Arduino Environment Guide for Andes Corvette-F1/T1

CS340400 Compiler Design

Outline

- Install Arduino
- Install Andes Corvette-F1/T1 Board Package
- Usage

Install Arduino

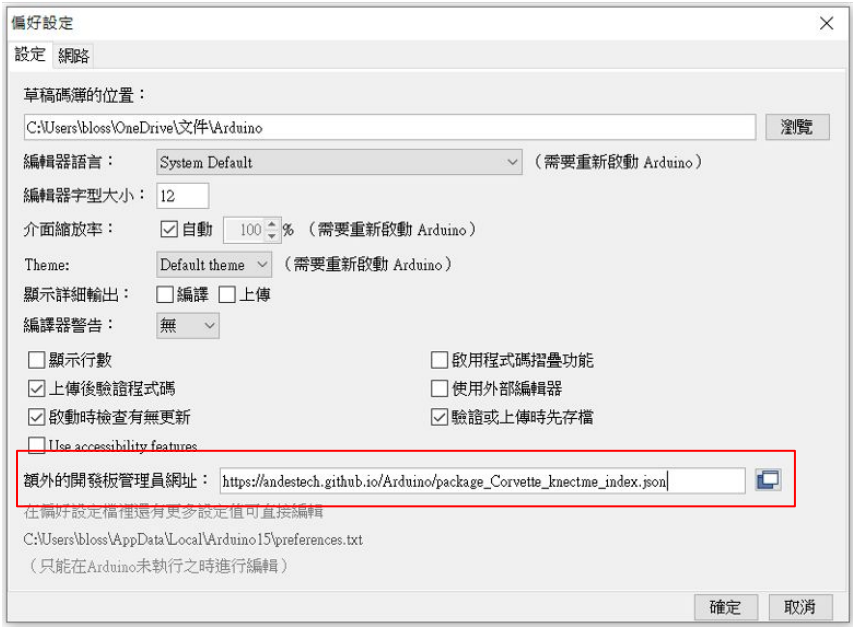
- System Requirements
  - OS: Windows 7 or above (Windows 10/11 tested)
  - USB: USB 2.0 or above
- Install Arduino 1.8.1 or above
  - 1.8.13/1.8.19/2.3.2 have been tested
  - If you find any problem when using other newer version, try switching to older version
    - https://www.arduino.cc/en/software/OldSoftwareReleases > Arduino 1.8.x

