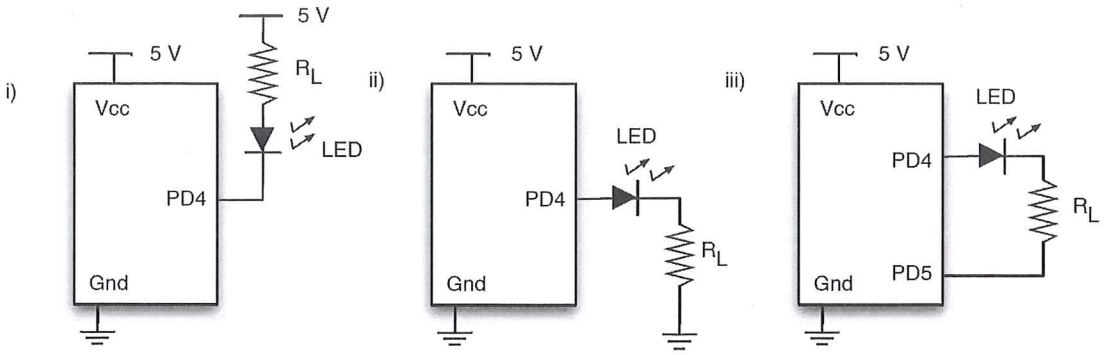
ENCE260 Embedded Systems tutorial 2 solutions

Q1



The resistor R_L in each case controls the current & hence luminance of the LED.

2) a) 0 = input 1 = output

PB7	PB6	PB5	PB4	PB3	PB2	PB1	PB0
1	1	1	0	1	1	1	1

0XEF

b) L6 & L7

c) R3 is a guard resistor in case PB4 is accidentally set as a high output.

d) There is no pull-up resistor to 5V, for when the switch is not pushed.

e) PORTB &= ~(1<<7);

f) PB0 = 1, PB2 = 0, PB3 = 0 (L1 & L3 on)
PB1 = 0 (L2 & L4 off)
PB6 = 1, PB7 = 1 (L6 & L7 off)
PB5 = 0 (L5 off)
PB4 does not matter as input

PB7	PB6	PB5	PB4	PB3	PB2	PB1	PB0
1	1	0	0	0	0	0	1
128	64	32	16	8	4	2	1

decimal value = 128 + 64 + 1 = 193

3) a) 10

b)
```
#define HUEY 10
#define DEWEY 400
#define LOUIE 10
flasher (HUEY, DEWEY, LOUIE);
```

c) $\text{Duty-cycle} = \dfrac{\text{ON_TIME}}{\text{ON_TIME} + \text{OFF_TIME}}$

This will vary!

$\text{Duty-cycle} = \dfrac{\text{HUEY}}{\text{DEWEY} - \text{LOUIE} + \text{HUEY}}$

$\text{Max Duty-cycle} = \dfrac{10}{400 - 9 + 10} = \dfrac{10}{401}$

$= 2.49\ \%$

$\text{Min Duty-cycle} = \dfrac{10}{400 - 0 + 10} = \dfrac{10}{410} = \dfrac{1}{41}$

$= 2.44\ \%$

d) Data abstraction allows routines to be used independently of the architecture.