1. (40) Prove the following equations:

   (a) \[ \sum_{i=1}^{n} i^3 = \left( \frac{n(n+1)}{2} \right)^2 \]

   (b) \[ \sum_{i=0}^{n} 2^i = 2^{n+1} - 1 \]

2. (20) As you remember, first step in any inductive proof is to show the base step. Here is an example showing if the base is not satisfied and checked, proof by induction can result in wrong results:

   (a) Using proof by induction, without checking the base case, show that \( n = n + 1 \). (this is obviously a wrong equation, and the reason it is asked is to show you how important the base case is!)

   (b) Give another example of a wrong equation which can be proven using induction if we ignore the base case. Show the proof by induction (w/o the base case).

3. (20) Modify the NQueen java program so the code will print **ALL** of the possible solutions for any given \( N \). The given code currently prints the first solution only.

4. (20) Given the code for the MazeRat program, complete implementation of the `solveMazeUtil` method. You only need to print one solution in this program.