CMSC 441
Homework 3

Reading Assignment:

- Listen to Camille Saint-Saens' Danse Macabre.
- Read Chapter 4 Section 5 of text, and read the Brassard/Bratley (BB) handout

Homework:

1) Problem 2.3.7, page 75 of BB handout

2) Problem 2.3.9, page 76 of BB handout

3) Problem 2.3.10, page 76 of BB handout

4) Problem 2.3.12, page 76 of BB handout

5) Exercise 4.5-1, page 96 of text

6) The n-th Fibonacci number F(n) is defined by the following recursion

$$\begin{cases} F(n) = F(n-1) + F(n-2) & \text{for } n \geq 2 \\ F(0) = 0, \quad F(1) = 1 \end{cases}$$

Given that the Fibonacci numbers satisfy the following equality

$$\begin{bmatrix} F(n-1) & F(n) \\ F(n) & F(n+1) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}^n \quad \text{for } n \geq 2,$$

construct (in pseudo code) an algorithm that computes the n-th Fibonacci number in time complexity $\Theta(\log n)$. Then explain why your algorithm is of time complexity $\Theta(\log n)$.

Hint. Use the method of repeated squares for computing matrix powers.

7) Determine the asymptotic time efficiency of the following algorithm:

```
Algorithm   GE ( A[0..n-1,0..n] )
    //Input: An n×(n+1) matrix A[0..n-1,0..n] of reals
    for i ← 0 to n-2 do
        for j ← i+1 to n-1 do
            for k ← i to n do
                A[j,k]←A[j,k] – A[i,k]*A[j,i]/A[i,i]
```

Be sure to explain how you got your answer.