# Lab 1: Pre-Lab Assignment - SOLUTIONS Spring 2019

Student Name:		
_		
	Date	

1. (2 points) Enable the clock of GPIO Port A (for joystick), Port B (for Red LED) and Port E (for Green LED)

Register	31	30	29	28	27	26	25	24	23	22	21	20	19	18	11	16	15	14	13	12	11	10	6	8	7	9	2	4	3	2	-	0
AHB2ENR														RNGEN		AESEN			ADCEN	OTGFSEN					GPIOHEN	GPIOGEN	GPIOFEN	GPIOEEN	GPIODEN	GPIOCEN	GPIOBEN	GPIOAEN
Mask	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Value																												1			1	1

MASK = 0x00000013;

RCC->AHB2ENR = 0x00000013;

Alternative solution (using constants in C):

RCC->AHB2ENR |= (RCC\_AHB2ENR\_GPIOAEN | RCC\_AHB2ENR\_GPIOBEN | RCC\_AHB2ENR\_GPIOEEN);

- 2. (2 points) Pin Initialization for Red LED (PB 2)
  - a. Configure PB 2 as Output

GPIO Mode: Input (00), Output (01), Alternative Function (10), Analog (11, default)

Register	31	30	29	28	27	26	25	24	23	52	21	20	19	18	17	16	15	14	13	15	11	10	စ	ω	_	9	2	4	်	7	1	0
MODER	7	MODER 19[1:0]	MODEP 14[1:0]		. 4364.		MODED 12[1:0]	171	7	MODER 1 [1:0]	0.101010101	MODER IULIU	10.100110.01	MODENS[1.0]	MACDED 914-01	MODERA[1.0]	MACDED 254:01	ואוסטפראין וייטן	10.110.01	INCDERel I.U.	10.03	WODERSI I.U.	10.17	MODEN4[1.0]	MODED 254.01	MODERS[I.U]	MODED 254:01	וןאסט	10.11.01	MODEN [[.0]	MODE DOI:01	MODEL (9)
Mask	0	0	0	0	00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 0	1	0	0	00	0
Value																											0	1				

In this case, you need two masks: one to clear bits 5 and 4 and another to set bit 4. It is also possible to clear only bit 5.

GPIOB Mode Register MASK Value = 0x00000030 and 0x00000010 (in HEX)

```
GPIOB->MODER &= \sim(0x00000030); //Clear bits 4 and 5
GPIOB->MODER |= 0x00000010; //Set bit 4
```

#### **Alternative solution:**

```
GPIOB->MODER &= ~(0x03<<4);
GPIOB->MODER |= 1<<4;
```

**Alternative solution (using constants in C):** 

GPIOB->MODER &= ~(GPIO\_MODER\_MODE2);

**GPIOB->MODER** |= **GPIO\_MODER\_MODE2\_0**;

#### b. Configure PB 2 Output Type as Push-Pull

Push-Pull (0, reset), Open-Drain (1)

Register	31 30 30 29 29 27 29 24 29 29 29 20 19 10 10 10 10 10 10 10 10 10 10 10 10 10		6 4	13	12	11	10	တ ထ	_	9	2	4	3	7	_	0
OTYPER		OT4E		OT13	OT12	ı⊢ ı	<u>`</u> II	OT9 OT8	OT7	ОТ6	OT5	OT4	ОТЗ	ОТ2	OT1	ОТО
Mask	Reserved		0	0	0	0	0	0 0	0	0	0	0	0	1	0	0
Value														0		

GPIOB Output Type Register MASK Value = 0x00000004 (in HEX)

**GPIOB->OTYPER** &=  $\sim$ (0x00000004);

**Alternative solutions:** 

GPIOB->OTYPER &= ~(1<<3);

**GPIOB->OTYPER &= ~(GPIO\_OTYPER\_OT2);** 

## c. Configure PB 2 Output Type as No Pull-up No Pull-down

NO PUPD (00, reset), Pullup (01), Pulldown (10), Reserved (11)

