

## Abstract Algebra 1

### Quiz 1

Name: \_\_\_\_\_

You have 10 minutes to complete this quiz. If you have a question raise your hand and remain seated. In order to receive full credit your answer must be **complete**, **legible** and **correct**. Show your work, and give adequate explanations.

1. Define “monoid”.

A **monoid** is an algebraic structure  $\langle M; \circ, 1 \rangle$ , defined in signature with a binary operation  $\circ$  and a zeroary operation  $1$ , which satisfies laws saying that  $\circ$  is an associative operation and  $1$  is a left and right identity element for  $\circ$ .

2. Describe examples of monoids  $\mathbb{M}$  and  $\mathbb{N}$  and a homomorphism  $h: \mathbb{M} \rightarrow \mathbb{N}$ .

The simplest example is the one where  $\mathbb{M} = \mathbb{N} = \langle \{1\}; \circ, 1 \rangle$  are 1-element monoids and  $h: \mathbb{M} \rightarrow \mathbb{N}$  is the identity function.

We gave this example in class:

$$h: \langle M_2(\mathbb{R}); \cdot, I \rangle \rightarrow \langle \mathbb{R}; \cdot, 1 \rangle: X \mapsto \det(X).$$