Due Date: Thursday, October 13 at 5PM EDT

Carefully read and provide solutions to the problems below, showing all work required to justify any conclusions you make. You are encouraged to collaborate with your classmates, but all solutions turned in should be your own work. If you do collaborate, please record the names of those other students on your submitted work. Finally, your work should be submitted as a PDF on Gradescope before the listed due date.

Textbook problems: 11.1, 11.2, 11.3, 11.7, 12.6, 16.1, 17.1

Problem 1. (Lecture 5.1, Exercise 2) Describe all solutions to the linear system

$$
\begin{aligned}
x &\equiv 1 \pmod 2 \\
x &\equiv 2 \pmod 3 \\
x &\equiv 3 \pmod 4 \\
x &\equiv 4 \pmod 5 \\
x &\equiv 5 \pmod 6 \\
x &\equiv 0 \pmod 7
\end{aligned}
$$

Problem 2. Let p be prime and suppose k divides $p - 1$. Show that $x^k \equiv 1 \pmod p$ has exactly k incongruent roots mod p.