A. 前置作業：

1. 至官網安裝 win10 版本的 Visual Studio Code (Download Visual Studio Code - Mac, Linux, Windows)

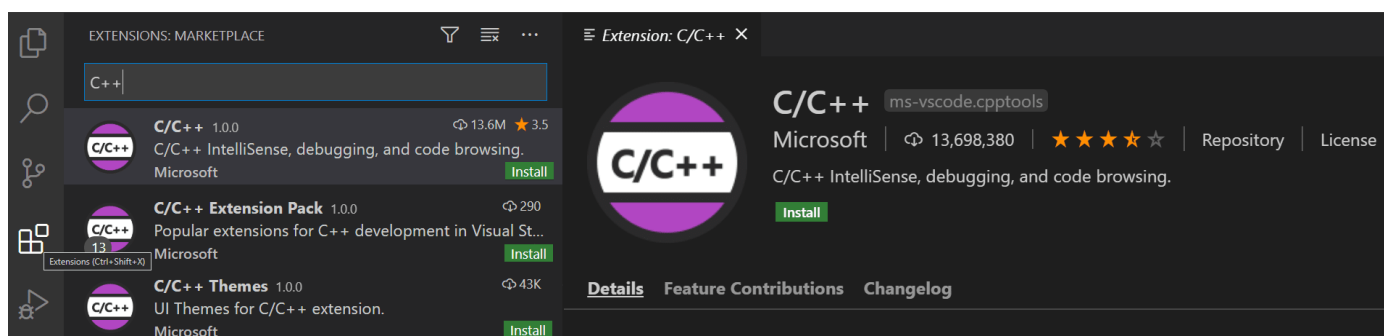

2. 依說明安裝 Mingw-w64 (https://code.visualstudio.com/docs/cpp/config-mingw)

