# CS323 Assignment1

SID: 12011625

## Required Exercises

### Exercise 1

```
int a3 = a3 * 3;
```

7 tokens will be generated:

<**int**>

<id, pointer to symbol_table entry for **a3**>

<assign_op>

<id, pointer to symbol_table entry for **a3**>

<mult_op>

<number, integer value **3**>

<**;**>

### Exercise 2

1. $n+1$
2. $n-1$
3. $1$
4. $1$
5. If $m=n$, the number of proper prefix of length $m$ is $0$. Else, the number is $1$.
6. $1+1+2+\ \dots\ +n=\frac{n(n+1)}{2}+1$
7. $2^n$

### Exercise 3

1. $((\epsilon|a)^*b^*)^*=(a^*b^*)^*$. 空串 $\epsilon$ 以及任意由 $a$ 或 $b$ 组成的字符串
2. 长度至少为 $3$，倒数第三个字符为 $a$，其余字符均为 $a$ 或 $b$ 的字符串
3. 长度至少为 $3$，有且仅有 $3$ 个字母 $b$，其余字符均为 $a$ 的字符串

## Exercise 4

1. Define $A = [0-9]$, $B = [1-9]$.

   So the regular expression is **86-755-**$BA^7$.

2. The regular expression is $a(a|b)^*b$.

3. Define $L = [bcdfghjklmnpqrstvwxyz]$. (not containing **aeiou**)

   So the regular expression is $L^*a(a|L)^*e(e|L)^*i(i|L)^*o(o|L)^*u(u|L)^*$.

# Optional Exercises

## Exercise 1

We just need to prove that $L((a^*b^*)^*) \subseteq L((a|b)^*)$ and $L((a|b)^*) \subseteq L((a^*b^*)^*)$.

First, obviously, $L(a) \subseteq L(a|b)$. $L(a^*) \subseteq L((a|b)^*)$. Similarly, $L(b^*) \subseteq L((a|b)^*)$. Therefore, $L(a^*b^*) \subseteq L((a|b)^*(a|b)^*) = L((a|b)^*)$. $L((a^*b^*)^*) \subseteq L(((a|b)^*)^*) = L((a|b)^*)$.

On the other hand, $L(a) \subseteq L(a^*) \subseteq L(a^*b^*)$. $L(b) \subseteq L(b^*) \subseteq L(a^*b^*)$. Therefore, $L(a|b) \subseteq L(a^*b^*|a^*b^*) = L(a^*b^*)$. $L((a|b)^*) \subseteq L((a^*b^*)^*)$.

Therefore, $L((a^*b^*)^*) = L((a|b)^*)$, which means that $L_1$ and $L_2$ are equivalent.