EE 367 Introduction to Microprocessors

Due Wednesday February 20, 2019

Reading:

- Lecture notes
  - Part 3, sections 5 to end
  - Part 4, sections 1 to 4.3
  - Chapter 12, More PIC Microcontrollers

Assignment:

0 Problems 7, 8, 9 of homework 2.

(If you already turned them in, be sure the grade is counted toward the HW 3 grade).

1 Binary numbers

A. Convert the following unsigned binary numbers to hexadecimal and to decimal

(1) %0000 1010
(2) %0110 1110

B. Convert the following hexadecimal numbers to binary and to decimal

(1) $3F
(2) $F3
(3) $1ABC

C. Convert the following decimal numbers to binary and hexadecimal

(1) 99T
(2) 199T
2 Decoders

A. (Essay question) What role does a decoder chip play in a microprocessor system?

B. Lines from a bus typically are inputs into a decoder chip. What bus?

C. What type of decoder is used in the Really Small Processor

(1) Two-to-Four

(2) Three-to-Eight

(3) Four-to-Sixteen

D. Why is three-to-eight a standard size decoder, and not three-to-ten or three-to-twelve?

E. A three-to-eight decoder has how many of each of the following types of pins:

(1) Power supply lines

(2) Address lines

(3) Output lines

(4) Decoders also need one or more input control signals for enabling the chip. If a three-to-eight decoder is packaged in a 16-pin package and all the pins are used, how many control signals will it have?

(5) How many control signals are used in the 74LS138 chip for enabling the chip?

3 Draw the timing diagram for an RSP transaction RSP_TFG

4 Processors are composed of three elements: registers, buses and logic

A. (Essay Question) Describe in a few sentences the function of each processor element: registers, buses and logic.

B. The chips of the RSP are listed in table 1 and shown functionally in figure 1 of the Lab Manual Introduction. Counting chips that are used purely for tri-state control of signals as part of buses, indicate for each of chips $J_1$...$J_{24}$ (not including omitted chips), whether the chip is part of group a) registers, b) buses or c) logic. Include the PIC processor and LED drivers as “other”.

(Revised: Jan 16, 2019)
5 Debugging strategies

A. What debugging technique can detect broken or missing wires.

B. What is the name of a debugging or trouble shooting strategy that requires the engineer to determine input patterns on a chip that could produce an observed output pattern?

C. What is the name of a debugging or trouble shooting strategy that requires the engineer to determine the anticipated output pattern, based on knowledge of the input pattern.

6 RSP Transaction

Draw a timing diagram showing the action of the T&C Logic of the RSP during this E-Clock cycle. Include in your diagram a) the 6 input signals to the 74LS139s (1\overline{E} ... 2A_0), b) all output signals of the 74LS139s that are activated during the cycle. Be sure to show all causality arrows.
7 (Essay question)

- Considering the reading, state two advantages of in-circuit serial programming.

8 D flip-flops

A. Which of the inputs of the D flip-flop are

(1) Synchronous inputs

(2) Asynchronous inputs

B. Draw a timing diagram for a synchronous event in a D flip-flop that respects all timing requirements.

C. Draw a timing diagram for a synchronous event in a D flip-flop that violates a timing requirement. Show specifically in your timing diagram what timing requirement is violated.

D. (True / False) If a circuit violates a flip-flop timing requirement, it is guaranteed that the circuit will give incorrect results.

9 Words in computers

A. Name at least three types of meaning that a word of bits can have.

B. One use for a word of data is as a code, representing some meaning such as a letter. How many different codes can be represented by

(1) A 4-bit word

(2) An 8-bit word

(3) A 16-bit word

C. Of the 4-bit, 8-bit and 16-bit word sizes, which is the smallest word that can provide a different code for each letter of the Roman alphabet.

D. How many bits does the data word in a PIC18 processor have?