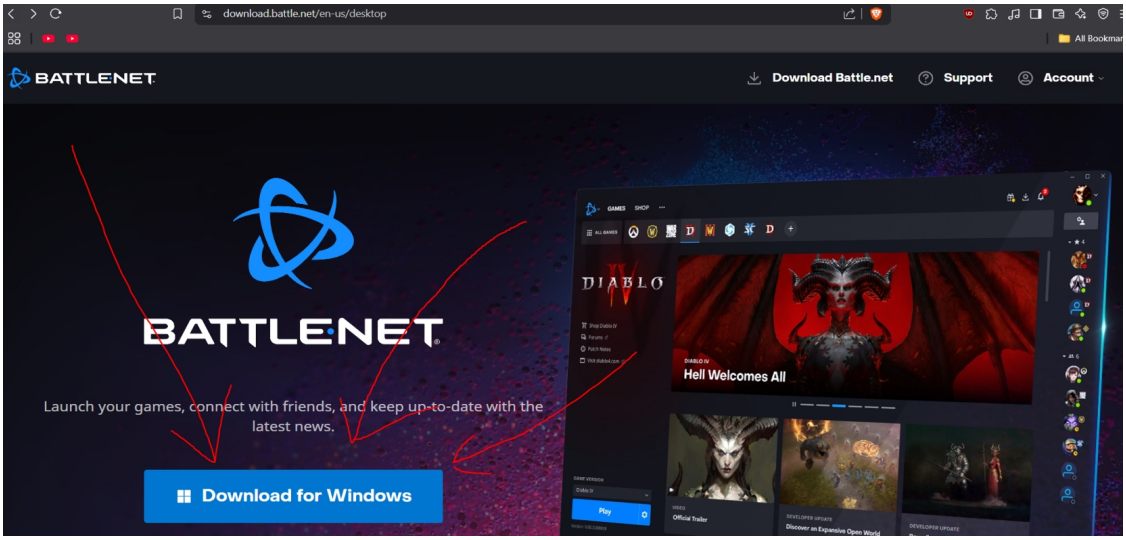
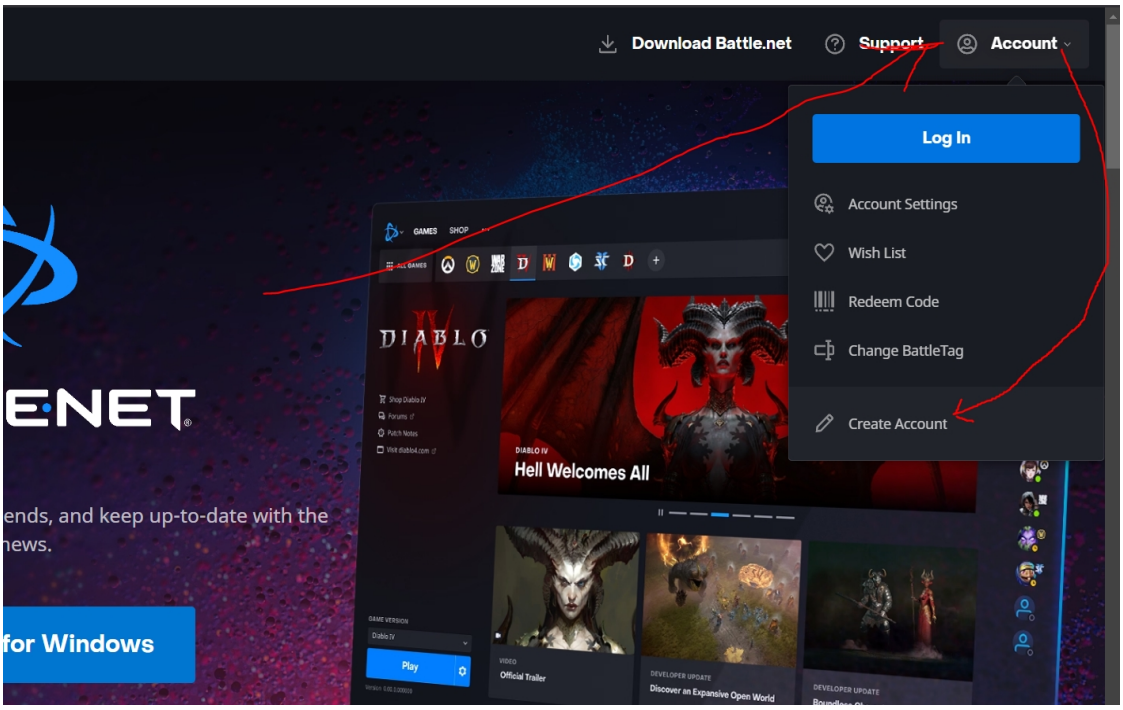
Instructions on how to run Starcraft II bot

