**CSE 551 – Assignment 1**

Submitted By:

**Ankit Sharma**

1219472813

ashar263@asu.edu

**Solution for Question (1)**

(i)

To prove above equation, by the definition of big-O, we need to prove that:

where and are positive constants.

=

So,

where

Hence **proved**,

(ii)

To prove above equation, by the definition of theta notation, we need to prove that:

where , and are positive constants.

Dividing whole equation by , we get

We know that,

and,

(because )

From eq(ii) and eq(iii) we can see that is a decreasing function which can be bounded by and where and .

Therefore, eq(i) holds true:

where and

Hence **proved**,

**(iii)**

To prove above equation, by the definition of big-O, we need to prove that:

…………eq(i)

where and are positive constants.

since, ………….eq(ii)

Combining eq(i) and eq(ii), we get:

which does not hold true as can be value greater than constant

Hence **disproved**,

**(iv)**

To prove above equation, by the definition of theta notation, we need to prove that:

where , and are positive constants.

Dividing whole equation by we get,

Since is a continuously growing function, therefore part of the above equation does not hold true for all

Hence **disproved**,

**(v)**

To prove above equation, by the definition of big-O, we need to prove that:

where and are positive constants.

Dividing both sides by , we get:

which is not true because is a continuously growing function for .

Hence **disproved**,

**Solution for Question (2)**

Given, Operations in 1 sec =

Therefore, Operations in 1 hour =

**2(i)** Time for n2 operation =

Max input *n* = =

**2(ii)** Time for n3 operation =

Max input *n* = =

(input cannot be fraction)

**2(iii)** Time for operation =

Max input =

(input cannot be fraction)

**2(iv)** Time for operation =

Max input = = 28.4 = **28** (input cannot be fraction)

**Solution for Question (3)**

Given, for problem instance size =

sec

sec

**3(i)** Let’s assume size of problem instance that can be solved by in one year

Therefore, time taken by for sec

sec (considering year not to be a leap year)

So,

Since we need to consider only completed instances, Therefore:

Size of problem instance that can be solved by in one year is **.**

**3(ii)** Slower machine denoted by

100 times faster machine denoted by

Let, operations that can be done in 1 year on

and operations that can be done in 1 year on

where and are size of the problem instance that can be solved by and in 1 year.

year on years

From the eq(i) in solution 3(i), we know that:

So,

Since we need to consider only completed instances, therefore size of problem instance that can be solved by in one year on 100 times faster machine () is **.**

**3(iii)** Given, for problem instance size =

sec

sec

*If , is faster.*

sec = sec

sec = sec

*If , is faster.*

sec = sec

sec = sec

*If , is faster.*

sec = sec

sec = sec

*If , is faster.*

sec = sec

sec = sec

*If , is faster.*

sec = sec

sec = sec

*If , is faster.*

sec = sec

sec = sec

From the above calculation, it can be clearly seen that for problem size less than 20,  **will produce faster results**.

**Solution for Question (4)**

Given,

From our knowledge of growth rate of polynomial and exponential functions we can infer that:

growth rate of

Arranging , and in ascending order of growth rate –

and

Therefore, growth rate of ……………… eq(i)

Arranging , and in ascending order of growth rate –

and

Therefore, growth rate of ……………… eq(ii)

Combining eq(i) and eq(ii) we get our list of –

**functions in ascending order of growth rate**: