CS 5602 S19 HW 01

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Submit your assignment as a single PDF file with that includes all the answers to the individual questions, all pictures, all code, all code output, and anything else that you need to include to support your answers. This should all be well-organized and attractively laid out.

If you need a program that helps you put PDF files together into a single PDF file, try http://www.pdfsam.org/. The program there is open source and available for free. Please do original work here. I am not interested in having copies of existing programs, because it is important for you to master these concepts before we start to apply them.

1. (5 points) Find all the subgroups of S_2, the symmetric group on 2 elements.

2. (10 points) Find all the subgroups of S_3, the symmetric group on 3 elements.

3. (15 points) Find all the subgroups of S_4, the symmetric group on 4 elements.

4. (15 points) Write a Python program that can multiply permutations correctly when the permutations are represented by one-dimensional lists. For example, [3, 2, 4, 1] represents the permutation that takes 1 to 3, 2 to 2, 3 to 4, and 4 to 1. Show some nontrivial examples with permutations that are at least 10 elements long.

5. (15 points) Assume that we represent polynomials as lists. For example, $x^3 + 2x + 15$ can be represented by [1, 0, 2, 15]. Write a program that takes two polynomials as input (you may assume integer coefficients), call them p(x) and q(w). Your program should output 2 polynomials, m(x) and r(x), such that p(x) = m(x)*q(x) + r(x). Provide some nontrivial examples with polynomials of degree at least 10.

6. (15 points) Write a GCD routine for polynomials using your polynomial division function from the previous exercise. Provide some nontrivial examples with polynomials of degree at least 10.

7. (15 points) Write a Python function that takes a permutation given as a list, and returns the permutation in cycle notation. Show some nontrivial examples with permutations that are at least 10 elements long.

8. (10 points) Write a Python function that takes a permutation in cycle structure and returns the permutation in list notation. Show some nontrivial examples with permutations that are at least 10 elements long.