Identification Numbers and Error Correcting

Read the book chapters first, then make sure you can answer the questions in the notes. Following that, work on some skills-check problems and exercises. Then take the online quizzes.

Reading 16.1
Skills Check 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 14, 18, 19, 20, 23
Exercises 1, 2, 4, 5, 6, 9, 10, 13, 14, 15, 17, 18, 19, 21, 23, 26, 27, 31, 45, 46
Quiz Take the quiz[1]

16.1

- What is the idea behind the notion of a *check digits*?
- Review how to do integer division of two numbers, and obtain a *quotient* and a *remainder*.
- Way to perform an integer division in your calculator:

    - Say we want to divide 56 by 11.
    - First ask it to do the division $56/11$. You get something like 5.090909.
    - Keep the integer part: 5. That is your *quotient*.
    - Multiply by the divisor and subtract from the divident: $56 - 5 \times 11 = 1$. This is your *remainder*.
    - The four numbers now satisfy the relation: $56 = 5 \times 11 + 1$.
    - Can we recover a digit, if it somehow got corrupted and we didn't know its value?

- In all of the following schemes here are questions you should be asking:

    - How is the last digit (check digit) determined? Work out some examples.
    - Would this scheme detect any changes in the numbers (e.g. a 2 instead of a 3, a 0 instead of a 9 etc)?
    - Would this scheme detect any transpositions (i.e. if two numbers switch places)? What if the check digit switches places?
    - Can we recover a digit, if it somehow got corrupted and we didn't know its value?

- The *American Express traveler's cheque* scheme uses 10 digits.
- The *USPS money order* scheme is based on 11 digits.
- *Airline tickets* follow a "divide by 7" scheme, with a total of 7 digits.
- *Universal Product Code*, or UPC, is a 12 digit scheme.

    - What do the different digits represent?

- *Bank Identification Numbers* use a 9 digit scheme.

- **–** What is the advantage of using 3 weights?

- The *codabar* scheme is a 16 digit scheme used by all credit card companies. Make sure you understand how it works.

  - **–** Verify it on your credit card, if you have one.

- *ISBN* numbers come in a 10 digit scheme and a 13 digit scheme. These questions pertain to the 10 digit scheme.

  - **–** Verify the schemes in various books you have.
  - **–** How can we be sure these schemes detect 100% of single digit errors?
  - **–** How can we be sure these schemes detect 100% of transposition errors?
  - **–** Why do we some times see an X instead of a digit in ISBN codes?

- How does the *ISBN* 13 digit scheme work?