# Additional homework assignments

## Programming Questions

### Q.1

Design, using a subfunction an pair of programs in assembly. To take a user input as a number have the same subfunction operate on the number twice. Each time multiplying the number by itself, and returning the multiplication. Then output the final result. (Hint the subfunction should just do the math operation)

### Q.2

Re-write the above program but, utilizing the stack to pass **the return variable** to the main function.

## Pipeline Questions

Utilize the given set of instructions for the next two questions. Based of a 5-Stages MPS pipeline processor.

|  |  |
| --- | --- |
| Instruction Id | Instruction |
| 1 | lw $t0, 0($t3) |
| 2 | lw $t1, 0($t5) |
| 3 | add $t0, $t8, $t1 |
| 4 | add $t2, $t0, $t2 |
| 5 | lw $s1, 4($t3) |
| 6 | add $s1, $s0, $s1 |
| 7 | add $s3, $t2, $s1 |

### Q3.

How many data hazards are present in the above set of instructions? How many clock cycles with no forwarding and no compiler re-ordering would it take to complete the above code?

### Q4.

With forwarding and compiler re-ordering how many clock cycles would the above code require?

## Pipeline continued

### Q5.

For a 8 stage pipelined processor, a branch instruction can be resolved on the **6th** stage.

What is the penalty (in clock cycles) if a pipeline is stalled until a branch can be resolved?

### Q6.

Using the same processor described above if the known ideal CPI is 5 and there are no data hazards and no structure hazards. To execute a given program with 25% of the instructions are branching and the machine utilizes branch predictions with only 15% of the branches guessed **incorrectly**. What is the average CPI for this machine executing the given program?