# Tutorial Four – 2GA3 – Computer Architecture - Sep 30, 2018

Question 1:

Implement the following C code in MIPS assembly.

```
void swap(int v[], int k) {
            int temp;
           temp = v[k];
           v[k] = v[k+1];
           v[k+1] = temp;
}
```

**Answer: Book Exercise: section 2.13**

Question 2:

Implement the following C code in MIPS assembly.

```
int fib(int n){
if (n==0)
     return 0;
else if (n == 1)
      return 1;
else
      return fib(n−1) + fib(n−2);
```

Solution:

```
fib:    addi   $sp, $sp, -12   # make room on stack
        sw     $ra, 8($sp)     # push $ra
        sw     $s0, 4($sp)     # push $s0
        sw     $a0, 0($sp)     # push $a0  (N)
        bgt    $a0, $0, test2  # if n>0, test if n=1
        add    $v0, $0, $0     # else fib(0) = 0
        j      rtn             #
test2:  addi   $t0, $0, 1      #
        bne    $t0, $a0, gen   # if n>1, gen
        add    $v0, $0, $t0    # else fib(1) = 1
        j      rtn
gen:    addi   $a0, $a0,-1     # n-1
        jal    fib             # call fib(n-1)
        add    $s0, $v0, $0    # copy fib(n-1)
        addi   $a0, $a0,-1     # n-2
        jal    fib             # call fib(n-2)
        add    $v0, $v0, $s0   # fib(n-1)+fib(n-2)
rtn:    lw     $a0, 0($sp)     # pop $a0
```

```
lw      $s0, 4($sp)     # pop $s0
lw      $ra, 8($sp)     # pop $ra
addi    $sp, $sp, 12    # restore sp
jr      $ra
```

Question 3 (Try at home- Optional):

Implement the following C code in MIPS assembly.

```
void sort (int v[], int n) {
        int i, j;
        for (i = 0; i < n; i += 1) {
                for (j = i – 1; j >= 0 && v[j] > v[j + 1]; j =1) {
                        swap(v,j);
                        }
                }
        }
```

**Answer: Book Exercise: section 2.13**