CS 429 Homework 10

Name: ______________________  Section #: ______________________

Instructions: Work these problems on your own paper. As usual, you may collaborate with your classmates and ask for assistance from the TA. But don’t copy anyone else’s answer. Each problem is worth the same number of points (more or less).

1. Consider the following Y86 code fragment:

   irmovq $3, %rax
   irmovq $4, %rbx
   addq %rax, %rbx

   (a) Explain carefully the data dependency problem for the naive pipelined implementation (without data forwarding) of the Y86 we’ve been discussing. Be sure to say at which stages of the naive pipeline, the values of %eax and %ebx are needed by the addl statement and at which they become available.

   (b) Insert the minimum number of nop’s into the code to resolve the problem.

   (c) Explain the introduction of stalls and bubbles into the pipeline to resolve the problem without explicit nop’s.

   (d) Explain how adding data forwarding to the pipeline solves the problem. Be explicit about what values are forwarded and from what stages of the pipeline, and to which stage.


4. Toward the end of the Storage Technologies slideset (18) are two slides titled “Storage Trends” and “CPU Clock Rates” that show the trends over time in speed, cost, and capacity of several storage technologies and the clock speeds of state of the art processors. Do some internet investigation to estimate what the numbers would be if we were to add an additional column to those two charts for 2017 numbers. Describe where you found your data. If it’s for specific devices, identity them.