

1. Using statements about membership prove or disprove the following statement about sets  $A$  and  $B$ :  $A \cap B^c \subseteq (A \cap B)^c$ .
2. Suppose that the forecast is that it will rain only if the pressure is low.
  - (a) If the pressure is low will it rain?
  - (b) If the pressure is high will it rain?
3. Let  $A$  be the set of all natural numbers that are divisible by 3; let  $B$  be the set of all natural numbers that are not divisible by 3. Prove that  $A$  and  $B$  have the same cardinality.
4. The Sheffer Stroke is a logical operation (denoted by  $\uparrow$ ) that is defined by the table below. Write the truth table for  $(A \uparrow B) \uparrow (B \uparrow A)$ .

$P$	$Q$	$P \uparrow Q$
T	T	F
T	F	T
F	T	T
F	F	F

5. Give an example of a relation on  $A = \{1, 2, 3, 4\}$  that is symmetric and transitive but not reflexive. Prove that your example has required properties.
6. Let  $f : A \rightarrow B$  and  $g : B \rightarrow C$ . Prove or disprove: If  $g$  is surjective then  $g \circ f : A \rightarrow C$  is surjective.
7. Six men and two women have to form a line in front of the ticket office. In how many ways can they do it so that the two women are together.
8. A number, written in a system base 6, has the form  $123412341234 \dots 1234$  so that it has altogether 2000 digits. Prove that it is divisible by 5. Is it divisible by 10?