Session 3

Objective

- Gaining skills working with Clocking Configuration of MCU
- Gaining skills working with Timer and DAC peripherals
- Gaining skills working with oscilloscope

Software

1. STM32CubeCLT
2. VS Code
3. Extensions for VS Code:
   - STM32Cube for Visual Studio Code
   - Output Colorizer
4. Terminal
5. MultiVirAnalyzer

Hardware

1. Laboratory Stand
2. Oscilloscope

Task

Prerequisites

- [ ] 1. Using Laboratory Stand Schematic find DAC outputs and define what pins of MCU they are connected to.
- [ ] 2. Using MCU Datasheet determine what DAC and what channels are connected to the pins.
- [ ] 3. Examine the NUCLEO Board, find an external oscillator and determine its value.

Main

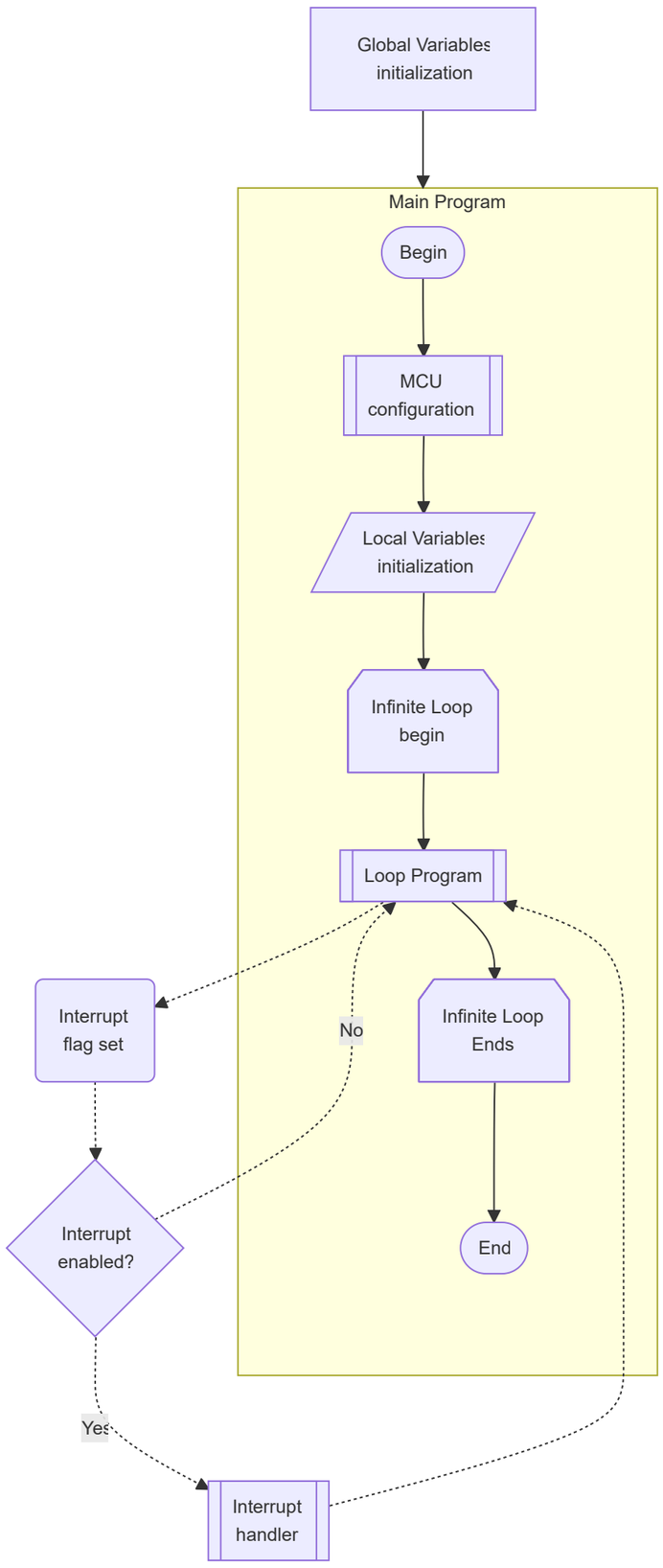
- [ ] 1. Configure system clocking including buses' prescalers and PLL coefficients so that you will get CPU clock according to your variant using an external oscillator and PLL. Refer to MCU Datasheet for max values of Main Clock and Bus clocks.
- [ ] 2. Enable FPU using this line

```
SCB->CPACR |= (3UL << 10 * 2) | (3UL << 11 * 2);
```

