

**Com S 321****Activity 5**

1. Add comments to the following MIPS code and describe in one sentence what it computes in register \$v0. Assume that \$a0 is used for the input and initially contains  $n$ , a positive integer. Assume that \$v0 is used for the output.

```
begin: addi    $t0, $zero, 0
      addi    $t1, $zero, 0
loop:  slt     $t2, $a0, $t1
      bne     $t2, $zero, finish
      add     $t0, $t0, $t1
      addi    $t1, $t1, 2
      j       loop
finish: add     $v0, $t0, $zero
```

2. Consider the following **while** loop in a high-level language:

```
while ( k == a [i] )    // k is in register $s5
{
    i = i + j ;          // i is in register $s3
                        // j is in register $s4
                        // base address of integer array a is in register $s6
} // end while
```

Exit: ...

The MIPS assembly language program given below implements the above loop.

```
Loop: add     $t1, $s3, $s3      # t1 ← i + i
      add     $t1, $t1, $t1      # t1 ← 4*i
      add     $t1, $t1, $s6      # t1 ← address of a [i]
      lw      $t0, 0($t1)        # t0 ← a [i]
      bne     $t0, $s5, Exit
      add     $s3, $s3, $s4      # i ← i + j
      J       Loop
Exit:  ...
```

Assume that in the while loop condition test,  $a[i + m*j]$  is equal to  $k$  for values of  $m$  in the range  $0 \leq m \leq 9$ , and is not equal to  $k$  when  $m = 10$ . Therefore, 10 iterations of the loop are executed.

- How many assembly language instructions are executed in the MIPS program given above for 10 iterations of the while loop?
- Write a semantically equivalent MIPS assembly language program to reduce by ten the number of instructions executed in part (a) for 10 iterations of the while loop.
- Write a semantically equivalent MIPS assembly language program to reduce by more than half the total number of instructions executed in part (a) for 10 iterations of the while loop.