1. What is a structural hazard?
   
   1. When an instruction cannot proceed because a hardware resource is not available that cycle.
   
   2. Pipeline A stalls to eliminate data hazards, and has an base CPI of 1. The average stall time is 3 cycles (i.e., the total, average CPI is 4). Pipeline B is a revised version with forwarding hardware that eliminates stalling for 50% of instructions. Use Amdahl’s law to compute the speed up of processor B compared to A.

   1. \[ \text{Stot} = 1/(0.5/(4/1) + (1-0.5)) = 1.6 \]
   
2. Does bypassing (or forwarding) eliminate structural hazards or data hazards?
   
   1. Data hazards
   
   4. Draw the data dependences in the following code

   1. add r1, r2, r3
   2. sub r4, r1, r3

5. What should be on the midterm?