Install Andes Corvette-T1 Board Package

- Add Boards Manager URLs
- Install Board Package
- Install Andes Driver

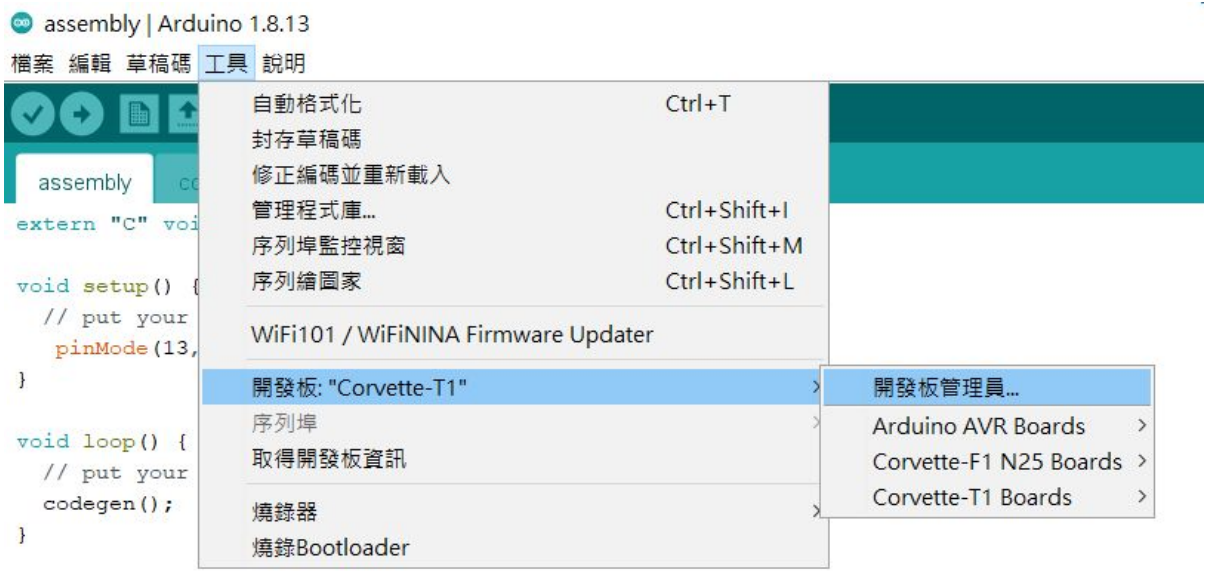
Add Boards Manager URLs

- Navigate to File > Preferences (檔案 > 偏好設定)
- Paste to additional boards manager URLs (額外的開發板管理員網址)
  - https://andestech.github.io/Arduino/package_Corvette_knectme_index.json



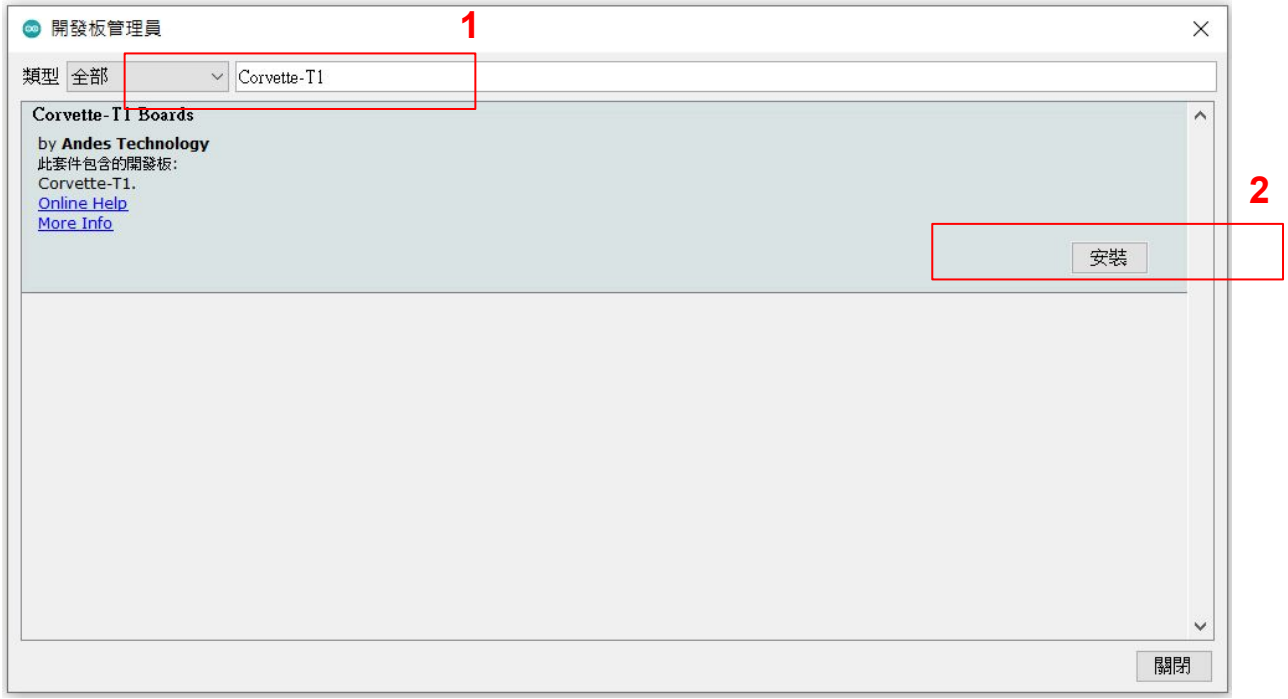
Install Board Package

- Navigate to Tools > Board: > Boards Manager… (工具>開發板>開發板管理員)



Install Board Package - T1 (cont.)