- 打開 Visual Studio Code 安裝 C/C++ extension

- 下載 MSYS2 並透過 MSYS2 安裝 Mingw-w64 工具鏈

```
User@DESKTOP-VDIT4R9 UCRT64 ~
$ pacman -S mingw-w64-ucrt-x86_64-gcc
resolving dependencies...
looking for conflicting packages...

Packages (15) mingw-w64-ucrt-x86_64-binutils-2.40-2
              mingw-w64-ucrt-x86_64-crt-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-ucrt-x86_64-gcc-libs-12.2.0-10  mingw-w64-ucrt-x86_64-gmp-6.2.1-5
              mingw-w64-ucrt-x86_64-headers-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-ucrt-x86_64-isl-0.25-1  mingw-w64-ucrt-x86_64-libiconv-1.17-3
              mingw-w64-ucrt-x86_64-libwinpthread-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-ucrt-x86_64-mpc-1.3.1-1  mingw-w64-ucrt-x86_64-mpfr-4.2.0-1
              mingw-w64-ucrt-x86_64-windows-default-manifest-6.4-4
              mingw-w64-ucrt-x86_64-winpthreads-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-ucrt-x86_64-zlib-1.2.13-3  mingw-w64-ucrt-x86_64-zstd-1.5.4-1
              mingw-w64-ucrt-x86_64-gcc-12.2.0-10

Total Download Size:    47.83 MiB
Total Installed Size:   402.51 MiB

:: Proceed with installation? [Y/n] Y
:: Retrieving packages...
 mingw-w64-ucrt-x86_64-isl-...  1386.1 KiB   288 KiB/s 00:05 [#########################] 100%
 mingw-w64-ucrt-x86_64-crt-...     3.3 MiB   480 KiB/s 00:07 [#########################] 100%
 mingw-w64-ucrt-x86_64-gcc-...   877.3 KiB   208 KiB/s 00:04 [#########################] 100%
 mingw-w64-ucrt-x86_64-binu...     6.1 MiB   635 KiB/s 00:10 [#########################] 100%
 mingw-w64-ucrt-x86_64-head...     5.7 MiB   569 KiB/s 00:10 [#########################] 100%
 mingw-w64-ucrt-x86_64-libi...   719.9 KiB   395 KiB/s 00:02 [#########################] 100%
 mingw-w64-ucrt-x86_64-zstd...   612.7 KiB   487 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-gmp-...   571.2 KiB   623 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-mpc-...   104.2 KiB   161 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-mpfr...   430.2 KiB   351 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-zlib...    91.8 KiB  76.4 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-winp...    40.0 KiB  37.7 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-libw...    29.9 KiB  25.8 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-wind...     3.0 KiB  5.00 KiB/s 00:01 [#########################] 100%
 mingw-w64-ucrt-x86_64-gcc-...    28.0 MiB  1457 KiB/s 00:20 [#########################] 100%
 Total (15/15)                    47.8 MiB  2.29 MiB/s 00:21 [#########################] 100%
(15/15) checking keys in keyring                            [#########################] 100%
(15/15) checking package integrity                          [#########################] 100%
(15/15) loading package files                               [#########################] 100%
(15/15) checking for file conflicts                         [#########################] 100%
(15/15) checking available disk space                       [#########################] 100%
:: Processing package changes...
( 1/15) installing mingw-w64-ucrt-x86_64-libwinpthread-git  [#########################] 100%
( 2/15) installing mingw-w64-ucrt-x86_64-gcc-libs           [#########################] 100%
( 3/15) installing mingw-w64-ucrt-x86_64-zstd               [#########################] 100%
( 4/15) installing mingw-w64-ucrt-x86_64-binutils           [#########################] 100%
( 5/15) installing mingw-w64-ucrt-x86_64-headers-git        [#########################] 100%
( 6/15) installing mingw-w64-ucrt-x86_64-crt-git            [#########################] 100%
( 7/15) installing mingw-w64-ucrt-x86_64-gmp                [#########################] 100%
( 8/15) installing mingw-w64-ucrt-x86_64-isl                [#########################] 100%
( 9/15) installing mingw-w64-ucrt-x86_64-libiconv           [#########################] 100%
(10/15) installing mingw-w64-ucrt-x86_64-mpfr               [#########################] 100%
(11/15) installing mingw-w64-ucrt-x86_64-mpc                [#########################] 100%
(12/15) installing mingw-w64-ucrt-x86_64-windows-default... [#########################] 100%
(13/15) installing mingw-w64-ucrt-x86_64-winpthreads-git    [#########################] 100%
(14/15) installing mingw-w64-ucrt-x86_64-zlib               [#########################] 100%
(15/15) installing mingw-w64-ucrt-x86_64-gcc                [#########################] 100%

User@DESKTOP-VDIT4R9 UCRT64 ~
$ gcc --version
gcc.exe (Rev10, Built by MSYS2 project) 12.2.0
Copyright (C) 2022 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

```
User@DESKTOP-VDIT4R9 UCRT64 ~
$ pacman -S --needed base-devel mingw-w64-x86_64-toolchain
:: There are 19 members in group mingw-w64-x86_64-toolchain:
:: Repository mingw64
   1) mingw-w64-x86_64-binutils  2) mingw-w64-x86_64-crt-git  3) mingw-w64-x86_64-gcc
   4) mingw-w64-x86_64-gcc-ada  5) mingw-w64-x86_64-gcc-fortran
   6) mingw-w64-x86_64-gcc-libgfortran  7) mingw-w64-x86_64-gcc-libs  8) mingw-w64-x86_64-gcc-objc
   9) mingw-w64-x86_64-gdb  10) mingw-w64-x86_64-gdb-multiarch  11) mingw-w64-x86_64-headers-git
   12) mingw-w64-x86_64-libgccjit  13) mingw-w64-x86_64-libmangle-git
   14) mingw-w64-x86_64-libwinpthread-git  15) mingw-w64-x86_64-make  16) mingw-w64-x86_64-pkgconf
   17) mingw-w64-x86_64-tools-git  18) mingw-w64-x86_64-winpthreads-git
   19) mingw-w64-x86_64-winstorecompat-git

Enter a selection (default=all): default
error: invalid number: default

Enter a selection (default=all):      按下 Enter 鍵即可!
resolving dependencies...
looking for conflicting packages...

