```
  /* USER CODE END 1 */

  /* MCU Configuration--------------------------------------------------------*/

  /* Reset of all peripherals, Initializes the Flash interface and the Systick. */
  HAL_Init();

  /* Configure the system clock */
  SystemClock_Config();

  /* Initialize all configured peripherals */
  MX_GPIO_Init();

  /* USER CODE BEGIN 2 */
  /* USER CODE END 2 */

  /* Infinite loop */
  /* USER CODE BEGIN WHILE */
  while (1)
  {
  /* USER CODE END WHILE */
            int j;
            GPIOA->ODR ^= 1<<5;
            for(j=0;j<2000000;j++);


  /* USER CODE BEGIN 3 */

  }
  /* USER CODE END 3 */
}
```

2 Using debugging feature, set Breakpoint at "for loop", then debug on STM32F4 Discovery Board.

2.1 From STM32F4XX Reference manual, what are these GPIO registers

2.1.1 GPIOD_MODER : Mode Register

0x40020C00

2.1.2 GPIOD_OTYPER : type Register

0x0

2.1.3 GPIOD_OSPEEDR

0xc0000000

2.1.4 GPOD_PUPDR

0x64000000

2.1.5 GPIOD_ODR

0x20 : ไฟติด

0x0 : ไฟดับ

2.2 Using step/suspend/resume debugging feature on SW4STM32, what is the value of GPIOD_MODER and GPIOD_ODR from the start of debugging and breakpoint. What are the relations to LEDs' Discovery Board.

MODER : 0xa8000000 → 0xa8000400

ODR : 0xa8000000 → 0x0 → 0x20 → 0x0 → . . .

LED ไฟดับ LED ไฟติด

3 Create a new project with 4 times speed of System Clock using "Clock Configuration" on STM32CubeMX. What are the value of PLLP, PLLN and PLLM register, before and after set the new speed. (Look at RCC register on STM32F407 Reference manual)

Before : CLK 25 : /2, x50, /8

After : CLK 100 : /2, x100, /8

4 Use a STM32 Cube embedded software libraries instead of direct register assignation and for loop delay (using functions from stm32f4xx_hal.c and stm32f4xx_hal_gpio.c in STM32F4xx_HAL_Driver) to create a same behavior as example code on 1.

```
int main(){
    ;
    while(1){
        int j;
        HAL_GPIO_TogglePin(GPIOA, GPIO_PIN_5);
        HAL_Delay(1000);
    }
}
```