PWM and timers:

PWM outputs are generated using timers in a microcontroller. We will learn more about timers in ECE230. These timers are operated at a particular frequency to track the number of cycles in which the output signal is high or low to produce a PWM signal with the desired duty cycle (percent of time output is high). The Arduino Uno has 3 Timers and 6 PWM output pins. The relation between timers and PWM outputs is:

- Pins 5 and 6: controlled by timer0
- Pins 9 and 10: controlled by timer1
- Pins 11 and 3: controlled by timer2

Library and communication conflicts:

The complication that can arise from this connection is that sometimes the timers used for PWM are also used for other functionalities. Some of the libraries and communication methods conflict with IO pins used for PWM. Please note, this only impacts PWM usage on these pins. These pins can still be used for digital I/O, you just can't use analogWrite() on these pins while these libraries are used.

Servo Library – the servo library uses Timer1. You can't use PWM on Pin 9, 10 when you use the Servo Library on an Arduino.

Tone library – the tone() function uses at least Timer2. You can't use PWM on Pin 3,11 when you use the tone() function on Arduino Uno.

SPI communication – Pin 11 has shared functionality for PWM and MOSI. MOSI is needed for the SPI interface, you can't use PWM on Pin 11 and the SPI interface at the same time on Arduino.

Example If you used tone() to generate a sound on the buzzer, then used analogWrite() to output a PWM signal on Pin 11, you would likely notice that your buzzer no longer is playing the tone you expect. This is because the analogWrite() is using Timer2 to produce the PWM signal, so the frequency of the signal generated for tone is now the same as the PWM frequency (usually 490 Hz or 980 Hz), producing an undesirable tone.

Note that Pin 0, 1 are used for UART communication (TX, RX signals), so they cannot be used for digital I/O while **Serial** is being used.

More information and details on Arduino timers can be found at

https://arduino-info.wikispaces.com/Timers-Arduino