

**TRƯỜNG ĐẠI HỌC BÁCH KHOA – TP. HỒ CHÍ MINH**  
**KHOA KHOA HỌC VÀ KỸ THUẬT MÁY TÍNH**

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**Lab 1 - LED Animation**  
**Microcontroller - Microprocessor (Lab)**

**COURSE ID: CO3010 - HK251**

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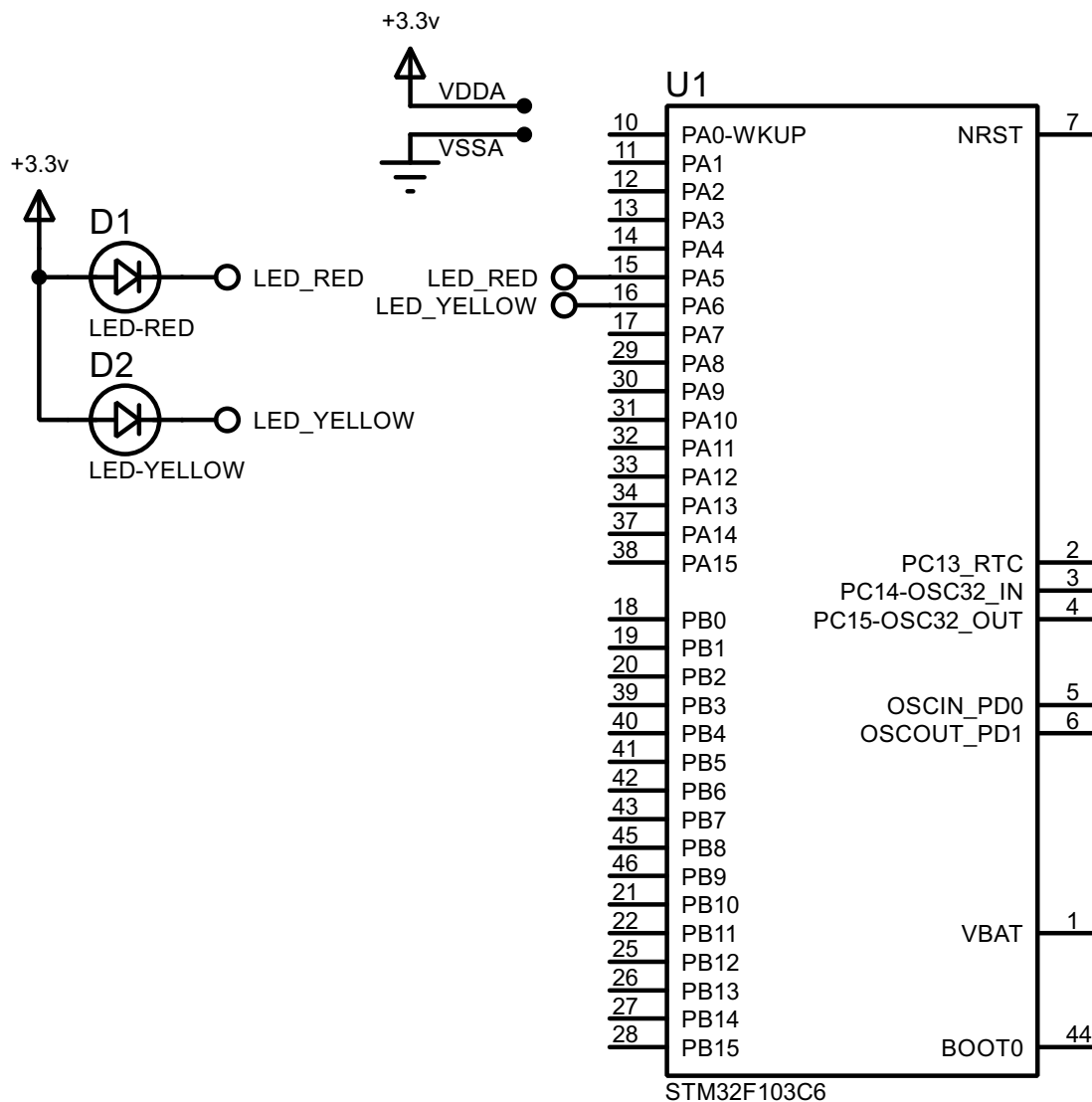
**Supervising Lecturer: Dr. VÕ TUẤN BÌNH**