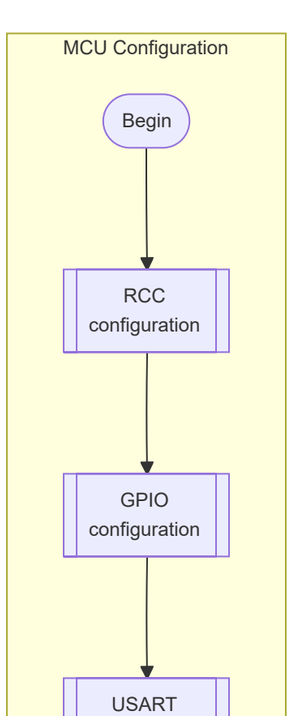
- [ ] 3. Enable clocking on needed peripherals.
- [ ] 4. Configure GPIO for USART and DAC.
- [ ] 5. Configure DAC.
- [ ] 6. Configure USART for data exchange.
- [ ] 7. Choose Timer for interrupt generation and configure it.
- [ ] 8. Turn on interrupts needed in NVIC.
- [ ] 9. Start DAC conversions and Timer counting.
- [ ] 10. Write a program that uses Timer Interrupt Handler to generate sine wave on DAC Channel output with its frequency and amplitude according to the variant.
- [ ] 11. Add a possibility to change frequency and amplitude using USART communication with PC.

Guide

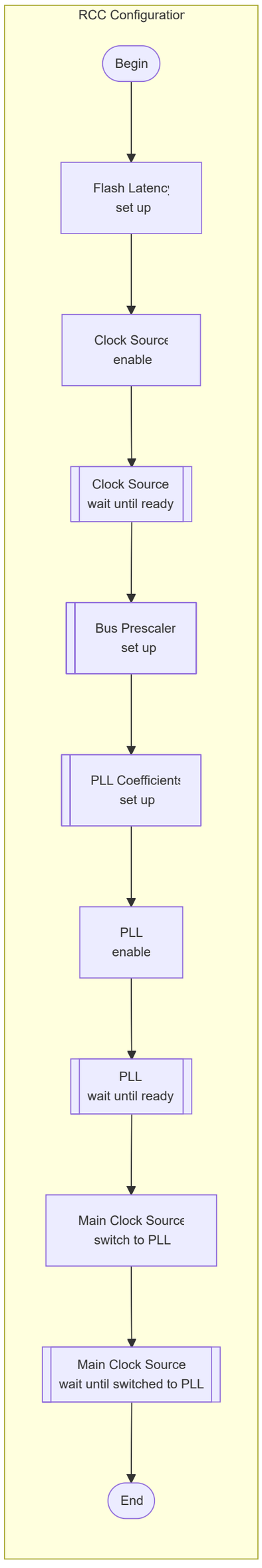
Recollect recommended program flow for the interrupt-driven application



