

**Programming Language Concepts, CS2104**  
**Tutorial 1 (26 August 2011)**  
**(All students must prepare/attempt in advance.)**

**Exercise 1**

Translate the following C programs into the Vanilla Assembly Language.

(a)

```
int f(int a, int b) {  
    while ( a != b )  
        if ( a < b )  
            b -= a ;  
        else  
            a -= b ;  
    return a ;  
}
```

(b)

```
extern int a[] ;  
  
int f() {  
    return a[0] - a[1]*a[2]*(a[1]+a[2]) - a[3] << a[4] ;  
}
```

(c)

```
int f(int x) {  
    switch ( x ) {  
        case 0 :  
            return 13 ;  
        case 1 :  
            return 8 ;  
        case 2 :  
            return 5 ;  
        case 3 :  
            return 3 ;  
        default :  
            return -1 ;  
    }  
}
```

## Exercise 2

Explain how the variables in the following programs have their values computed

```
void f() {  
    unsigned char a[4] = { 1, 2, 3, 4 } ;  
    int b = * (int*)&a[0] ;  
    char c[4] ;  
    *(unsigned *)&c[0] = b ;  
    short d = *(short*)&a[2] ;  
    b <<= 1 ;  
    *(int*)&a[0] = b ;  
}
```

.

## Exercise 3

Write a VAL program that computes the minimum of an array of integers. The address of the array is given the register `ebx`, and the length of the array (that is, the number of elements, each element being an integer), is given in the register `ecx`. The return value should be placed in the register `eax`, as usual.