- Search for Corvette-T1 and install Corvette-T1 Boards (Corvette-F1 N25 for F1)



Install Andes Driver

- Find Arduino's AppData directory, it may be different from the following paths, depending on your system.
  - C:\Users\${USERNAME}\AppData\Roaming\Arduino15\
  - C:\Users\${USERNAME}\AppData\Local\Arduino15\
- Execute install_driver.exe & reboot your computer
  - Arduino15\packages\Corvette\tools\burner\5.1.0- ast\libusb-AICE-driver\Install_driver.exe

Usage

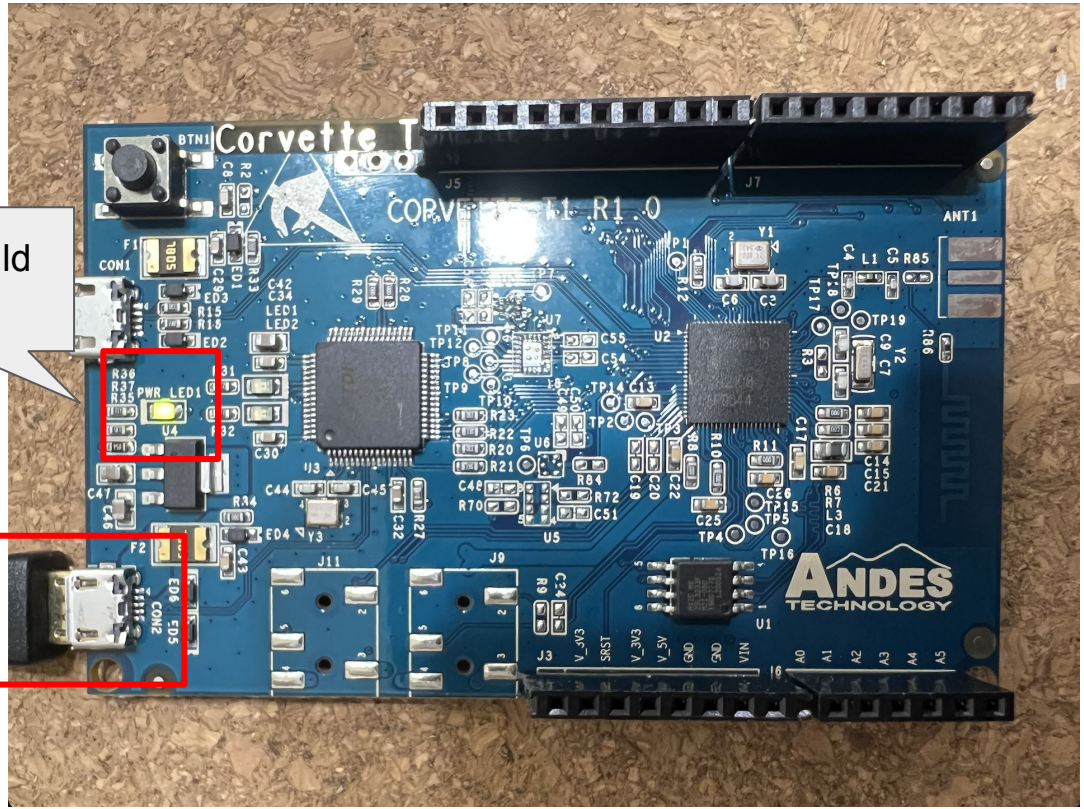
- Connect Corvette-F1/T1 to USB
- Set Board-to-Use in Arduino
- Upload/Test Sample Assembly Project

