Department of Mathematics
Maths 190 and Maths 190G
Lecture 7 Summary

In this lecture we illustrated the idea of "crazy clock" (or *modular*) arithmetic. This is the arithmetic you use to answer questions like: **What time will it be in 100 hours?** or **On what day of the week will my 98th birthday fall?** Modular arithmetic is also used to detect errors in supermarket price scanners and bank cheques.

In this lecture we:
• Defined the notion of *equivalence* for integers "mod p" where p was an arbitrary positive integer, beginning with the example of $p=12$ relevant to ordinary "clock" arithmetic.
• Worked out examples of equivalence calculations.
• Illustrated the application of modular arithmetic to error detection in supermarket bar codes (13-digit European Article Numbers).
• Discussed briefly the concept of multiplication for crazy clocks, making the claim that division *without fractions* is also possible, provided the clock has p^n hours with p prime.

Before you come to the next lecture: You should spend an hour or two thinking and about the ideas presented in the lecture and read Section 2.4 of the textbook. Also, make sure you can answer the following questions posed in class regarding bar codes:

Q1. Why can you always detect a single error?

Q2. When can you tell if two *adjacent* digits have been interchanged? Always? Sometimes? Never?

Q3. What if two digits with a single digit between them are swapped?