Register	31	29 28	27 26	25 24	22 23	21 20	6 8	16	15	13	1 6	၈ ထ	     	2 4	8 2	0
PUPDR	PUPDR15[1:0]	PUPDR14[1:0]	PUPDR13[1:0]	PUPDR12[1:0]	PUPDR11[1:0]	PUPDR10[1:0]	PUPDR9[1:0]	PUPDR8[1:0]	PUPDR7[1:0]	PUPDR6[1:0]	PUPDR5[1:0]	PUPDR4[1:0]	PUPDR3[1:0]	PUPDR2[1:0]	PUPDR1[1:0]	PUPDR0[1:0]
Mask	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 1	0 0	0 0
Value														0 0		

GPIOB Pull-up Pull-down Register MASK Value = 0x00000030 (in HEX)

**GPIOB->PUPDR &= \sim(0x00000030)**;

**Alternative solutions:** 

**GPIOB->PUPDR &= \sim(0x03<<4)**;

**GPIOB->PUPDR &= ~GPIO\_PUPDR\_PUPD2**;

## 3. (2 points) Pin Initialization for Green LED (PE 8)

## a. Configure PE 8 as Output

GPIO Mode: Input (00), Output (01), Alternative Function (10), Analog (11, default)

Regis	ter	31	30	29	28	27	<b>5</b> 6	25	24	23	22	7	20	19	18	17	16	15	4	13	12	11	9	6	∞	7	9	2	4	3	7	_	0
MODE	R	2	MODER19[1:0]	MODERATION		MODER13[1:0]		MODER12[1:0]	. 1	MODEB11[1:0]		MODER 10[1:0]	ין טועי-	MODERALI-01	MODELIAS[1:0]	MODER8[1:0]		MODER7[1-0]	[o]	MODERA[1:0]	MODEL (VI)	MODER5[1:0]	[o]o	MODERAL1-01	[0.1]	MODEB3[1:0]	MODERAJ I.UJ	MODER 2011-01	- ואלו	MODER1[1:0]	[o., ],	MODERO[1:0]	MOCELVOI 1:0]
Masi	<b>(</b>	0	0	0	0	0	0	0	0	00		0	0		0	1	1	0	0	0	0	00	0	0	0		00	0	0		0	0	0
Valu	e															0	1																

In this case, you need two masks: one to clear bits 17 and 16 and another to set bit 16. It is also possible to clear only bit 17.

GPIOE Mode Register MASK Value = 0x00030000 and 0x00010000 (in HEX)

```
GPIOE->MODER &= ~(0x00030000); //Clear bits 17 and 16

GPIOE->MODER |= 0x00010000; //Set bit 16
```

**Alternative solutions:** 

```
GPIOE->MODER &= ~0x03<<16;
GPIOE->MODER |= 1<<16;
```

**Alternative solution (using constants in C):** 

```
GPIOE->MODER &= ~GPIO_MODER_MODE8;
GPIOE->MODER |= GPIO_MODER_MODE8_0;
```

#### b. Configure PE 8 Output Type as Push-Pull

Push-Pull (0, reset), Open-Drain (1)

Register	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	9	တ	œ	7	9	2	4	3	2	1	0
OTYPER																	OT15	OT14	OT13	OT12	OT11	OT10	ОТЭ	ОТВ	OT7	ОТб	OT5	OT4	ОТЗ	OT2	OT1	ОТО
Mask							F	Rese	erve	d							0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Value																								0								

GPIOE Output Type Register MASK Value = 0x00000100 (in HEX)

**GPIOE->OTYPER** &=  $\sim$ (0x00000100);

**Alternative solutions:** 

**GPIOE->OTYPER &= ~(1<<8)**;

**GPIOE->OTYPER &= ~(GPIO\_OTYPER\_OT8)**;

### c. Configure PE 8 Output Type as No Pull-up No Pull-down

NO PUPD (00, reset), Pullup (01), Pulldown (10), Reserved (11)

Register	31	29	27 26	25 24	22 23	21 20	18		15 14	2 4	1 6	တ ထ	<b> </b>   9	<b>c</b> 4	8 2	1
PUPDR	PUPDR15[1:0]	PUPDR14[1:0]	PUPDR13[1:0]	PUPDR12[1:0]	PUPDR11[1:0]	PUPDR10[1:0]	PUPDR9[1:0]	PUPDR8[1:0]	PUPDR7[1:0]	PUPDR6[1:0]	PUPDR5[1:0]	PUPDR4[1:0]	PUPDR3[1:0]	PUPDR2[1:0]	PUPDR1[1:0]	PUPDR0[1:0]
Mask	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 1	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Value								0 0								

