1. Assume that an automobile assembly process takes 6 hours.

   Chassis  |  Motor  |  Interior  |  Exterior

   ![Vehicle Diagram]

   a) If the stages take the following amounts of time, then what is the time between completions of automobiles?
   - Chassis 1 hour
   - Motor 1 hour
   - Interior 3 hour
   - Exterior 1 hour

   b) How could the factory fix the above problem to get a completion rate of 1 car per hour?

2. Consider the following sequence of instructions:

   Instruction 1: MUL R3, R3, R5
   Instruction 2: ADDI R4, R3, 1
   Instruction 3: ADDI R3, R5, 8
   Instruction 4: SUB R7, R3, R4

   If these instructions were issued (selected to be executed) out-of-order and completed out-of-order, then:
   a) why would writing R3 in instruction 3 before reading R3’s value in instruction 2 cause a problem? (WAR)

   b) why would writing R3 in instruction 3 before writing R3 in instruction 1 cause a problem? (WAW)

   c) If we had more registers (say R33 - R64) and utilized them dynamically as the program executes (called “register renaming”), which registers could we rename to eliminate the WAR and WAW dependencies?