Packages (58) binutils-2.40-1   bison-3.8.2-4  diffstat-1.65-1   diffutils-3.9-1   dos2unix-7.4.4-1
              flex-2.6.4-3  m4-1.4.19-2  make-4.4.1-1  mingw-w64-x86_64-bzip2-1.0.8-2
              mingw-w64-x86_64-expat-2.5.0-1   mingw-w64-x86_64-gettext-0.21.1-1
              mingw-w64-x86_64-gmp-6.2.1-5   mingw-w64-x86_64-isl-0.25-1
              mingw-w64-x86_64-libffi-3.4.4-1   mingw-w64-x86_64-libiconv-1.17-3
              mingw-w64-x86_64-libsystre-1.0.1-4   mingw-w64-x86_64-libtre-git-r128.6fb7206-2
              mingw-w64-x86_64-mpc-1.3.1-1   mingw-w64-x86_64-mpdecimal-2.5.1-1
              mingw-w64-x86_64-mpfr-4.2.0-1   mingw-w64-x86_64-ncurses-6.4.20230211-1
              mingw-w64-x86_64-openssl-3.1.0-1   mingw-w64-x86_64-python-3.10.10-1
              mingw-w64-x86_64-readline-8.2.001-6   mingw-w64-x86_64-sqlite3-3.41.1-1
              mingw-w64-x86_64-tcl-8.6.12-1   mingw-w64-x86_64-termcap-1.3.1-6
              mingw-w64-x86_64-tk-8.6.12-1   mingw-w64-x86_64-tzdata-2022g-1
              mingw-w64-x86_64-windows-default-manifest-6.4-4   mingw-w64-x86_64-xxhash-0.8.1-2
              mingw-w64-x86_64-xz-5.4.1-1   mingw-w64-x86_64-zlib-1.2.13-3
              mingw-w64-x86_64-zstd-1.5.4-1   patch-2.7.6-2   pkgconf-1.9.4-1   texinfo-7.0.2-1
              texinfo-tex-7.0.2-1   base-devel-2022.12-2   mingw-w64-x86_64-binutils-2.40-2
              mingw-w64-x86_64-crt-git-10.0.0.r234.g283e5b23a-1   mingw-w64-x86_64-gcc-12.2.0-10
              mingw-w64-x86_64-gcc-ada-12.2.0-10   mingw-w64-x86_64-gcc-fortran-12.2.0-10
              mingw-w64-x86_64-gcc-libgfortran-12.2.0-10   mingw-w64-x86_64-gcc-libs-12.2.0-10
              mingw-w64-x86_64-gcc-objc-12.2.0-10   mingw-w64-x86_64-gdb-13.1-3
              mingw-w64-x86_64-gdb-multiarch-13.1-3
              mingw-w64-x86_64-headers-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-x86_64-libgccjit-12.2.0-10
              mingw-w64-x86_64-libmangle-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-x86_64-libwinpthread-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-x86_64-make-4.4-2   mingw-w64-x86_64-pkgconf-1~1.8.0-2
              mingw-w64-x86_64-tools-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-x86_64-winpthreads-git-10.0.0.r234.g283e5b23a-1
              mingw-w64-x86_64-winstorecompat-git-10.0.0.r234.g283e5b23a-1

