CS3230 Tutorial (Brute Force Algorithms, week of 6 February)

1. Prove that selection sort is not stable but bubble sort is stable. Improve the bubble sort algorithm so that the best case cost is linear in the input size.

2. Give an example of a text of length n and a pattern of length m such that the brute force string matching algorithm makes $m(n-m+1)$ character comparisons.

3. Design an algorithm to count the number of substrings that begin with the character 'A' and end with the character 'X'. For example, there are four such substrings in the text CAXAAYXZA: AX, AXAAYX, AAYX, AYX. Determine the efficiency class of your algorithm.

4. There are $n \geq 3$ professors, each has a roti-prata, positioned in a lecture theatre so that each has a unique nearest neighbor. At a signal, everybody hurls his/her prata at the nearest neighbor without miss. If n is odd, prove that at least one professor is not hit.

5. Determine if the following algorithm solves the job assignment problem correctly.

```
// Input Cost matrix: C[1..n, 1..n]
// Output Assignment matrix: A[1..n]
// Initialize A[1..n] to -1
for i from 1 to n do
    find ji such that C[i, ji] is a minimum of C[i,j] for
        those j's with A[j] = -1
    A[ji] <- i
od
```

6. Write a program to determine the decimal digit represented by each of the letters appearing in the following sum.

```
      s e n d
  +   m o r e
  ------------
    m o n e y
```

7. Write a program to generate all 3 x 3 magic squares. That is, fill the 3 x 3 matrix with the numbers from 1 to 9 such that the three entries in any row, any column, and any of the two diagonals sum to 15.