1 Install Starcraft II

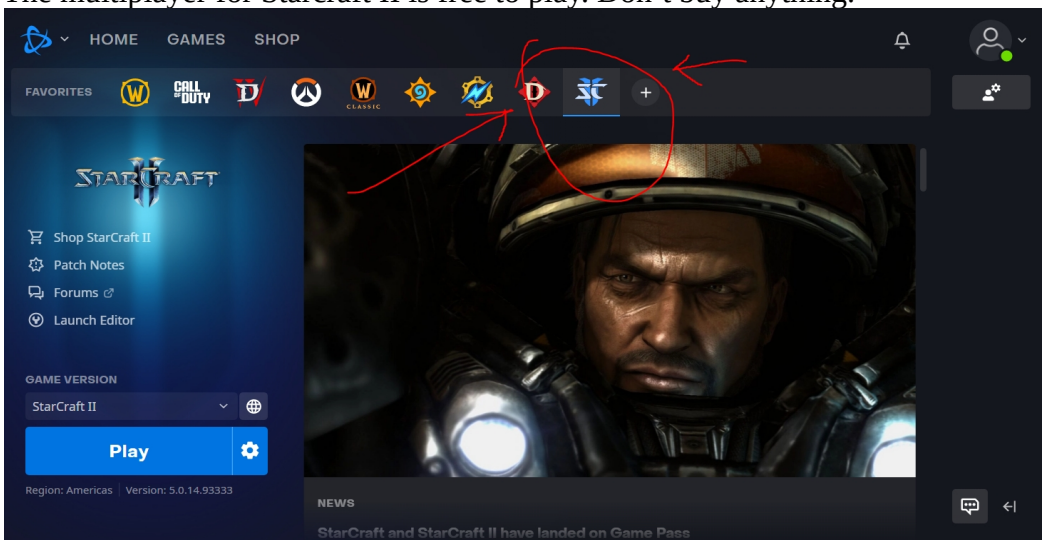
- 1.1 Install Battlenet and create an account.
  - If you already have battlenet, skip step 1.1.
  - Blizzard is the company that made Starcraft II and their games are downloadable through Battlenet. I believe this the website for Battlenet -> https://download.battle.net/en-us/desktop. Creating an account is also necessary.





  - Creating an account and downloading battlenet is necessary because blizzard decided to make their games all run through battlenet. Having an account/battlenet is necessary to view replays and download Starcraft II. Playing local bot games through the api does not require being logged in if Starctaft II is already downloaded. The name used for the account does not matter. It will only be used for downloading Starcraft II and watching replays.

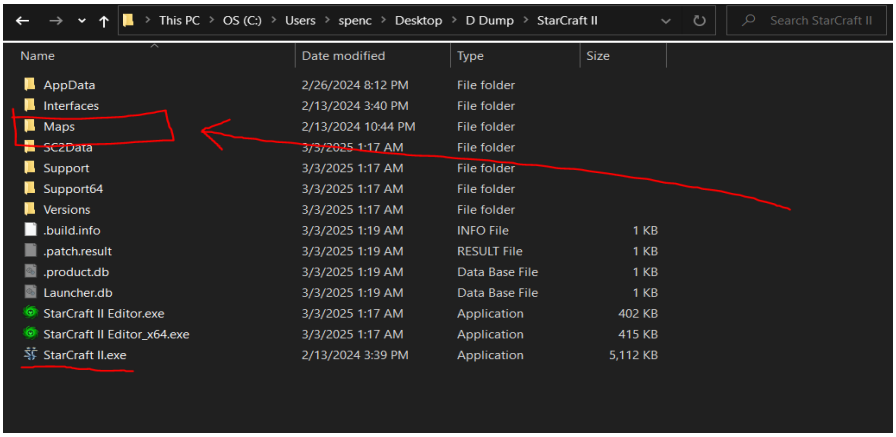
- 1.2 Install Starcraft II
  - If you already have Starcraft II installed, skip step 1.2.
  - The multiplayer for Starcraft II is free to play. Don’t buy anything.



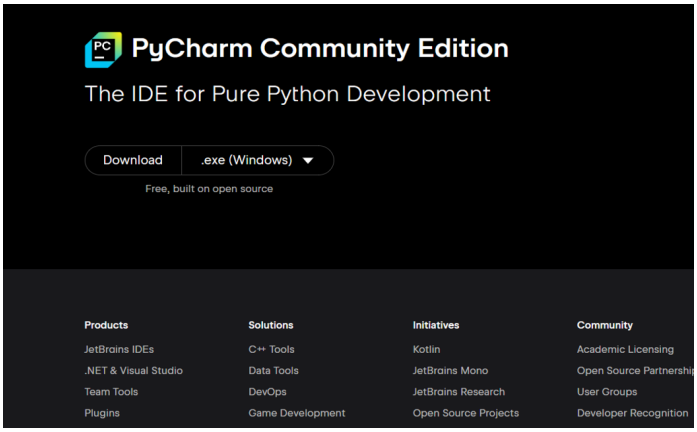
- There will be some set up questions such as where to install to. This will be referenced later when moving the “Maps” folder.