Connect Corvette-T1 to USB

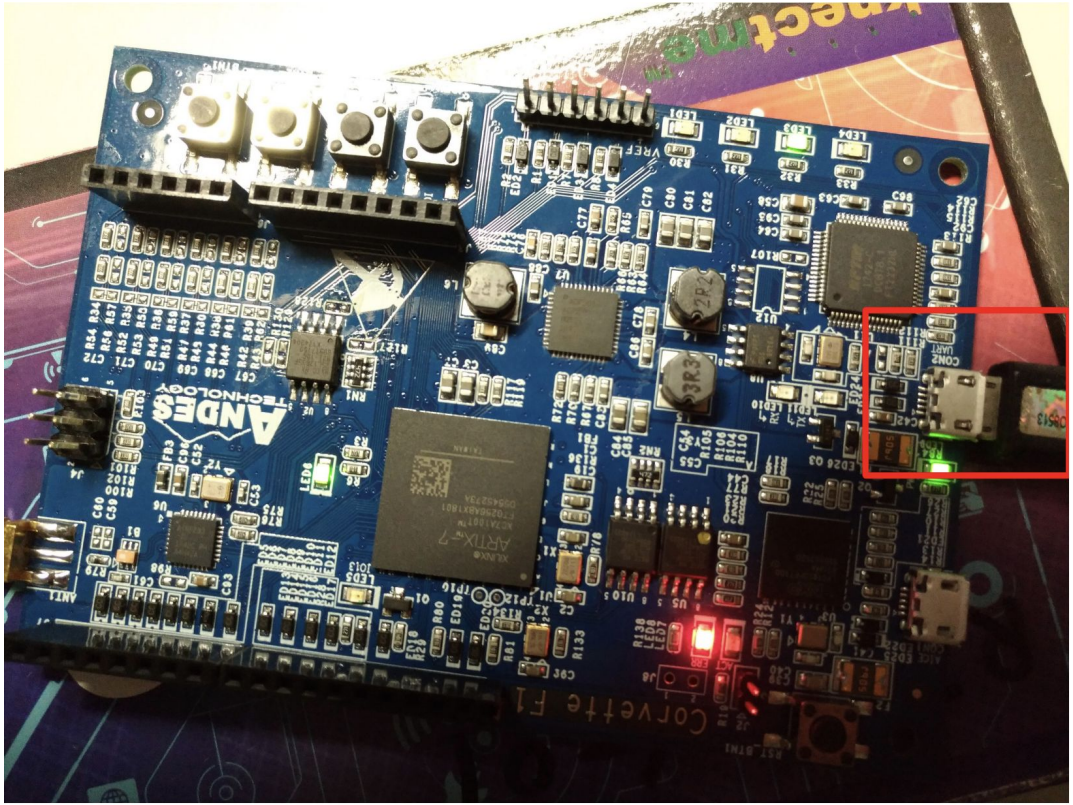
1. Connect USB to your computer

LED1 should light up

2. Connect Micro USB port “COM2”



Connect Corvette-F1 to USB

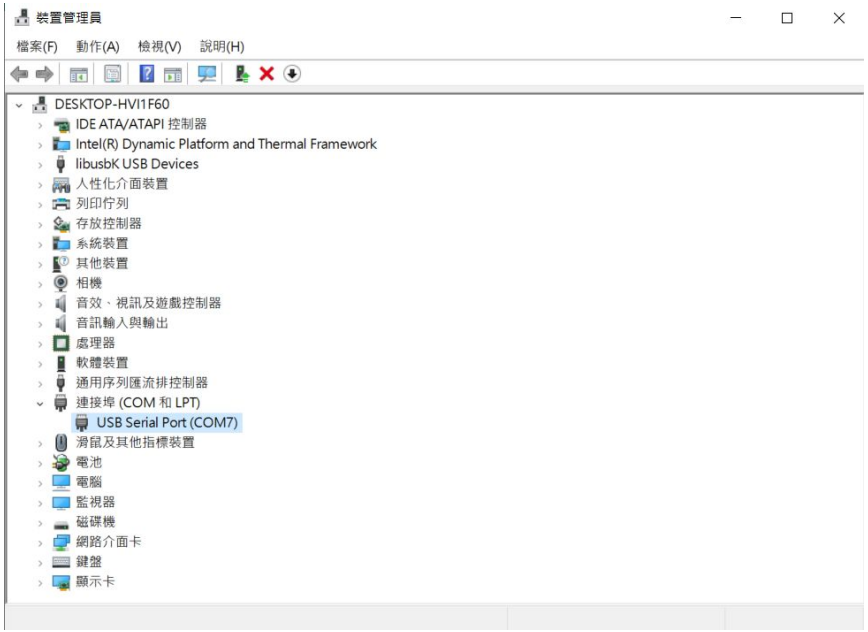