# 1 Exercise

The GitHub link for the lab files: [https://github.com/hygameo/VXL-VDK\\_2352458](https://github.com/hygameo/VXL-VDK_2352458)

## 1.1 Exercise 1

1.1.1 Report 1: Depict the schematic from Proteus simulation in this report.

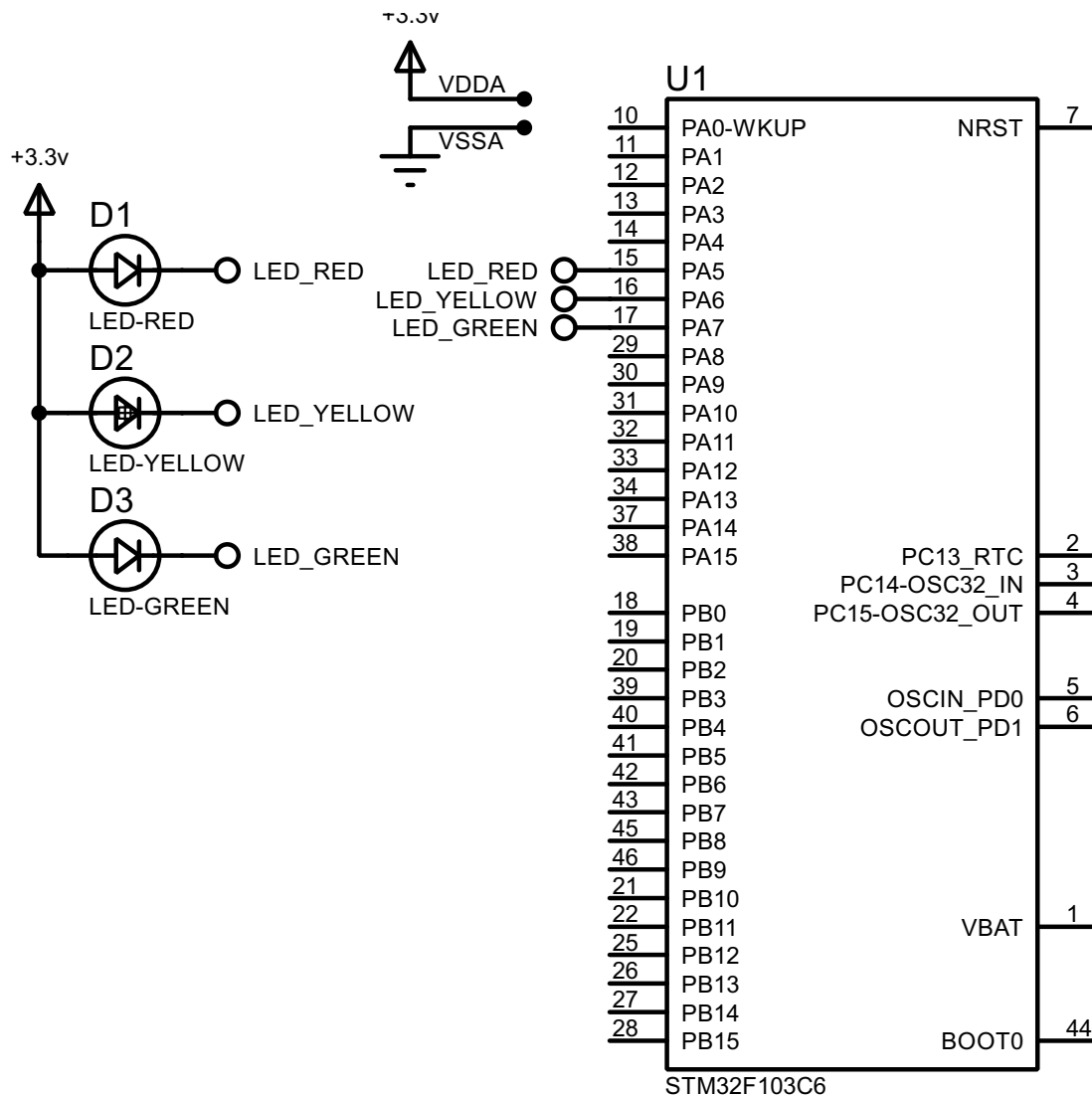


1.1.2 Report 2: Present the source code in the infinite loop while of your project.

```
1 HAL_GPIO_WritePin(GPIOA, LED_RED_Pin, GPIO_PIN_SET);  
2 HAL_GPIO_WritePin(GPIOA, LED_YELLOW_Pin, GPIO_PIN_RESET);  
3  
4 while (1)  
5 {  
6     HAL_GPIO_TogglePin(GPIOA, LED_RED_Pin | LED_YELLOW_Pin);  
7     HAL_Delay(2000);  
8 }
```

