

Chapter 17 Written Problems Worksheet

Use this sheet to record your answers to the following Chapter 17 Challenge Problems.

- 17-2. Examine the square wave shown in Figure 17.26 below. Give the **pulse width** of the pulses, the **period, T** , of the wave, and the **frequency, f** , of the wave. Use appropriate units. Express the frequency in Hertz (Hz).

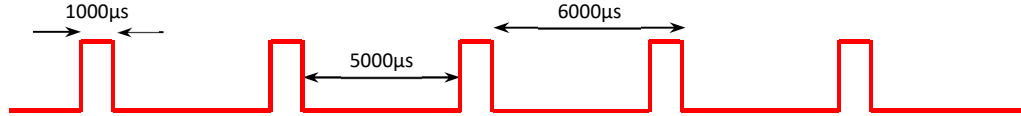


Figure 17.26. A train of pulses. What is the pulse width, period of the wave, and frequency of the wave? What is the time between a rising edge and a falling edge? What is the time between subsequent leading edges?

Pulse width = _____

Period, T = _____

Frequency, f = _____

- 17-4. Programmers can control the brightness of an LED and the speed and direction of a servomotor by varying the width of the pulses of a square wave sent to each device. What is this technique commonly called?

- 17-5. When using pulse width modulation (PWM) techniques, typically, what is the period of the square waves produced?

- 17-6. Examine the square wave shown in Figure 17.27 below. Give the **pulse width** of the pulses, the **period, T** , of the wave, and the **duty cycle** of the wave. Use appropriate units. Express the duty cycle as a percentage.

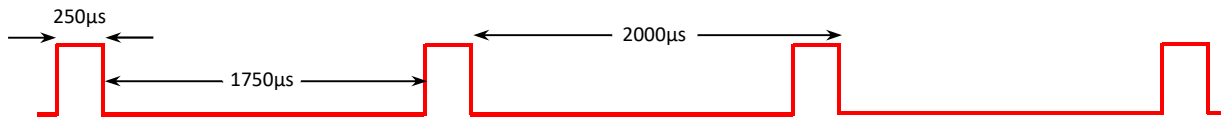


Figure 17.27. A square wave made up of a train of pulses. What is the pulse width, period of the wave, and its duty cycle?

Pulse width = _____

Period, T = _____

Duty cycle = _____

- 17-7. The code below is meant to turn on an external LED connected to pin 8 on the Teensy 3.2 microcontroller but it contains **one mistake**. Do **not** run this code with your microcontroller – instead, **identify** and **correct** the mistake.

```
void setup() {
  pinMode(8, INPUT);
}

void loop() {
  digitalWrite(8, HIGH);
}
```

- 17-8. The code below is meant to turn on an external LED connected to pin 8 on the Teensy 3.2 microcontroller but it contains **one mistake**. Do **not** run this code with your microcontroller – instead, **identify** and **correct** the mistake.

```
void setup() {  
  pinMode(8, OUTPUT);  
}  
  
void loop() {  
  analogWrite(8, 125);  
}
```

- 17-9. The code below is meant to turn on an external LED connected to pin 10 on the Teensy 3.2 microcontroller but it contains **one mistake**. Do **not** run this code with your microcontroller – instead, **identify** and **correct** the mistake.

```
void setup() {  
  pinMode(10, OUTPUT);  
}  
  
void loop() {  
  analogWrite(10, 555);  
}
```

- 17-10. Fill in the blanks of the following code with values that could be used to create the square wave shown in Figure 17.26 (see previous page) with the Teensy's signal pin 8. Assume that the signal pin has been properly placed in **OUTPUT** mode.

```
digitalWrite(8, _____);  
  
delayMicroseconds(_____);  
  
digitalWrite(8, _____);  
  
delayMicroseconds(_____);
```

- 17-11. Fill in the blanks of the following code with values that could be used to create the square wave shown in Figure 17.27 (see previous page) with the Teensy's signal pin 8. Assume that the signal pin has been properly placed in **OUTPUT** mode.

```
digitalWrite(8, _____);  
  
delayMicroseconds(_____);  
  
digitalWrite(8, _____);  
  
delayMicroseconds(_____);
```

- 17-12. Fill in the blank of the following code with values that could be used to create the square wave shown in Figure 17.27 (see first page) with the Teensy's signal pin 9. Assume that the signal pin has been properly placed in **OUTPUT** mode.

```
analogWrite(9, _____);
```

- 17-13. **[INTENSIVE ONLY]** Explain why it is possible to use the **analogWrite()** command to create the square wave shown in Figure 17.27 (see first page), but it cannot be used to create the wave shown in Figure 17.26 (see first page).

- 17-14. **[INTENSIVE ONLY]** Why is it not possible to use the **analogWrite()** command to cause the Teensy's onboard LED to blink?