1. Connect USB to your computer

2. Connect Micro USB port “COM2”

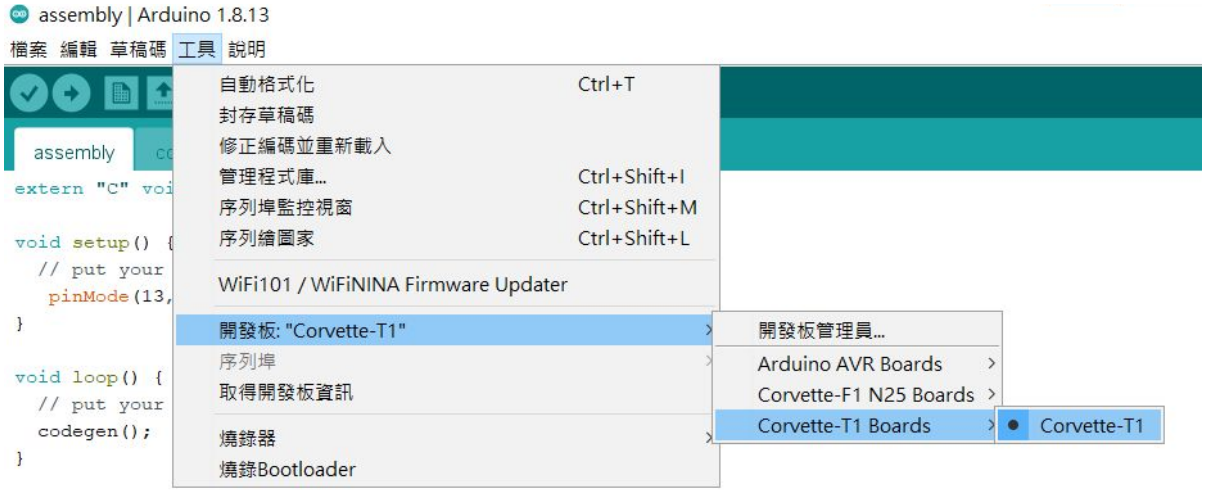
Connect Corvette-T1 to USB (cont.)

- In your device manager (裝置管理員), “USB Serial Port (COMX)” should appear. (e.g. COM7, COM6, …)



