, and Rh negative otherwise. He or she is type AB, A, or B depending on which of the other antigens he or she has, with type O having neither A nor B. Draw a Venn diagram, and identify each of the eight areas.

	Liked Very Much	Liked Slightly	Disliked Slightly	Disliked Very Much
Men	1	3	5	10
Women	6	8	3	1
Boys	5	5	3	2
Girls	8	5	1	1

Figure 2.5: ◇

5. Considering only two subsets, the set  $X$  of people having antigen A, and the set  $Y$  of people having antigen B. define (symbolically) the types AB, A, B and O.
6. A person can receive blood from another person if he or she has all the antigens of the donor. Describe in terms of  $X$  and  $Y$  the sets of people who can give to each of the four types. Identify these sets in terms of blood types.
7. The tabulation in Figure 2.5 records the reaction of a number of spectators to a television show. All the categories can be defined in terms of the following four:  $M$  (male),  $G$  (grown-up),  $L$  (liked),  $V$  (very much). How many people fall into each of the following categories?
  - (a)  $M$ .
  - (b)  $L$ .
  - (c)  $V$ .
  - (d)  $M \cap \tilde{G} \cap \tilde{L} \cap V$ .
  - (e)  $\tilde{M} \cap G \cap L$ .
  - (f)  $(M \cap G) \cup (L \cap V)$ .
  - (g)  $\tilde{M} \cap \tilde{G}$ .
  - (h)  $\tilde{M} \cup \tilde{G}$ .
  - (i)  $M - G$ .
  - (j)  $[\tilde{M} - (G \cap L \cap \tilde{V})]$ .

8. In a survey of 100 students, the numbers studying various languages were found to be: Spanish, 28; German, 30; French, 42; Spanish and German, 8; Spanish and French, 10; German and French, 5; all three languages, 3.
- (a) How many students were studying no language?
  - (b) How many students had French as their only language?
  - (c) How many students studied German if and only if they studied French?

[Hint: Draw a Venn diagram with three circles, for French, German, and Spanish students. Fill in the numbers in each of the eight areas, using the data given above. Start from the end of the list and work back.]