國立清華大學資訊工程學系

CS 4100 --- 計算機結構

102 學年度下學期

Homework #8

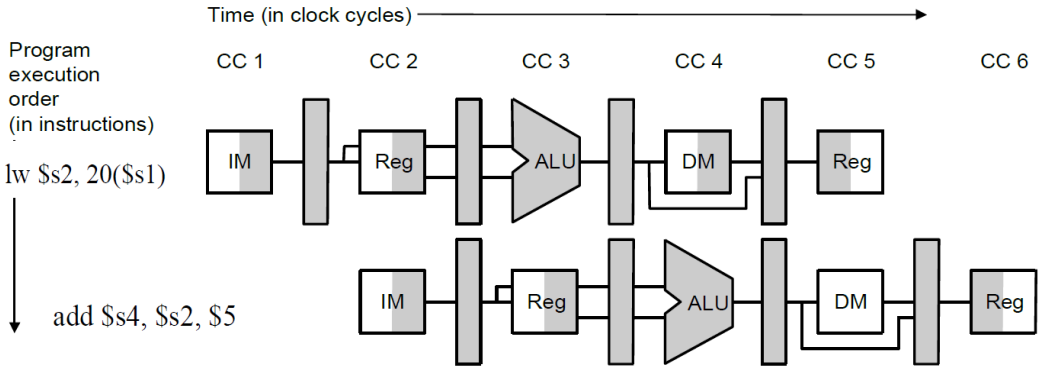
(Due: 2014/05/15 10:10am)

For the following code segments, answer the three questions.

```
lw      $s2, 10($s1)
lw      $s1, 10($s6)
sub     $s6, $s1, $s2
addu    $s6, $s2, $s2
and     $s3, $s6, $s8
sw      $s6, 20($s1)
```

1. Indicate and explain all the dependences and hazards of above code segments.
2. To solve the hazards, you are required to use the following two methods.
   - Assume the 5-stage MIPS pipeline (1 cycle/stage) with no forwarding and let the processor stall on hazards.
   - Assume the 5-stage MIPS pipeline (1 cycle/stage) with full forwarding and use NOPs to deal with hazards.

   Give a graphical representation as below to show the result of the above two methods and point out data dependency.



3. After "question 2" to resolve hazards, how many cycles are needed to finish these instructions?

For the following code segments, answer the three questions.

```
lw      $s1, 0($s2)
addi    $s1, $s1, 1
sw      $s1, 0($s2)
addi    $s2, $s2, 1
sub     $s4, $s3, $s2
beq     $s4, $s2, Somewhere
```

1. Indicate and explain all the dependences and hazards of above code segments.
2. Indicate all the forwarding and stall, if necessary, to solve the hazards in an optimized way. Give a graphical representation to show the results.
3. After "question 2" to resolve hazards, how many cycles are needed to finish these instructions?