

**Problem 1.** A *monoid* is a list  $(A, m, e)$  where  $A$  is a set,  $m : A \times A \rightarrow A$  is a function, and  $e$  is an element of  $A$ , satisfying the following conditions:

(i) For any  $f \in A$ ,  $g \in A$ , and  $h \in A$  we have

$$m(m(f, g), h) = m(f, m(g, h)),$$

and

(ii) for any  $f$  in  $A$ , we have

$$m(e, f) = m(f, e) = f.$$

Let  $S$  be a set and let  $A$  be the set of functions from  $S$  to itself. Define

$$m : A \times A \rightarrow A$$

by  $m(f, g) = f \circ g$ . Prove that  $(A, m, e)$  is a monoid.

**Problem 2.** Find at least one problem or concept that is confusing and ask a question about it. Try to find a problem that is relevant to sections §§3–7, 11, or 20. Make your question as specific as you can (try to pinpoint exactly what you find confusing).