GPIOE Pull-up Pull-down Register MASK Value = **0**x**00030000** (in HEX)

**GPIOE->PUPDR** &=  $\sim$ (0x00030000);

**Alternative solutions:** 

**GPIOE->PUPDR &= \sim(0x03<<16)**;

**GPIOE->PUPDR &= ~GPIO\_PUPDR\_PUPD8**;

#### 4. (2 points) Pin Initialization for Joy Stick

a. Configure PA0 (Center), PA1 (Left), PA2 (Right), PA3 (Up), and PA5 (Down) as Input

GPIO Mode: Input (00), Output (01), Alternative Function (10), Analog (11, default)

Register	31	30	53	28	27	26	25	24	23	22	21	20	19	18	17	16	15	4	13	12	11	9	6	∞	7	ဖ	2	4	3	7	_	0
MODER	777	MODER 13[1:0]	MODE B14[1:0]	DEN 14[ 1.	_	שכו	MODER12[1:0]	טבויובן ו	2,7	INCDER   I.O.	MODER10[1:0]	MODELNIO[1.0]	MODEP9[1:0]	MODEL (3[1.0]	MODED811.01	ואוסטבו גפן ו. טן	MODER7[1:0]	[5::]	MODEDE[1:0]	MODERO[1.0]	MODER 5[1-0]	MODEL (9]	MODERAL1:01	WODE114[1:0]	MODER3[1:0]	MODEL (8)	MODED261:01	-	MODEP 1[1:0]	MODELY I[ 1:0]	MODEROIT-01	[o:-]o:-]
Mask	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1
Value																					0	0			0	0	0	0	0	0	0	0

GPIOA Mode Register MASK Value = 0x00000CFF (in HEX)

GPIOA->MODER &=  $\sim$ (0x00000CFF);

**Alternative solution (using constants in C):** 

GPIOA->MODER &= ~(GPIO\_MODER\_MODEO | GPIO\_MODER\_MODE1 | PIO\_MODER\_MODE2 | GPIO\_MODER\_MODE3 | GPIO\_MODER\_MODE5);

b. Configure PA0 (Center), PA1 (Left), PA2 (Right), PA3 (Up), and PA5 (Down) as Pulldown

NO PUPD (00, reset), Pullup (01), Pulldown (10), Reserved (11)

Register	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17		15	14	13	12	11	10	9	8	7	9	2	4	8	7	1	0
PUPDR	77	PUPURISI U	2.7	ר ו	72072	UPU	PI IPDR10[1:0]	ולאו עוכ	DI IDDB 44 [4:0]		7	PUPDR10[1:0]	0.00	PUPURS[1:0]	10. 178 97 91 19	- 1040	10. 172 20 10	בו ער	I). PDRRIT (1)	- 100	10: 173 AUGI 10		PI IPDR4[1-0]	ו הוא וס	[0.15DB3[4.0]		10.112000110	ואור	[0: 1] Fadai la	[0:1] [0:0]	10-130909119	ווסאטרט
Mask	0	_	0	0	00	0 0	0	0	•	0	0	0	0	00	0 0	0	0	0	00	0	1 1	1	0	0	1	1 0	1	1	1 1	1 0	1	1 0
Value																					1	0			1	0	1	0	1	0	1	0

In this case, you need two masks: one to clear bits 11, 10, 7, 6, 5, 4, 3, 2, 1 and 0, and another to set bits 11, 7, 5, 3, and 1. It is also possible to clear only bits 10, 6, 4, 2 and 0. GPIOE Pull-up Pull-down Register MASK Value = 0x00000CFF and 0x000008AA (in HEX)

#### **Alternative solution:**

GPIOA->PUPDR &= ~(GPIO\_PUPDR\_PUPD0 | GPIO\_PUPDR\_PUPD1 | GPIO\_PUPDR\_PUPD2 | GPIO\_PUPDR\_PUPD3 | GPIO\_PUPDR\_PUPD5);

GPIOA->PUPDR |= (GPIO\_PUPDR\_PUPD0\_1 | GPIO\_PUPDR\_PUPD1\_1 | GPIO\_PUPDR\_PUPD2\_1 | GPIO\_PUPDR\_PUPD3\_1 | GPIO\_PUPDR\_PUPD5\_1);