Week 10 Lab

CC2511

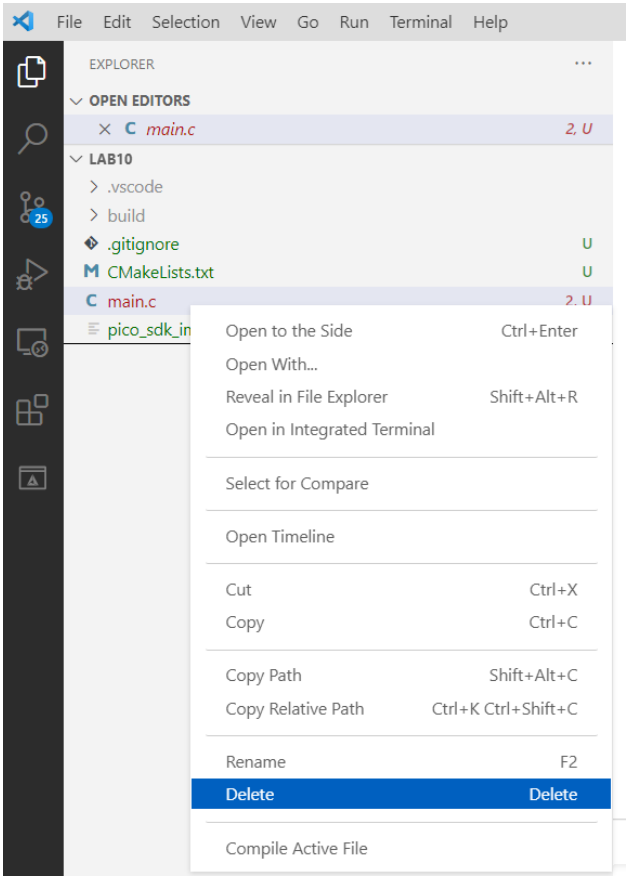
Task Description

Your task is to write an assembly language program to blink the on-board LED. This is similar to your first C program back in Week 3, except that now you're doing it in hand-written assembly.

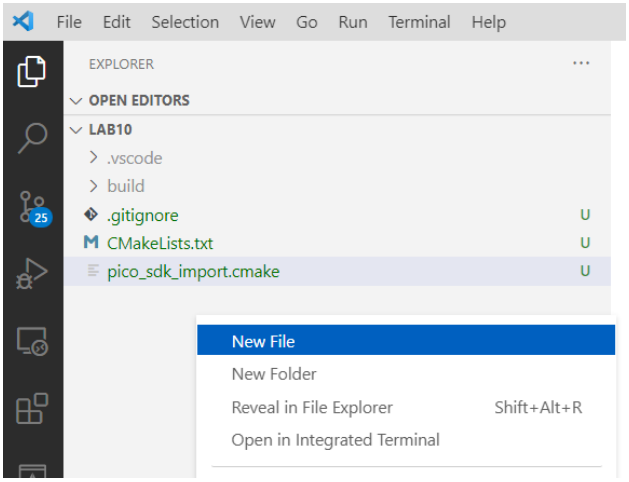
The purpose of this task is to learn the fundamentals of ARM assembly, to prepare for a more advanced task next week.

Suggested steps

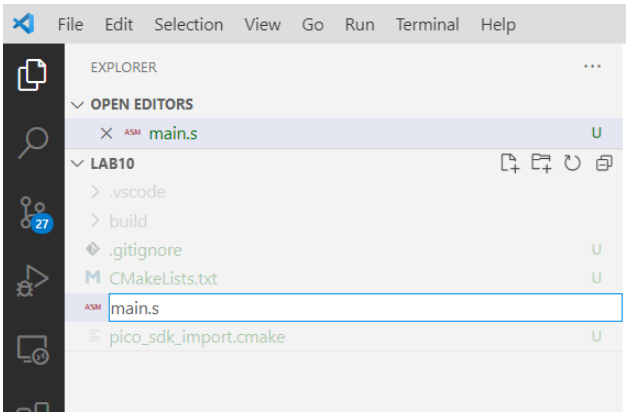
1. Create a new Pico project with Picoprobe debugger support and without any extra libraries.
2. **Delete the main.c** file by right clicking on it in the Source view.



3. Right click within the Explorer pane and choose **New File**.



4. Name the file as **main.s**



5. Open **CMakeLists.txt** and change **main.c** to **main.s**.
6. Copy and paste the starter code from LearnJCU.
7. Build the project (press F7) at this point to make sure that everything is set up correctly.

Hints

- You can write to peripheral registers by:
  1. Loading the address into a general purpose register,
  2. Loading the value into another general purpose register, and
  3. Using the `str` instruction.
- You must first configure the relevant pins for GPIO. Refer back to your Week 3 lab to determine which registers you need to set.

Note that you may need to look up addresses of these registers in the reference manual!

- You can emulate the C operators `|`, & and ~ using the assembly instructions below:

C	Assembly
|	orrs
&	ands
~	mvn

- You can delay by creating a loop that counts down from a large number. This is probably what you did in Week 3; now you must implement this in assembly code. Use conditional branch instructions to achieve this loop.
- Assembly language code must be well commented, or else it becomes difficult to read.
- Some developers find it useful to write C-like pseudo-code in a comment before each block of assembly code, e.g.:

```
/* *REG_GPIO_OE_SET = r1; */
ldr  r0, =REG_GPIO_OE_SET
str  r1, [r0]
```

- The ARM instruction set is documented online:

`https://developer.arm.com/documentation/dui0662/a/The-Cortex-M0--Instruction-Set?lang=en`

Assessment

To complete this lab task, you must demonstrate to your prac tutor:

- A working board that blinks at least one LED.
- Handwritten assembly code implementing this task that is well commented.