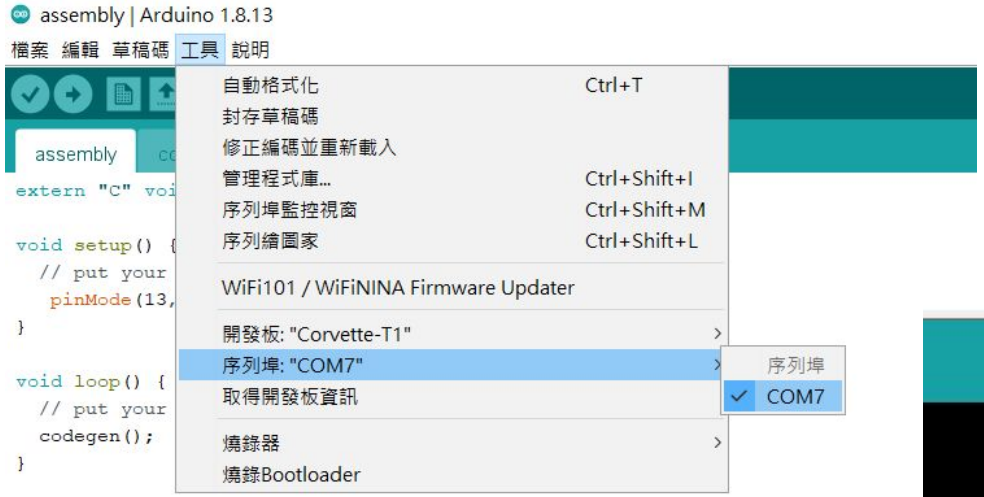
Set Board-to-Use in Arduino

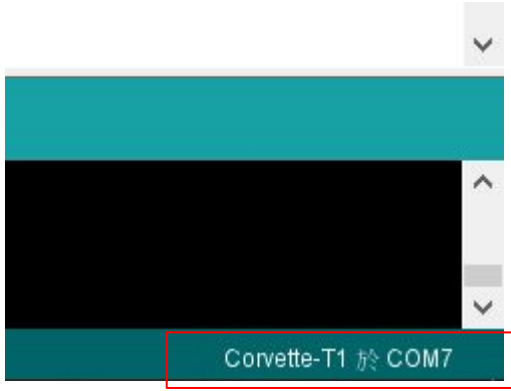
- Navigate to Tools > Board: and select Corvette-T1.



Set Board-to-Use in Arduino (cont.)

- Navigate to Tools > Port, choose the serial port appears in your device manager “USB Serial Port (COMx)”.

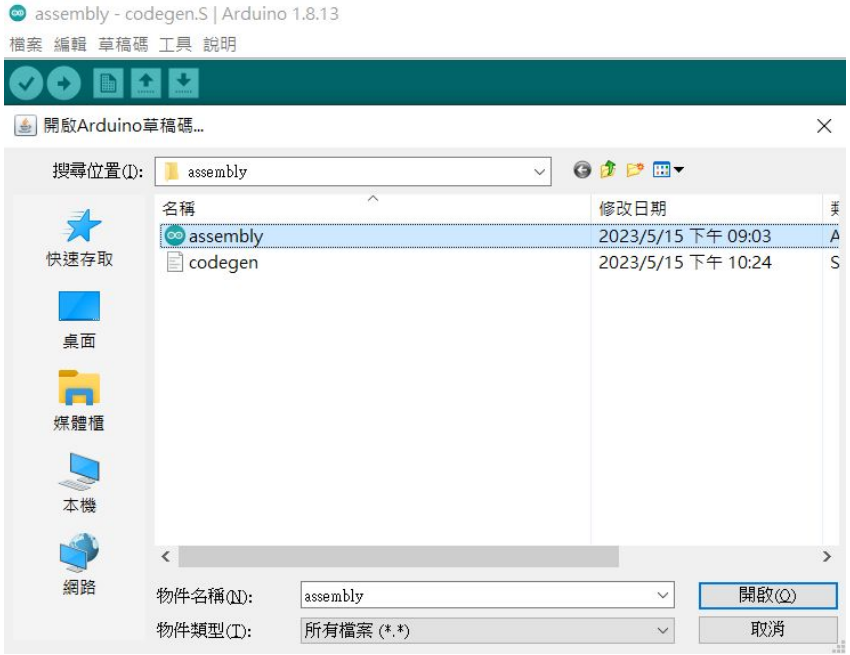




Success!

Upload/Test Sample Assembly Project

- Download sample - Corvette.zip from eeclass
- Navigate to File > Open, and open Corvette/assembly_T1/assembly.ino



Upload/Test Sample Assembly Project (cont.)

