# CSC265 Fall 2020 Homework Assignment 8
### due Tuesday, November 24, 2020

1. Consider the following simplified version of the Mastermind game.
   The Chooser chooses a sequence of two (not necessarily different) colours from among {Blue, Green, Red}. The Guesser must discover this sequence.
   Each turn, the Guesser gives the Chooser a sequence of two (not necessarily different) colours from among {Blue, Green, Red}. Then the Chooser responds with the number of positions in which the two sequences agree.
   The game ends when the Chooser answers 2, indicating that the Guesser has discovered the sequence.

   (a) Prove that any decision tree for this problem has height at least 4.
       If you can't solve this problem, you will get a small number of marks for proving that any decision tree for this problem has height at least 3.

   (b) Give a decision tree for this problem that has height 4. Justify why your algorithm is correct.

2. Consider the problem of searching for a value $x$ in an $n \times n$ matrix $A$ of integers in which the entires of each row are sorted in nondecreasing order from left to right and the entries of each column are sorted in nondecreasing order from top to bottom.
   Prove that every algorithm solving this problem which only performs comparisons between $x$ and elements of $A$ must perform at least $2n - 1$ comparisons in the worst case.