## 1.2 Exercise 2

### 1.2.1 Report 1: Present the schematic.



### 1.2.2 Report 2: Present the source code in while.

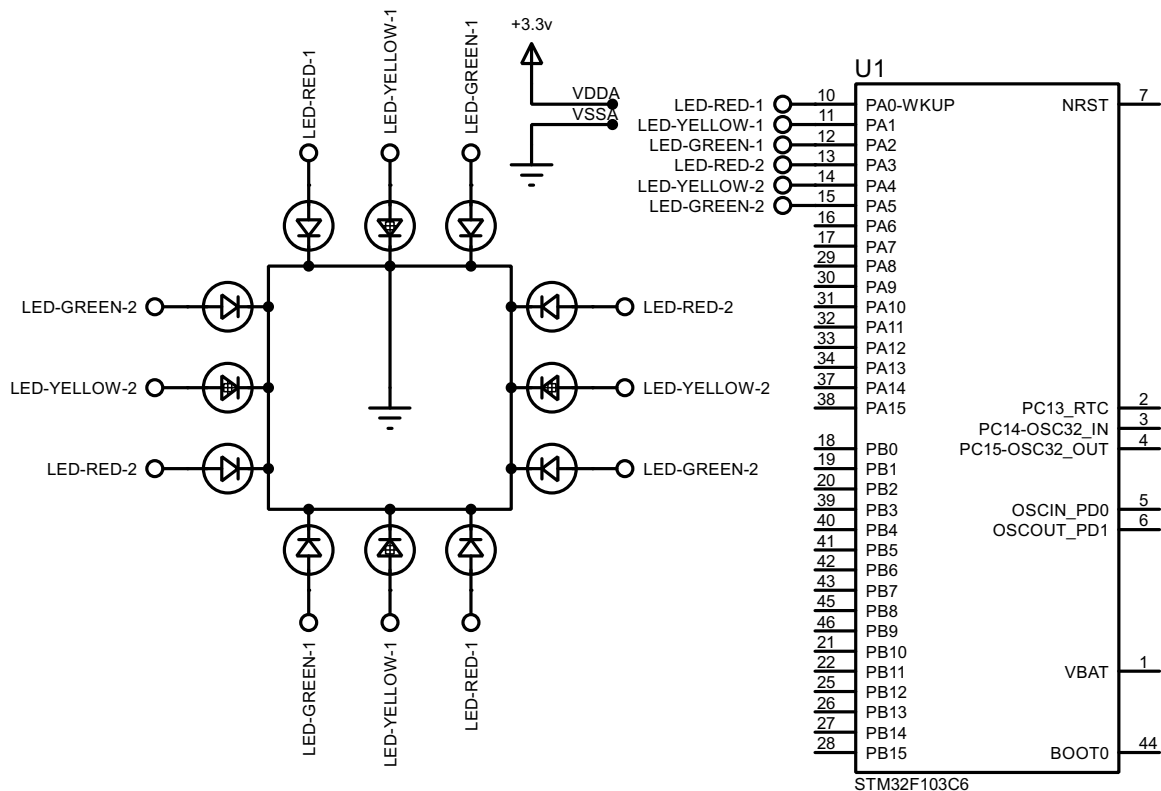
```

1 while (1)
2 {
3     HAL_GPIO_WritePin(GPIOA, LED_RED_Pin, GPIO_PIN_RESET);
4     HAL_GPIO_WritePin(GPIOA, LED_YELLOW_Pin, GPIO_PIN_SET);
5     HAL_GPIO_WritePin(GPIOA, LED_GREEN_Pin, GPIO_PIN_SET);
6     HAL_Delay(5000);
7
8     HAL_GPIO_TogglePin(GPIOA, LED_RED_Pin | LED_YELLOW_Pin);
9     HAL_Delay(2000);
10
11    HAL_GPIO_TogglePin(GPIOA, LED_YELLOW_Pin | LED_GREEN_Pin);
12    HAL_Delay(3000);
13 }