- In Arduino IDE, there will have two files, *assembly* and *codegen.S*.

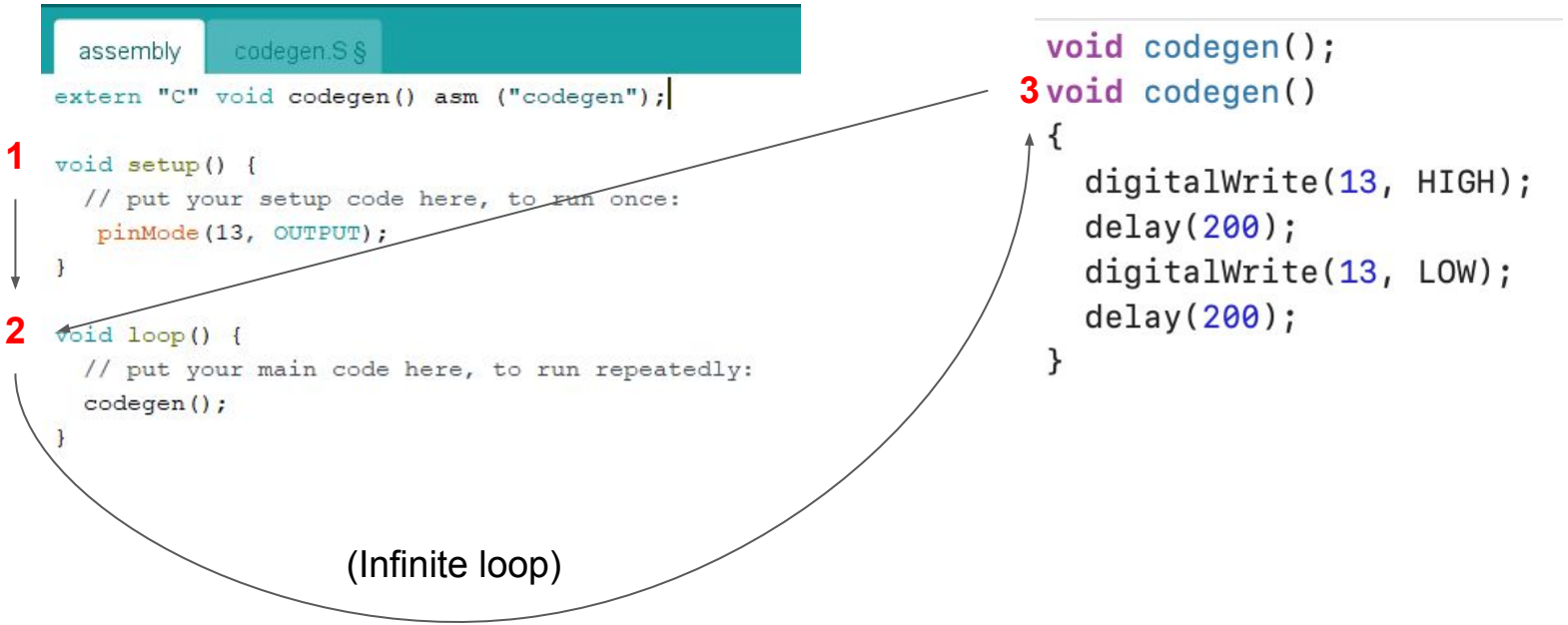
assembly | codegen.S §

```
extern "C" void codegen() asm ("codegen");

void setup() {
  // put your setup code here, to run once:
   pinMode(13, OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  codegen();
}
```

Sample Assembly Project Explained



Sample Assembly Project Explained (cont.)

