

CMSC 442/653
Instructor: Dr. Lomonaco

Homework 1

- **Listening Assignment:** Listen to Beethoven's 5-th symphony.
- **Reading**
Assignment: <http://www.cs.umbc.edu/~lomonaco/s06/652/slides/Equilateral-Triangle.pdf>
- **Optional Reading assignment:** Peterson & Weldon, "Error-Correcting Codes," MIT Press, (Second Edition), Chapter 2.

- 1) Construct the multiplication table of the group of symmetries of the equilateral triangle given by the presentation

$$(\rho, \sigma : \rho^3 = 1, \sigma^2 = 1, \rho\sigma = \sigma\rho^2)$$

Assume that the distinct group elements are:

$$1, \rho, \rho^2, \sigma, \rho\sigma, \rho^2\sigma$$

- 2) Construct the multiplication table of the group of symmetries of the square given by the presentation

$$(\rho, \sigma : \rho^4 = 1, \sigma^2 = 1, \rho\sigma = \sigma\rho^3)$$

Assume that the distinct group elements are:

$$\{ \rho^m \sigma^n : 0 \leq m < 4, 0 \leq n < 2 \}$$

Additional problem for grad students in CMSC 653:

Grad3) Let S be a set with an associative binary operation $\bullet : S \times S \rightarrow S$. Let e_L be a left identity of S (i.e., $e_L \bullet s = s \forall s \in S$), and let e_R be a right identity of S (i.e., $s \bullet e_R = s \forall s \in S$).

a) Prove that $e_L = e_R$.

b) Also prove that S can have at most one 2-sided identity.

Grad4) Let S be a set with an associative binary operation $\bullet : S \times S \rightarrow S$ and a 2-sided identity e , and let $s \in S$. Let \tilde{s}_L and \tilde{s}_R be elements of S such that

$$\tilde{s}_L \bullet s = e = s \bullet \tilde{s}_R$$

Prove that $\tilde{s}_L = \tilde{s}_R$.