INEL 6009: Homework 6
Pipeline Execution and Performance

Task:

Consider the following ARM code:

```
Start   AND R0,R1, #0
        OR R1,R0, #40
        LDRB R2, [R1,R0]
        LDRB R3, [R1, #2]
        ADD R5,R0,R0
Loop    ADD R5,R2,R5
        SUBS R3,R3,#1
        BNE Loop
        STRB R5, [R1,#3]
End     B End
```

Part 1: Assuming that there is no mechanism to prevent hazards and that the instructions are executed in a five-stage pipelined unit, identify all the potential hazards that the code has.

Part 2: Assume that there is a mechanism that detects all types of hazard and inserts idle cycles as necessary to prevent the hazards to cause an incorrect execution of the program (this mechanism is **not** one of the static or dynamic mechanisms that prevent hazards and reduced wasted cycles). Assume also that the memory latency is 3 cycles. For a typical five stages pipelined unit, show how the instructions move through the stages, cycle after cycle, from the beginning of the program until the end of the second iteration of the loop.

Part 3: Indicate what combination of mechanisms can be used to reduce to the maximum the number of cycles wasted due to the hazards of the program.

Part 4: For a typical five stages pipelined unit, show how the instructions move through the stages, cycle after cycle, from the beginning of the program until the end of the second iteration of the loop when the mechanisms listed in part 3 are used.

Part 5: Determine the CPI for the case of part 2 (show your calculations).

Part 6: Determine the CPI for the case of Part 4 (show your calculations).

Submission:

Upload a pdf document with your answers on or before 3/28/2016.

Rubrics:

Part 1:
A maximum of 4 points will be awarded if all possible hazards are identified. Otherwise, partial points will be awarded based on the percentage of hazards identified.

Part 2:
A maximum of 8 points will be awarded if the sequence of instructions flow through the pipeline correctly. Otherwise, partial points can be awarded depending on the correctness of the program.

Part 3:
3 points will be awarded if the combination of the mechanisms can reduce the number of wasted cycles to the maximum. Partial points can be awarded based on how close to the maximum the combination gets.

Part 4:
A maximum of 8 points will be awarded if the sequence of instructions flow through the pipeline correctly. Otherwise, partial points can be awarded depending on the correctness of the program.

Part 5:
5 points will be awarded if the CPI is correctly calculated. Otherwise, partial points can be awarded depending on how close to the correct answer the solution provided is.

Part 6:
5 points will be awarded if the CPI is correctly calculated. Otherwise, partial points can be awarded depending on how close to the correct answer the solution provided is.