Homework assignment 4:
Due date: Sunday, September 27, 2020 at 11:59pm

1- Suppose a machine on average takes 10^{-8} seconds to execute a single algorithm step. What is the largest input size for which the machine will execute the algorithm in 2 seconds assuming the number of steps of the algorithm is T(n) =
   a. log n
   b. $\sqrt{n}$
   c. n
   d. n^2
   e. n^3
   f. 2^n

2- For the machine in the previous example, how long will it take to run the algorithm for an input of size 1,000, assuming the time complexities from the same example?

3- An algorithm takes *0.5* seconds to run on an input of size *100*. How long will it take to run on an input of size *1000* if the algorithm has a running time that is *linear? quadratic? log-linear? cubic?*

4- An algorithm is to be implemented and run on a processor that can execute a single instruction in an average of 10^{-9} seconds. What is the largest problem size that can be solved in *one hour* by the algorithm on this processor if the number of steps needed to execute the algorithm is *n, n^2, n^3, log n?* Assume n is the input size.

5- Determine the asymptotic running time for the following piece of code, assuming that n represents the input size.

a.
```
sum = 0;
    for(i=0; i < n; i++)
        sum++;
```

b.
```
sum=0;
    for(i=0;i<n;i++)
        for(j=0; j< n*n;j++)
            sum++;
```

c.
```
sum=0;
    for(i=0;i<n;i++)
        for(j=0; j< i;j++)
            sum++;
```

d.
```
sum = 0;
    for(i=0; i < n; i++)
        for(j=0; j < i*i; j++)
            for(k=0; k < j; k++)
                sum++;
```

e.
```
sum = 0;
    for(i=0; i < n/2; i++)
        for(j=0; j < (i*i)/2; j++)
            sum++;
```

f.
```
for(i=0; i < length(a) ; i++)
    binary_search(a, a[i]); //key = a[i]
```

g.
```
for(i=0; i < n; i++)
    for(j=0; j < n; j++)
        linear_search(a, key); //key is not in array, length(a) == n
```

6- What is the *largest* value of *n* such that an algorithm whose running time is $10n^2$ runs faster than an algorithm whose running time is *50n* on the same machine?