

**CMSC 442/653**  
**Instructor: Dr. Lomonaco**  
**Homework 2**

- **Listening Assignment:** Sergei Prokofiev's Cinderella's Waltz  
<https://www.youtube.com/watch?v=YOv7yWEv54o>
- **Reading Assignment:**  
<http://www.cs.umbc.edu/~lomonaco/f11/653/handouts/Permutations-Handout.pdf>
- **Optional Reading assignment:** Peterson & Weldon, "Error-Correcting Codes," MIT Press, (Second Edition), Chapter 2.

- 1) (20pts) Let  $a$  and  $b$  be the permutations defined in the above handout on permutations.
- a) Using the  $2 \times 11$  representation of permutations, compute the  $2 \times 11$  representation of the permutation  $ba$ .
  - b) Using the product of disjoint cycles representation of permutations  $a$  and  $b$ , compute the product  $ba$  in the product of disjoint cycles form
  - c) Using the  $2 \times 11$  representation of  $b$ , compute the  $2 \times 11$  representation of the permutation  $b^{-1}$
  - d) Using the product of disjoint cycles representation of the permutation  $b$ , compute the inverse  $b^{-1}$  in product of disjoint cycles representation form

- 2) (20pts) Construct the addition and multiplication tables for the ring  
$$R = \mathbb{Z}_{15}$$
List all the units in  $R$ . List all the non-trivial divisors of zero in  $R$ .

- 3) (20pts) Construct the addition and multiplication tables for the ring  
$$R = GF(2)[x] \text{ mod } x^3 + 1 = 0$$
List all the units in  $R$ . List all the non-trivial divisors of zero in  $R$ .

- 4) (20pts) Construct the addition and multiplication tables for the ring  
$$R = GF(2)[x] \text{ mod } x^4 + 1 = 0$$
List all the units in  $R$ . List all the non-trivial divisors of zero in  $R$ .

- 5) (20pts) Construct the addition and multiplication tables for the ring  
$$R = GF(2)[x] \text{ mod } x^3 + x + 1 = 0$$
List all the units in  $R$ . List all the non-trivial divisors of zero in  $R$ .