Total Download Size:    162.50 MiB
Total Installed Size:  1029.15 MiB

:: Proceed with installation? [Y/n] Y
```
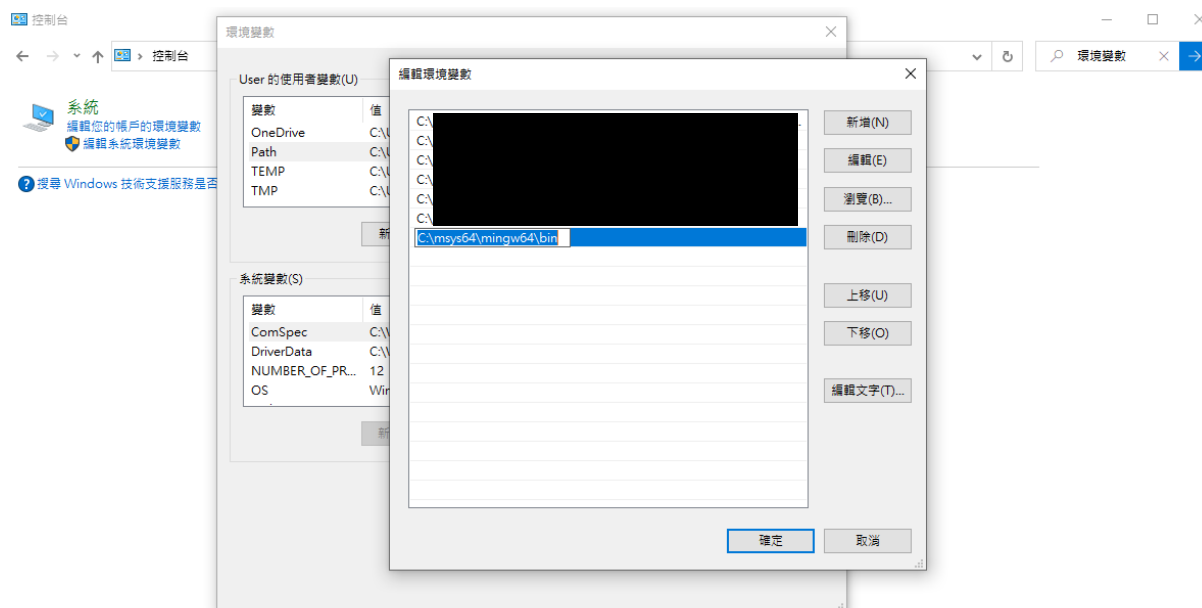
- 打開控制台—編輯您的帳戶的環境變數—點擊 Path—新增 Mingw-w64 目標檔案夾路徑(應為
  C:\msys64\mingw64\bin)

3. 打開命令提示字元，依序輸入 gcc --version、g++ --version、gdb --version 確認安裝成功

■ 命令提示字元

```
Microsoft Windows [版本 10.0.18363.1556]
(c) 2019 Microsoft Corporation. 著作權所有，並保留一切權利。

C:\Users\User>gcc --version
gcc (Rev10, Built by MSYS2 project) 12.2.0
Copyright (C) 2022 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.


C:\Users\User>g++ --version
g++ (Rev10, Built by MSYS2 project) 12.2.0
Copyright (C) 2022 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.


C:\Users\User>gdb --version
GNU gdb (GDB) 13.1
Copyright (C) 2023 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

