1. Suppose that algorithm $A$ uses $313 \cdot n^3$ operations while algorithm $B$ uses $2 \cdot n^4$ operations. Determine the value $N$ such that $A$ is as fast or faster than $B$ for all $n \geq N$. [4 points]

2. exercise 3.1-2, p 52 [4 points]

3. exercise 3.1-4, p 53. Additionally, is $2^{2n+1} = O(2^{2n})$? [5 points]

4. exercise 3-2, p 61. [8 points]

5. An algorithm takes 0.4ms for input size 50 (this allows you to determine the constant $c$, which will be different in each case). How large of an input can be solved in one hour if the run time of the algorithm is ... ?
   (a) $c n$
   (b) $c n \log n$
   (c) $c n^3$
   (d) $c 2^n$

[8 points]

6. What is the running time for the following code, which multiplies two $n \times n$ matrices $A$ and $B$, storing the result in $C$? [4 points]

   ```java
   for i=1 to n
       for j=1 to n {
           C[i,j] = 0
           for k=1 to n
               C[i,j] = C[i,j] + A[i,k]*B[k,j]
       }
   ```

7. Determine the run times of the following two pieces of code, which do pretty much nothing. [6 points]

   ```java
   sum =0
   for i = 1 to n*n
       for j=1 to i*i*i
           sum ++
   ```

   and
sum =0
for i = 1 to n^2
    j=i
    while j>0
        sum++
        j = (j div 5)

Total: 39 points

Notes:

• For Q2, we are not asking you to do questions 1 and 2. Just question 2 of section 3.1. Also, assume that $a \geq 0$. Hint: $(n + a) \leq 2n$ when $n \geq a$.

• An ms is 1/1000 of a second, also called a millisecond.