If you are using the board STM32F4Discovery from the lab, they are likely to be pre-install debugger as J-Link, if not, it would be ST-Link. You can change the debugger probe between ST-Link and J-Link here.

You can then hit "Debug"

Lab Exercises

1 Create a new STM32 Project by following the Getting Started guide, and insert new main function code as below.

```
int main(void)
{

  /* USER CODE BEGIN 1 */
    uint32_t i,j;
```

```
/* 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 (GPIO port mode register)

               configure the I/O direction mode

2.1.2   GPIOD_OTYPER (GPIO port output type register)

configure output type of the I/O port.

2.1.3   GPIOD_OSPEEDR (GPIO port output speed register)

configure the I/O output speed.

2.1.4   GPOD_PUPDR (GPIO port output pull-up/pull-down register)

configure the I/O pull-up or pull-down.

2.1.5   GPIOD_ODR (GPIO port output data register)

can be read and written.

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.

Start of debugging

GPIO MODER : 0xa8000000
GPIO ODR   : 0xa8000000

Breakpoint

GPIO MODER : 0xa80004a0
GPIO ODR   : 0xc20

At the start of debugging,
LED has no light. The value of GPIO MODER and ODR are 0xa8000000.
At the breakpoint,
The LED's light is turn on.
The value of GPIO MODER has changed to 0xa80004a0.
The value of GPIO ODR has changed to 0xc20.

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)

25 MHz

PLLP : 0x0
PLLN : 0x0 (N1,N4,N5 → 0x1)
PLLM : 0x0 (M3 → 0x1)

100 MHz

PLLP : 0x0
PLLN : 0x0 (N2,N5,N6 → 0x1)
PLLM : 0x0 (M3 → 0x1)

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 j;
GPIOA->ODR ^= 1<<5;
for(j=0;j<2000000;j++);
```

→

HAL_GPIO_TogglePin(GPIOA, GPIO_PIN_5);
HAL_Delay(1000);