```

## 1.3 Exercise 3

### 1.3.1 Report 1: Present the schematic.



### 1.3.2 Report 2: Present the source code in while.

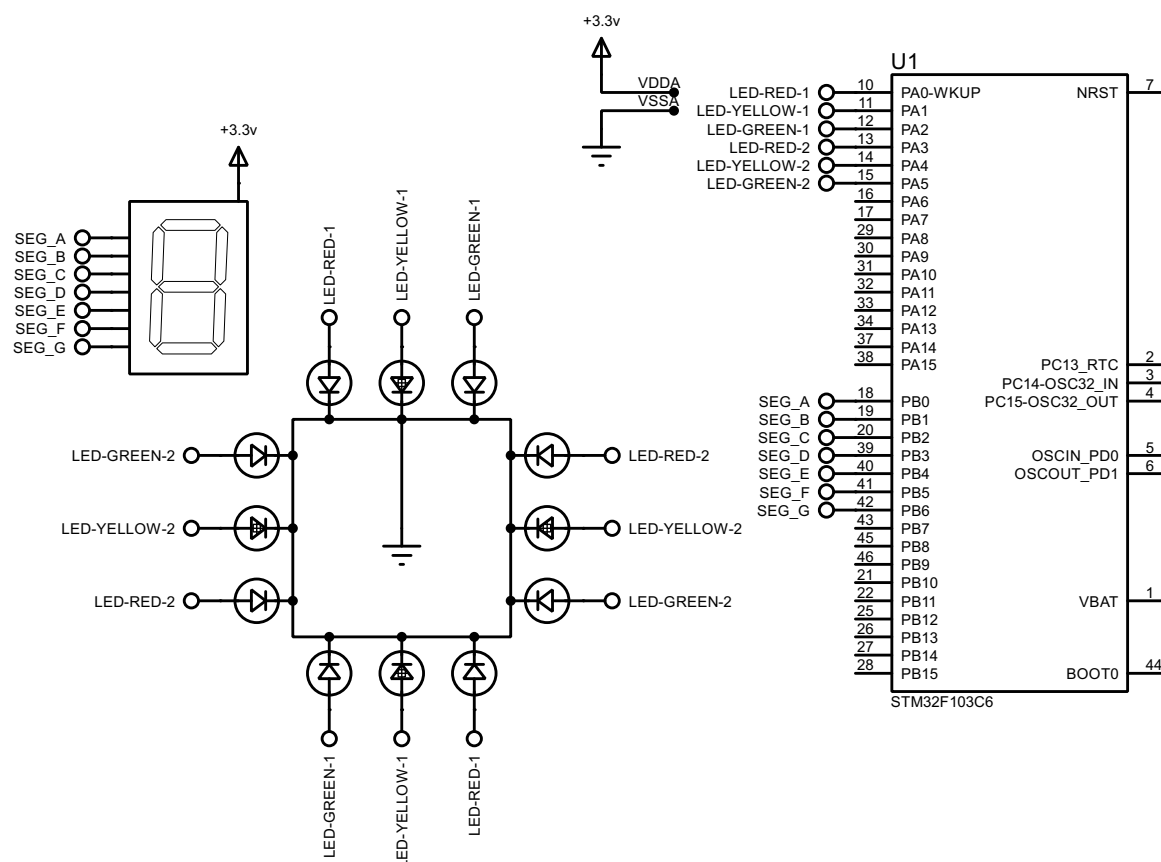
```

1 typedef enum {
2     RED = 0, YELLOW = 1, GREEN = 2
3 } LED;
4 void setLED(LED Road1LED, LED Road2LED, int sec) {
5     HAL_GPIO_WritePin(GPIOA,
6         LED_RED_1_Pin | LED_YELLOW_1_Pin |
7         LED_GREEN_1_Pin | LED_RED_2_Pin |
8         LED_YELLOW_2_Pin | LED_GREEN_2_Pin, GPIO_PIN_RESET);
9     HAL_GPIO_TogglePin(GPIOA,
10        (Road1LED == RED ? LED_RED_1_Pin : (Road1LED == YELLOW ?
11            LED_YELLOW_1_Pin : LED_GREEN_1_Pin)) |
12        (Road2LED == RED ? LED_RED_2_Pin : (Road2LED == YELLOW ?
13            LED_YELLOW_2_Pin : LED_GREEN_2_Pin))
14    );
15    HAL_Delay(sec * 1000);
16 }
17 int main(void){
18     while (1){
19         setLED(RED, GREEN, 3);
20         setLED(RED, YELLOW, 2);
21         setLED(GREEN, RED, 3);
22         setLED(YELLOW, RED, 2);
23     }
24 }