C:\Users\User>
```
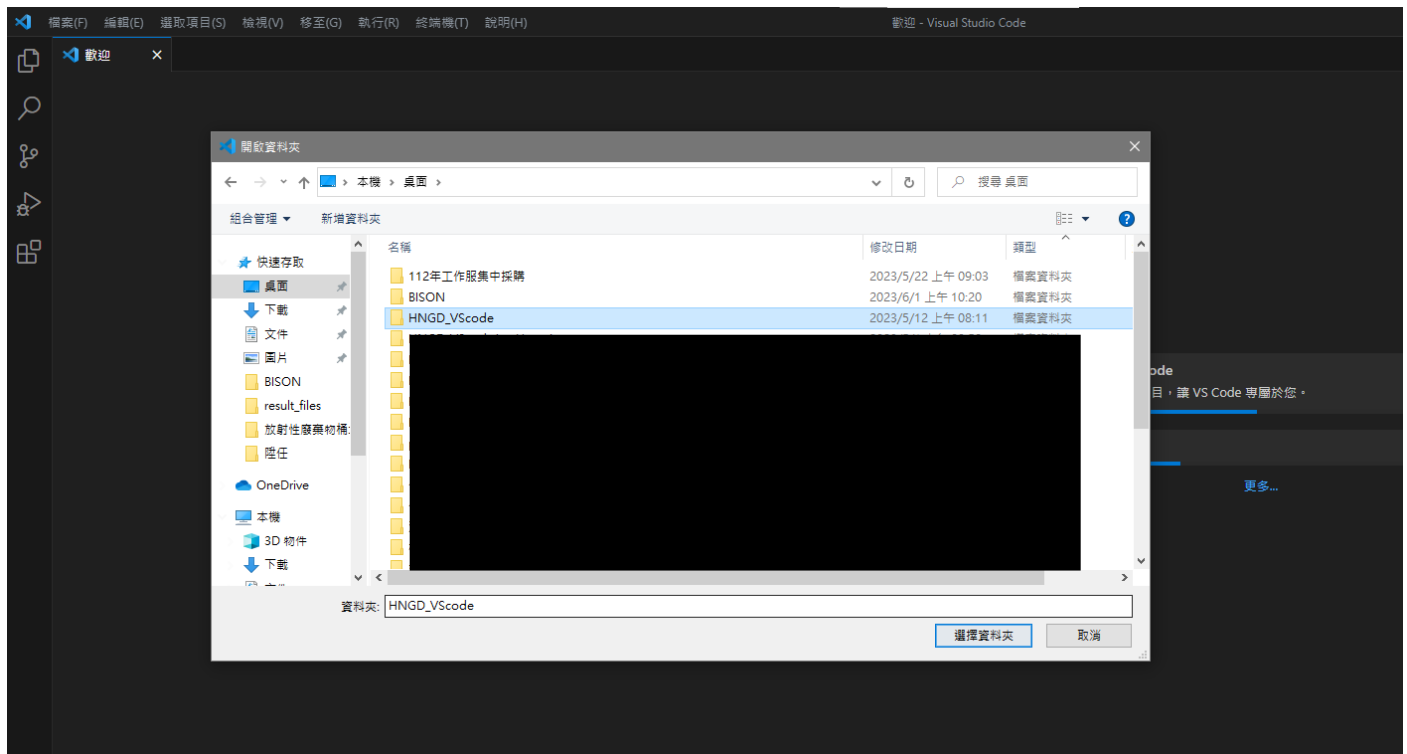
B. 使用步驟

1. 在 Visual Studio Code 中開啟從 github.com 下載的 HNGD_VScode 資料夾

2. 若想在模擬結束後播放提示音效，下載 VideoLAN (https://www.videolan.org/vlc/)並在 Path 新增其路徑 (播放提示音效 非必要，可直接 Ctrl＋/ 註解掉這行 `system("\"C:/Program Files (x86)/VideoLAN/VLC/vlc.exe\"  C:\\Users\\i1392\\Desktop\\HNGD_VScode\\notif.mp3");`)
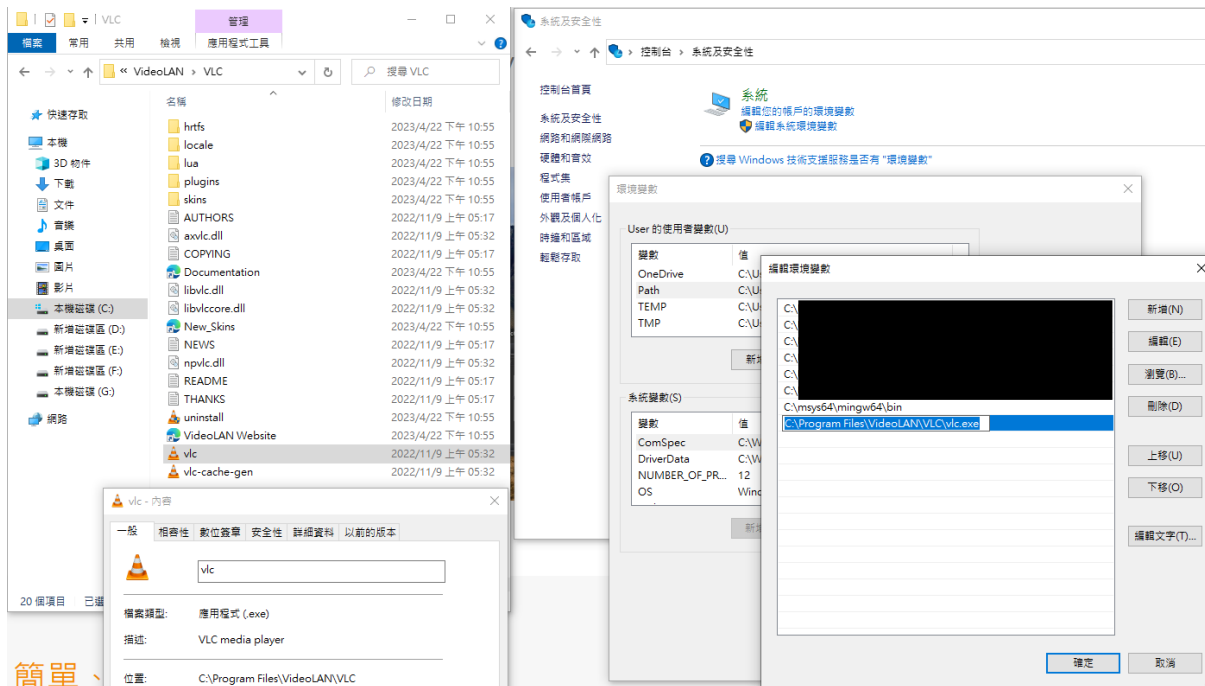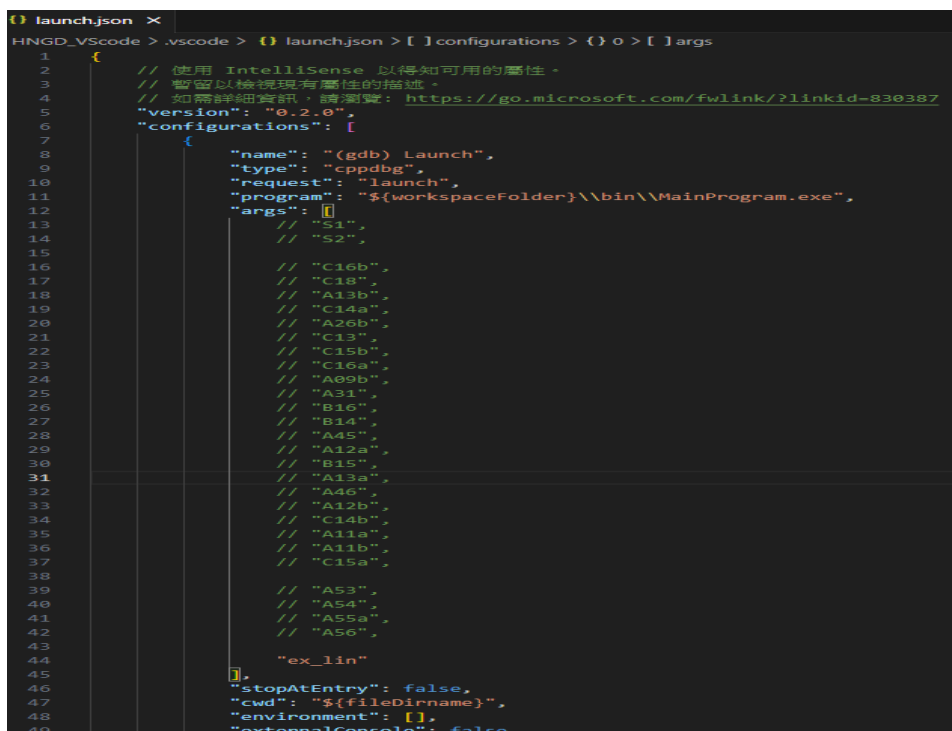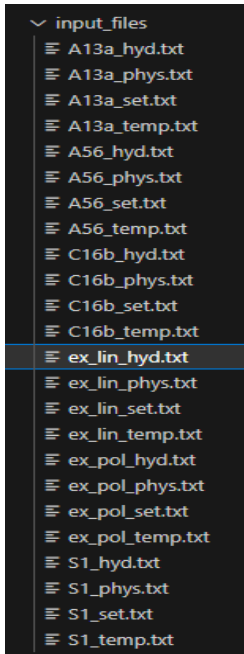
3. 在 MainProgram.C 中搜尋 /*custom*/ 以調整必要的設定(請參考 Florian Passelaigue 的 README.pdf 說明)

4. 從 launch.json 設定欲模擬的實驗名稱(如 C16b，請解除 C16b 這行的註解，預設為 ex_lin)

5. 確認 input_files 檔案夾有 C16b_set.txt(設定參數)、C16b_phys.txt (物理參數)、C16b_temp.txt (熱處理歷程)、
   C16b_hyd.txt (初始氫分佈)

6. 按下 debug 鍵(偵錯 C/C++ 檔案)進行模擬

7. 模擬結束後 result_files 資料夾將出現 C16b_input_check.txt(快速查看實驗資訊)、C16b_out.csv(結果檔)