Homework 1 – Introduction
Out: 1.27.21
Due: 2.3.21
George Kent-Scheller
u50686762

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".

"An embedded system is a computer system—a combination of a computer processor, computer memory, and input/output peripheral devices—that has a dedicated function within a larger mechanical or electrical system."- Wikipedia

b) Three companies that build processors for embedded systems.

- Intel.
- qualcomm
- NXP..

c) Three differences between a processor typically used for embedded systems and a processor used in a desktop or laptop computer.

- lower power usage for embedded systems
- Laptops can support graphics on the processor
- embedded systems processors are often responsible for the whole system instead of just the processing part.

d) Five industries that use embedded systems.

- farming
- defense
- automotive
- avionics
- robotics

e) What does the company ARM make?

- processors for mobile phones and some new laptops.

2. [Microprocessor attributes] For the following products, which attributes are most important for the processor?

a) Car brakes

-speed
-correct signaling interpretation
-long run time

b) Cell phone

- low power usage
- high usage time
- low price

c) Data center

- almost constant use time
- redundancy

        - multiprocessing
    d) Weather forecasting
        - for supercomputers
            - high matrix calculator ability
            - speed per calculation
        - for embedded sensors
            - durable components
            - low power usage
    e) Video games
        - speed
        - geometry processing operations
        - low price

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

-number of transistors is up
- size of transistors is down
- price of a personal computer is 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)
    2 gates
b) A four bit ripple carry adder (two 4-bit inputs and a five bit output)
    8 gates

5. [Digital Logic Review] In this class we are assuming that all registers are composed of positive edge triggered D flip-flops.

a) Why flip-flops and not latches?
    - because latches are async they can not be easily incorporated into larger clock based logic systems
b) Why D flip-flops? (a guess is fine)
    - it uses d flip flops because it simplifies the logic for storing data, you can just feed in a 1 or 0 and it will store that number
c) Why edge triggered?
    - it is edge triggered because it makes it easy to store data before will have been viewed on the next clock cycle
d) Why positive edge? (a guess is fine)
    - it is positive edge because all of the read instructions on a negative edge paradigme

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.

-A=C-2-4-1| 1
-B=1-3-7-2 |+2

3
-A=C-2-4-1| 4
-B=1-3-7-2 |+7

B3
-A=C-2-4-1| 2
-B=1-3-7-2 |+3

5B3
-A=C-2-4-1| C
-B=1-3-7-2 |+1

D5B3

b) What is A-B? The result should be written in hexadecimal. Show your work. EC413 Computer Organization, Spring 2021

-A=C-2-4(3)-1(b)| b
-B=1-3-7-2 |-2

9
-A=C-2(1)-3(D)-B| D
-B=1-3-7-2 |-7

69
-A=C(B)-1(C)-D-B| C
-B=1-3-7-2 |-3

969
-A=B-C-D-B| B
-B=1-3-7-2 |-1

A969

c) Convert A into a binary number.

-A=C-2-4-1
-A= 12-2-4-1
-A = 12-2-4-0001
-A = 12-2-0100-0001
-A = 12-0010-0100-0001
-A = **1100-0010-0100-0001**

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?
A=0-0-1-1
B=0-1-0-1
C= 0-1-1-1
S= 1-0-0-0
d = -8
a = 3
b= 5
a+b = 3+5 = 8

b) What is A-B?
A=0-0-1-1
B=0-1-0-1

A=0-0-1-1
B-=1-0-1-1
C= 0-0-1-1
S= 1-1-1-0
d = -2
a = 3
b= 5
a+b = 3-5 = -2

c) What is B-A?
A=0-0-1-1
B=0-1-0-1

A-=1-1-0-0
B=0-1-0-1
C= 0-1-0-0
S= 0-0-0-1+1
S = 0-0-1-0
d = 2
a = 3
b= 5
b-a = 5-3 = 2