

Problem Set 3

Due: Thursday, October 10

Work the following two problems. A subset of the problems will be graded. Be sure to adhere to the expectations outlined in the *Problem Set Guidelines Sheet*.

1. Find the missing digit in each of the following UPC numbers.

(a) $8 - 5357m - 00114 - 6$

(b) $m - 70330 - 50367 - 0$

(c) $0 - 13803 - 1065m - 1$

2. Every book has assigned to it an *International Standardized Book Number*, or *ISBN* for short. This is a 10-digit number and can usually be found on the back of the book. The first 9 digits contain information about the book – typically the first digit represents the language of the country in which the book was published, the next 4 represent the publisher, and the next 4 are assigned to that particular book by the publisher. The last digit is a check digit, and it is determined by the values of the first 9 digits. The idea is that a computer can be programmed to check to see if a potential ISBN is valid. This means, for example, if a clerk is typing an ISBN into a computer and makes a mistake, usually the computer will beep, announcing an error has occurred. Here is how the check digit is determined. Let a_1, \dots, a_9 be the first 9 digits of an ISBN number. Then the 10-th digit a_{10} (the check digit!) is chosen so that

$$a_1 + 2a_2 + \dots + 9a_9 + 10a_{10} \equiv 0 \pmod{11}.$$

A 10-digit number with digits a_1, \dots, a_{10} is called *ISBN valid* if this congruence equation holds.

- (a) Sometimes you'll come across a book whose ISBN ends in "X" rather than a digit. For example, your textbook *Elementary Number Theory, Second Edition* by Underwood Dudley has ISBN 0-486-46931-X. What does the X mean?
- (b) Suppose Alice and Bob were at a coffee shop one day discussing books, and Bob wrote down on a napkin the ISBN for a book he thought Alice would enjoy. Unfortunately, Alice put her coffee cup on the napkin and smudged one of the digits of Bob's ISBN. What she has left is 0-8218-51?4-1, where ? is the smudged digit. Determine the value of the missing digit. Then find the title and publisher of the book which Bob recommended to Alice. (*Hint*: Most library search engines can search for a book by its ISBN. Some search engines want spaces rather than dashes; others want just the numbers with no spaces or dashes.)