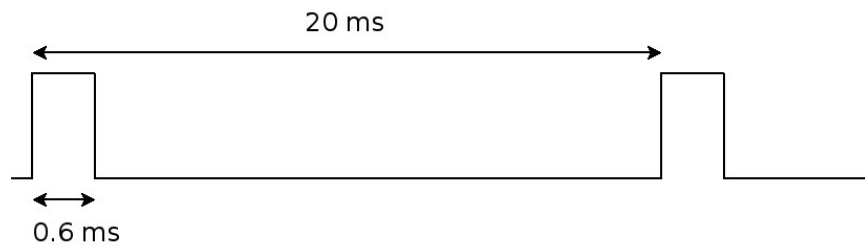


1.

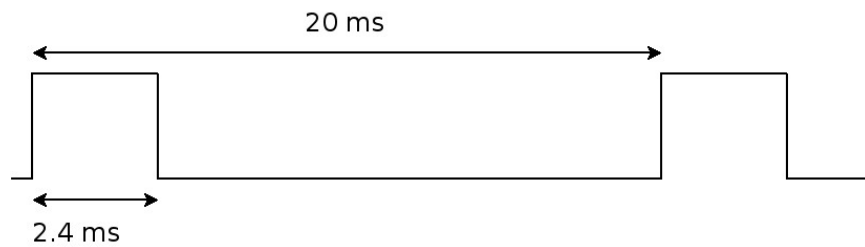
- a) A PWM signal is a means of encoding information by adjusting the lengths of time that a wave is in its high state and low state. The pulse wave has a predetermined cycle length, and the duty cycle is the percentage of the length of a cycle that the wave spends in the ON position.

b)

3% Duty Cycle:



12% Duty Cycle:



c)

```
#include <iostream>

using namespace std;

/*
 *   @func degreeToOnDelay
 *   @param    ser_pos    the position of the servo (0-180 degrees)
 *   @return    the time in microseconds that the PWM signal
 *               should be on
 */
float degreeToOnDelay (float servo_pos) {
    return (10 * servo_pos) + 600;
}

int main () {
    float pos, cycle;
    cout << "Please enter the current servo position (0-180): ";
    cin >> pos;
    cycle = degreeToOnDelay(pos);
    cout << "The PWM signal should be on for " << cycle << " microseconds" <<
        endl;

    return 0;
}
```

2.

```
bash-4.3$ echo "Hello"
Hello
bash-4.3$ echo "Hello" > message.txt
bash-4.3$ cat message.txt
Hello
bash-4.3$ echo "Hello" >> message.txt
bash-4.3$ cat message.txt
Hello
bash-4.3$ wc
Hello
How are you?
I am fine
    3    7   29
bash-4.3$ wc < message.txt
 2  2 12
```

In part 5.5, the '<' and '>' commands are used to write the appropriate port numbers to allow use of the robotic arm.