COSC330/PHYS306: Solutions to Homework 1

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January 29, 2024

1 Chapter 1

- Exercise 7: For the pulse shown in Fig. 1-60, graphically determine the following: (a) rise time, (b) fall time, (c) pulse width, and (d) amplitude.

  Solution: Use the graph to determine changes in time and voltage. (a) The rise time is typically measured from 10% amplitude to 90% amplitude. The amplitude is 10V, so we need the times that correspond to 9V and 1V. We have $\Delta t = 0.8 - 0.2$ μs, so 600 ns. (b) Similarly, we have $\Delta t = 3.5 - 2.9$ μs, so 600 ns. (c) THe pulse width is typically measured from 50% amplitude to 50% amplitude, so 5V and 5V. We have $\Delta t = 3.2 - 0.5$ μs, so 2.7 μs. (d) From the graph, the amplitude is 10V - 0V, so 10V.

- Exercise 8: Determine the period of the digital waveform in Fig. 1-61.

  Solution: The waveform repeats itself every 4 ms, so 4 ms.

- Exercise 9: What is the frequency of the waveform in Fig. 1-61?

  Solution: The inverse of the period is the frequency, so $1/T = f = 250$ Hz.

- Exercise 10: Is the pulse waveform in Fig. 1-61 periodic or non-periodic?

  Solution: It is periodic, from the graph.

- Exercise 11: Determine the duty cycle of the waveform in Fig. 1-61.

  Solution: The duty cycle is the ratio of pulse width to period, so 2 ms/4 ms gives 0.5 or 50 percent.

- Exercise 12: Determine the bit sequence represented by the waveform in Fig. 1-62. A bit time is 1 μs in this case.

  Solution: From the waveform, we read 10101110.

- Exercise 13: What is the the total serial transfer time for the eight bits in Fig. 1-62? What is the total parallel transfer time?

  Solution: The serial transfer time is 8 bits times 1 μs per bit, so 8 μs. For eight lines in parallel, we need only one bit time, or μs.

- Exercise 14: What is the period if the clock frequency is 3.5 GHz?

  Solution: Invert 3.5 GHz to find 0.286 ns.

- Exercise 15: Form a single logical statement from the following information: (a) The light is ON if SW1 is closed. (b) The light is ON if SW2 is closed. (c) The light is OFF if both SW1 and SW2 are open.

  Solution: This behavior resembles an OR gate. For a light, however, this can also be accomplished with a parallel power line and two lines with switches connected to the same light. A common example is a kitchen light that can be turned on with switches on each side of the room.

- Exercise 18: A basic 2-input logic circuit has a HIGH on one input and a LOW on the other input, and the output is HIGH. What type of logic ciruit is it?

  Solution: This is an OR gate.

- Exercise 20: A pulse waveform with a frequency of 10 kHz is applied to the input of a counter. During 100 ms, how many pulses are counted?

  Solution: Use $N = f\Delta t$. We have 10^{-1} s $\times$ 10^4 pulses s^{-1}, so 10^3 pulses.

- Exercise 29: A pulse is displayed on the screen of an oscilloscope, and you measure the base line as 1V and the top of the pulse as 8V. What is the amplitude?

  Solution: 8V - 1V = 7V.

- Exercise 30: A waveform is measured on the oscilloscope and its amplitude covers three vertical divisions. If the vertical control is set at 2V/div, what is the total amplitude of the waveform?

  Solution: 2V/div $\times$ 3 div is 6V.

- Exercise 31: The period of a pulse waveform measures four horizontal divisions on an oscilloscope. If the time base is set at 2 ms/div, what is the frequency of the waveform?

  Solution: First, determine the period: 8 ms (four divisions at 2ms/div). The frequency is then 1/8 kHz, or 125 Hz.