```

## 1.4 Exercise 4

### 1.4.1 Report 1: Present the schematic.



### 1.4.2 Report 2: Present the source code for display7SEG function.

```

1  uint8_t segmentMap[10] = {
2      0b1111110, 0b0110000,
3      0b1101101, 0b1111001,
4      0b0110011, 0b1011011,
5      0b1011111, 0b1110000,
6      0b1111111, 0b1111011
7  };
8
9  uint8_t SegPin[7] = {
10     SEG_A_Pin, SEG_B_Pin,
11     SEG_C_Pin, SEG_D_Pin,
12     SEG_E_Pin, SEG_F_Pin,
13     SEG_G_Pin
14 };
15
16 void display7SEG(int num) {
17     uint8_t bitmask = segmentMap[num];
18
19     for(int i = 0; i < 7; i++) HAL_GPIO_WritePin(GPIOB, SegPin[i], (
20         bitmask & (1 << (6 - i))) ? RESET : SET);

```

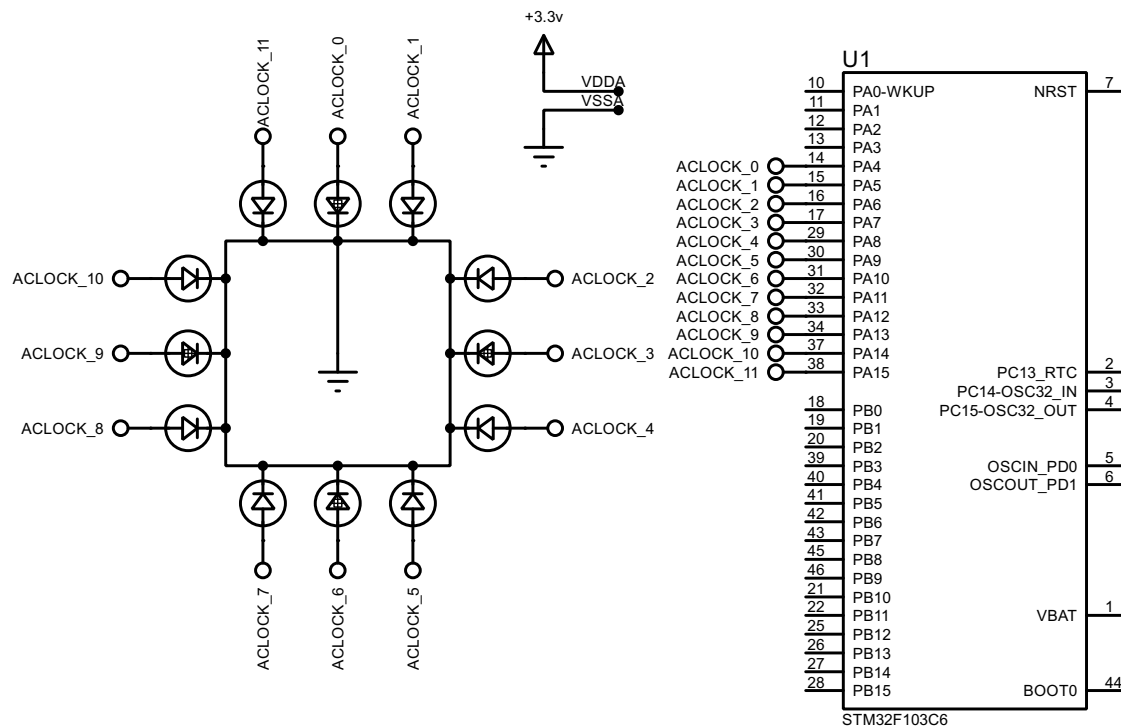
## 1.5 Exercise 5

### 1.5.1 Report 1: Present the source code.

```
1  typedef enum {
2      RED = 0, YELLOW = 1, GREEN = 2
3  } LED;
4  uint8_t segmentMap[10] = {
5      0b1111110, 0b0110000,
6      0b1101101, 0b1111001,
7      0b0110011, 0b1011011,
8      0b1011111, 0b1110000,
9      0b1111111, 0b1111011
10 };
11 uint8_t SegPin[7] = {
12     SEG_A_Pin, SEG_B_Pin,
13     SEG_C_Pin, SEG_D_Pin,
14     SEG_E_Pin, SEG_F_Pin,
15     SEG_G_Pin
16 };
17 void display7SEG(int num) {
18     uint8_t bitmask = segmentMap[num];
19
20     for(int i = 0; i < 7; i++) HAL_GPIO_WritePin(GPIOB, SegPin[i], (
21         bitmask & (1 << (6 - i))) ? RESET : SET);
22 }
23 void setLED(LED Road1LED, LED Road2LED, int sec){
24     HAL_GPIO_WritePin(GPIOA,
25         LED_RED_1_Pin | LED_YELLOW_1_Pin |
26         LED_GREEN_1_Pin | LED_RED_2_Pin |
27         LED_YELLOW_2_Pin | LED_GREEN_2_Pin , GPIO_PIN_RESET);
28
29     HAL_GPIO_TogglePin(GPIOA,
30         (Road1LED == RED ? LED_RED_1_Pin : (Road1LED == YELLOW ?
31             LED_YELLOW_1_Pin : LED_GREEN_1_Pin)) |
32         (Road2LED == RED ? LED_RED_2_Pin : (Road2LED == YELLOW ?
33             LED_YELLOW_2_Pin : LED_GREEN_2_Pin))
34     );
35
36     for(int i = sec; i > 0; i--){
37         display7SEG(i);
38         HAL_Delay(1000);
39     }
40 }
41 int main(void)
42 {
43     while (1)
44     {
45         setLED(RED, GREEN, 3);