- In HW3, you need to compile similar C programs to codegen.S

```
void codegen();
void codegen()
{
  digitalWrite(13, HIGH);
  delay(200);
  digitalWrite(13, LOW);
  delay(200);
}
```

assembly | codegen.S

```
// END PROLOGUE
```

```
addi sp, sp, -4
sw ra, 0(sp)
li a0, 13
li a1, 1
jal ra, digitalWrite
lw ra, 0(sp)
addi sp, sp, 4
```

pin13: LED3

```
addi sp, sp, -4
sw ra, 0(sp)
li a0, 200
jal ra, delay
lw ra, 0(sp)
addi sp, sp, 4
```

delay 200ms

```
addi sp, sp, -4
sw ra, 0(sp)
li a0, 13
li a1, 0
jal ra, digitalWrite
lw ra, 0(sp)
addi sp, sp, 4
```

```
addi sp, sp, -4
sw ra, 0(sp)
li a0, 200
jal ra, delay
lw ra, 0(sp)
addi sp, sp, 4
```

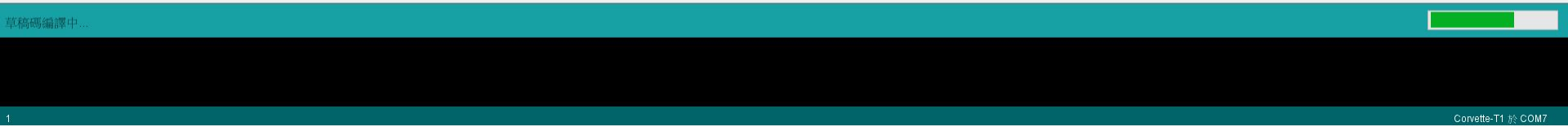
delay 200ms

Compile&Upload Program to Corvette-T1

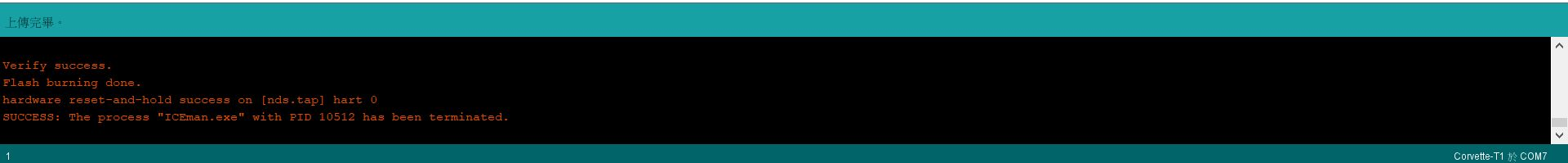
- Click upload icon 

to upload program to Corvette-T1.

- Wait for compiling assembly&codegen.S to the final executable.



- Upload success!



Compile&Upload Program to Corvette-T1 (cont.)

- LED3 should blink (on for 0.2 sec, off for 0.2 sec, on for 0.2 sec, …)
- **[Important!]** Try to modify delay's parameter to larger number (e.g. from 200 to 2000), save codegen.S, and upload again. See if the LED blinks slower.

LED3 is at the back of the board.

assembly | codegen.S §

```
// END PROLOGUE

addi sp, sp, -4
sw ra, 0(sp)
li a0, 13
li a1, 1
jal ra, digitalWrite
lw ra, 0(sp)
addi sp, sp, 4

addi sp, sp, -4
sw ra, 0(sp)
li a0, 2000
jal ra, delay
lw ra, 0(sp)
addi sp, sp, 4

addi sp, sp, -4
sw ra, 0(sp)
li a0, 13
li a1, 0
jal ra, digitalWrite
lw ra, 0(sp)
addi sp, sp, 4

addi sp, sp, -4
sw ra, 0(sp)
li a0, 2000
jal ra, delay
lw ra, 0(sp)
addi sp, sp, 4
```

Useful Reference

- 【2-1】Corvette-T1的Arduino IDE開發環境
- 【2-2】Corvette-T1的Arduino IDE實習範例
- RISC-V Specifications
- Introduction to Assembly: RISC-V Instruction Set Architecture, Berkeley

Thanks