# INF243-Mandatory Assignment 1

***Submission Deadline**: Feb. 13th, 2023*

Instructions for the assignment:

- This assignment has 2 pages and accounts for 10 points for your final grade
- Prepare a PDF file for your answers
  - you can use Latex (see manual at this link) as the text editor which compiles to a nice PDF file
  - you can use MS word as the text editor and convert it to a PDF file
  - you can answer the questions in a hand note, make sure that your hand writing can be easily recognized; you can take photo of your handnote and convert it to a PDF file
- For the lab assignment, you can use SageMath, Matlab or other languages.
  - explain the method you used and enclose the plotting and comments in your answers
  - make sure to properly comment your source code.
  - Compress your source code as a ZIP file and include it in your submission

Q1. Your friend wants to recommend you an interesting book. To save time, she sends the ISBN code instead of the complete book title. Unfortunately, you have received the following incomplete ISBN-13 code:

978-1?38551992

Find the missing digit and reveal the title and publisher of the book. [1 pt]

Q2. Suppose there are two binary symmetric channels with bit error probabilities $p_1 = 0.1$ and $p_2 = 0.01$, respectively. Calculate the capacities of these two BSCs and justify which one has better channel capacity. [1 pt]

Q3. Let a code $C = \{00000, 11100, 01011\}$. For a received word $y = 01111$, find the codeword that will be determined by maximal likelihood principle as the one that was sent (only for cases when such codeword can be uniquely determined). Suppose the BSC has bit error probability $p = 0.05$. Calculate the probability that the word $y$ will be decoded correctly. [1 pt]

Q4. **Lab Assignment.**

Read Algorithms 1.2-1.4 in Ch. 1 of the textbook and complete the following tasks:

- BPSK Simulation: Tasks 1-4 [5 pts]
- Coded BPSK Simulation: Task 1 [2 pts]