46         setLED(RED, YELLOW, 2);
47         setLED(GREEN, RED, 3);
48         setLED(YELLOW, RED, 2);
49     }
50 }
```

## 1.6 Exercise 6

### 1.6.1 Report 1: Present the schematic.



### 1.6.2 Report 2: Implement a simple program to test the connection of every single LED.

```

1  uint16_t ACLOCK_Pins[12] = {
2      ACLOCK_0_Pin , ACLOCK_1_Pin , ACLOCK_2_Pin ,
3      ACLOCK_3_Pin , ACLOCK_4_Pin , ACLOCK_5_Pin ,
4      ACLOCK_6_Pin , ACLOCK_7_Pin , ACLOCK_8_Pin ,
5      ACLOCK_9_Pin , ACLOCK_10_Pin, ACLOCK_11_Pin
6  };
7
8  int main(void)
9  {
10     while (1)
11     {
12         for(int i = 0; i < 12; i++){
13             HAL_GPIO_WritePin(GPIOA, ACLOCK_Pins[i], GPIO_PIN_SET);
14             HAL_Delay(250);
15         }
16         for(int i = 11; i > 0; i--){
17             HAL_GPIO_WritePin(GPIOA, ACLOCK_Pins[i], GPIO_PIN_RESET);
18             HAL_Delay(250);
19         }
20     }
21 }

```

## 1.7 Exercise 7

### 1.7.1 Report 1: Present the source code of this function.

```
1 void clearAllClock(void) {  
2     for (int i = 0; i < 12; i++) HAL_GPIO_WritePin(GPIOA, ACLOCK_Pins[  
3         i], GPIO_PIN_RESET);  
}
```

## 1.8 Exercise 8

### 1.8.1 Report 1: Present the source code of this function.

```
1 void setNumberOnClock(int num) {  
2     HAL_GPIO_WritePin(GPIOA, ACLOCK_Pins[num], GPIO_PIN_SET);  
3 }
```

## 1.9 Exercise 9

### 1.9.1 Report 1: Present the source code of this function.

```
1 void clearNumberOnClock(int num) {  
2     HAL_GPIO_WritePin(GPIOA, ACLOCK_Pins[num], GPIO_PIN_RESET);  
3 }
```

## 1.10 Exercise 10

### 1.10.1 Report 1: Integrate the whole system and use 12 LEDs to display a clock.

```
1 int hour = 0;  
2 int minute = 0;  
3 int second = 0;  
4  
5 while (1)  
6 {  
7     clearAllClock();  
8     setNumberOnClock(hour % 12);  
9     setNumberOnClock((minute / 5) % 12);  
10    setNumberOnClock((second / 5) % 12);  
11  
12    second++;  
13  
14    if(second == 60){ second = 0; minute++; }  
15    if(minute == 60){ minute = 0; hour++; }  
16  
17    if(hour == 12) hour = 0;  
18  
19    HAL_Delay(10);  
20 }
```