CS 201 Homework 06 Complexity

This assignment is to be done individually. You can share ideas and thoughts with other people in the class, but you should write up your own assignment.

Please submit your assignment electronically on Moodle as a PDF file. If you want to write it out on paper, which is likely the easiest way, scan your solution using any of the scanners (not `java.util.Scanner`) in the library or elsewhere. Alternatively, use LaTeX, which lets you produce gorgeously readable mathematical text like in this document. You may also try writing equations in Word or LibreOffice, though that seems unappealing.

(1) Determine how many times the output statement is displayed in each of the following code fragments. Indicate whether the number of times that the output is printed is *better* described as $O(n)$ or $O(n^2)$.

(a)
```
for (int i = 0; i < n; i++)
{
   for (int j = 0; j < n; j++)
   {
      System.out.println(i + " " + j);
   }
}
```

(b)
```
for (int i = 0; i < n; i++)
{
   for (int j = 0; j < 2; j++)
   {
      System.out.println(i + " " + j);
   }
}
```

(c)
```
for (int i = 0; i < n; i++)
{
   for (int j = i; j >= 0; j--)
   {
      System.out.println(i + " " + j);
   }
}
```

(d)
```
for (int i = 0; i < n; i++)
{
   for (int j = 0; j < i; j++)
   {
      if (j % i == 0)
      {
         System.out.println(i + " " + j);
      }
   }
}
```

(2) Let $T(n) = n^3 - 5n^2 + 23n - 7$. Find positive numbers N and c such that $T(n) \leq cn^3$ for all $n \geq N$.

(3) Show that n^2 is $O(n^3)$ by using the definition of Big Oh.

(4) Show that n^3 is not $O(n^2)$ by using the definition of Big Oh.