

Exercise 1

Delay 2ms

XTAL = 16MHz

$$\begin{aligned}\text{Max value} &= (2^8) - 1 \\ &= 255\end{aligned}$$

Prescaler	T counter clock (us) [prescaler x period (1/16 us)]	Timer Count (delay/T counter clock)
8	0.2	10,000 > 255
64	4	500 > 255
256	16	125
1024	64	31.25

Therefore suitable prescaler is 256

$$\begin{aligned}\text{Initial Counter Value} &= 255 + 1 - 125 \\ &= 131\end{aligned}$$

Exercise 2

Clock = $(1/16) \mu\text{s}$

Delay = 500 ms

$$\begin{aligned}\text{Max value} &= (2^8) - 1 \\ &= 255\end{aligned}$$

Prescaler	T counter clock(us) [prescaler x period (1/16 us)]	Timer Count (delay/T counter clock)
8	0.2	2500,000 > 255
64	4	125000 > 255
256	16	31250 > 255
1024	64	7812.5 > 255

Therefore we cannot increase the delay to 500 ms.

But can be implemented using a loop. (2ms x 250)

Exercise 3

To get the maximum time delay, We must use the maximum prescaler (1024).

As the number of bits is 8 and clock period is $\frac{1}{16}\mu s$,

$$2^8 \times \frac{1}{16} \times 10^{-6} \times 1024 = 16.384 \text{ ms}$$