Homework 1 – Introduction

Out: 1.27.21
Due: 2.3.21

1. [Computer Systems]
   There are at least 10 times as many microprocessors in embedded systems (including mobile devices) than in laptop and desktop computers. Using the internet, find the following:
   a) A definition of "embedded system".
   b) Three companies that build processors for embedded systems.
   c) Three differences between a processor typically used for embedded systems and a processor used in a desktop or laptop computer.
   d) Five industries that use embedded systems.
   e) What does the company ARM make?

2. [Microprocessor attributes]
   For the following products, which attributes are most important for the processor?
   a) Car brakes
   b) Cell phone
   c) Data center
   d) Weather forecasting
   e) Video games

3. List three attributes that have scaled with new generations of computers, and whether the scaling trend is up or down.

4. [Digital Logic Review]
   For both parts - what is the longest path (from any input to any output) that a signal must traverse? That is, how many gates does it have to go through?
   a) A four bit OR (two 4-bit inputs and one 4-bit output)
   b) A four bit ripple carry adder (two 4-bit inputs and a five bit output)

5. [Digital Logic Review]
   In this class we are assuming that all registers are comprised of positive edge triggered D flip-flops.
   a) Why flip-flops and not latches?
   b) Why D flip-flops? (a guess is fine)
   c) Why edge triggered?
   d) Why positive edge? (a guess is fine)

6. [Digital Logic Review]
   Assume that A = C241 and B = 1372 are unsigned 16-bit hexadecimal numbers.
   a) What is A+B? The result should be written in hexadecimal. Show your work.
   b) What is A-B? The result should be written in hexadecimal. Show your work.

c) Convert A into a binary number.

7. [Digital Logic Review]
   Assume that A = 0011 and B = 0101 are 4-bit 2's complement numbers. For each of the following use 2's complement arithmetic and then verify the computation in decimal.
   a) What is A+B?
   b) What is A-B?
   c) What is B-A?