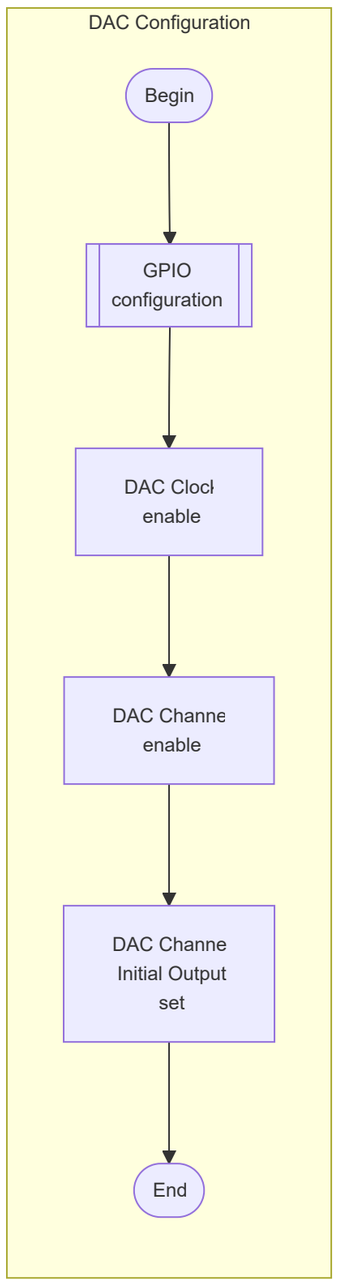
In case of this Laboratory Work MCU Configuration will include:



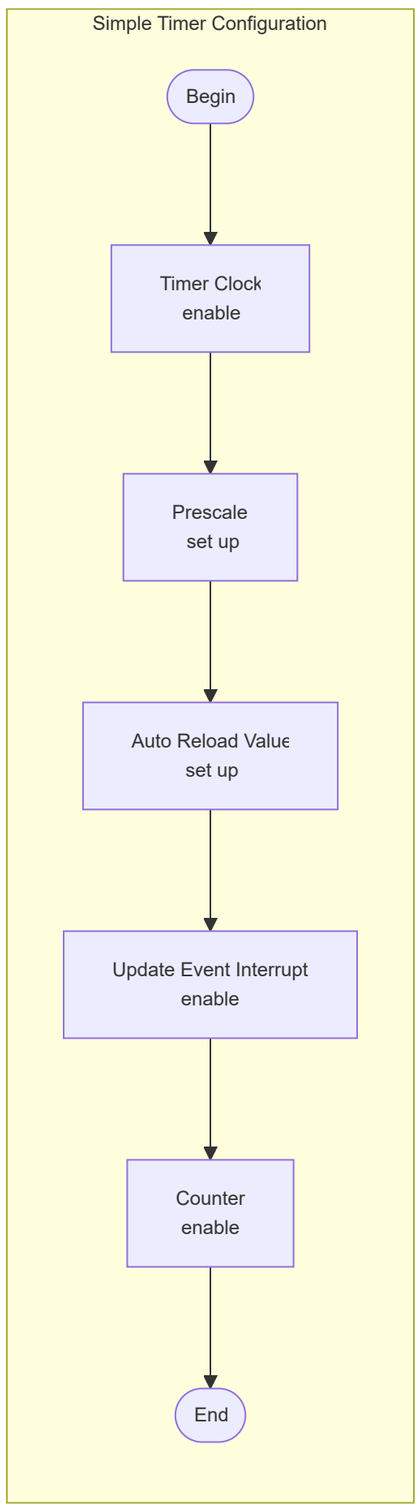
RCC Configuration with PLL flow chart



DAC configuration includes



Timer configuration includes



Options

Variant	CPU Frequency, MHz	Sine Frequency, Hz	Amplitude, V
1	40	10	1
2	50	15	1.5
3	60	20	2
4	70	25	2.5
5	80	30	3
6	90	10	1

Variant	CPU Frequency, MHz	Sine Frequency, Hz	Amplitude, V
7	100	15	1.5
8	110	20	2
9	120	25	2.5
10	130	30	3
11	140	10	1
12	150	15	1.5
13	160	20	2
14	170	25	2.5
15	180	30	3

Advanced

Implement other signal shapes: square, triangle, saw.

Questions

1. What clock sources are in microcontollers?
2. How MCU clock can be changed?
3. Why do we need frequency prescalers for buses?
4. In what moment clocking on peripheral should be enabled and why?
5. What resolution DAC has?
6. What maximum voltage level can DAC give?
7. What is Prescaler of the Timer?
8. What is Auto Reload Value of the Timer?
9. What is Update Event in the Timer?
10. How we can control timing in MCU program using Timers?