PHY622/Assignment 2

Date: March 14, 2018

Note: Solve the following problems. The submission of assignment is NOT required. You are encouraged to discuss with each other and/or contact the instructor if you have any difficulty in solving the problems.

Problem 1. Using a step-by-step procedure to construct group multiplication table, show that there is only one group of order three. How many different groups are there of given order n if n is a prime number?

Problem 2. Consider the symmetry group of the square consisting of rotations around the center and reflections about the horizontal and vertical axes. Enumerate the number of elements, the classes, the subgroups and invariant subgroups. Is this group a direct product of some of its subgroups?

Problem 3. Show that every finite discrete group G of order n is isomporphic to a subgroups of S_n, where S_n is permutation group of n objects.

Problem 4. Consider the group $O(2)$ consisting of all linear transformations of 2-dimensional Euclidean space which leave the origin and the length of vectors unchanged. What is the dimension of its irreducible representation?

Problem 5. Consider the group $O(3)$ consisting of all linear transformations of 3-dimensional Euclidean space which leave the origin and the length of vectors unchanged. Find its subgroups. Can it be written as direct product of some of its subgroups?