2 Set up things

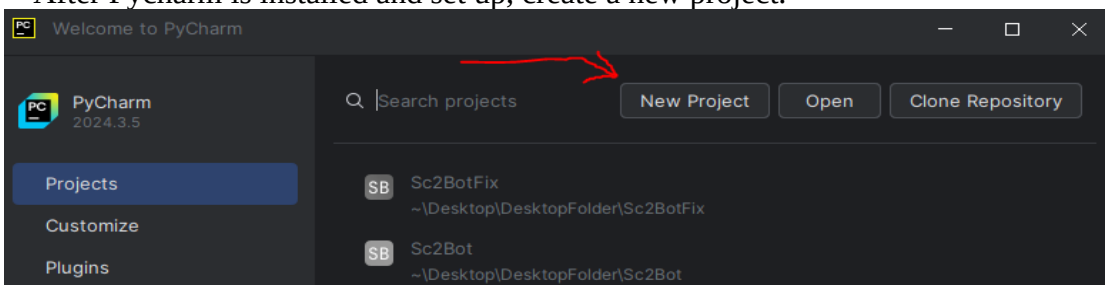
- I thought about trying to have the project be an exe and decided it was a bad idea.
  - It is more modifiable as a python project.
  - The hardest part of this project is setting up the environment and that would be required even if it was an exe.
- 2.1 Set up “Maps” folders
  - The api can not run local games unless there is a map folder with maps in it. I included a map folder with 1 map and set up my test script to reference that map. Copy and paste the map folder from the project named “Maps” to the folder where “Starcraft II.exe” is located. There is a maximum file size and the map might be too large. The default locations for windows PC to install Starcraft II is "`C:\Program Files (x86)\StarCraft II\`”. The file path can be changed in step 1.2. My filepath is different.



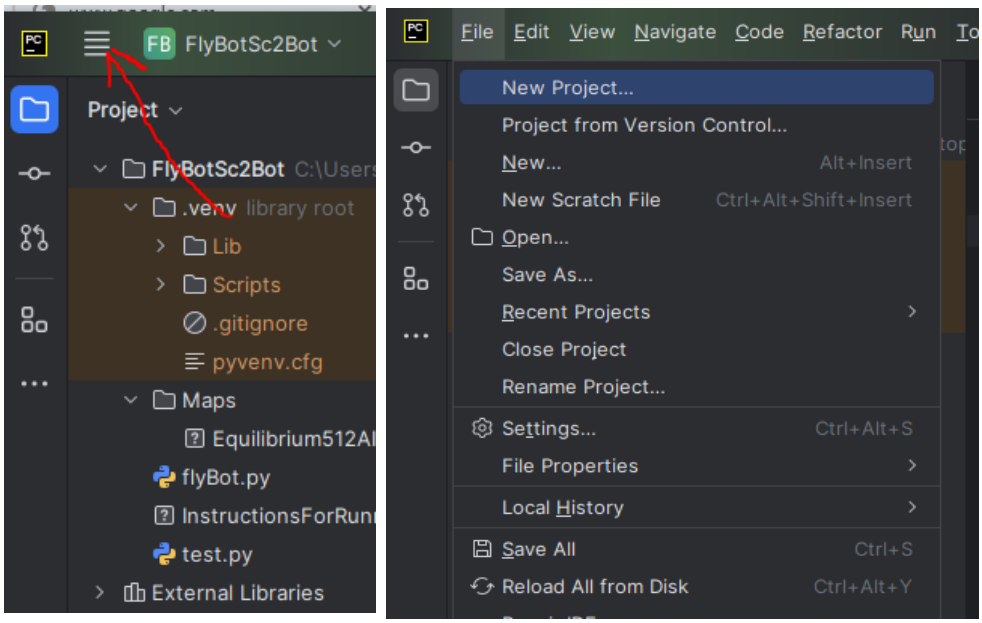
    - Maps the bot people use are here: https://aiarena.net/wiki/maps/
    - Maps the official blizzard people have are here: https://github.com/Blizzard/s2client-proto#downloads
- 2.2
  - Install Python. If you already have python installed, skip step 2.2. I am using Python 3.9.13. Newer versions should work. I think this is the website for python: https://www.python.org/downloads/
  - Python has a thing called pip. Make sure the version of Python has pip. Pip is going to be used later.
- 2.3
  - Install Pycharm. If you have a different preferred IDE or already have Pycharm installed, skip 2.3. I barely got this to run on my other computer. This is the website for the windows version. https://www.jetbrains.com/pycharm/download/?section=windows. If you are not using windows, there is probably a different place to find the correct version. The free version of Pycharm requires scrolling to the bottom of the page. I do not know why they had the free version at the bottom.



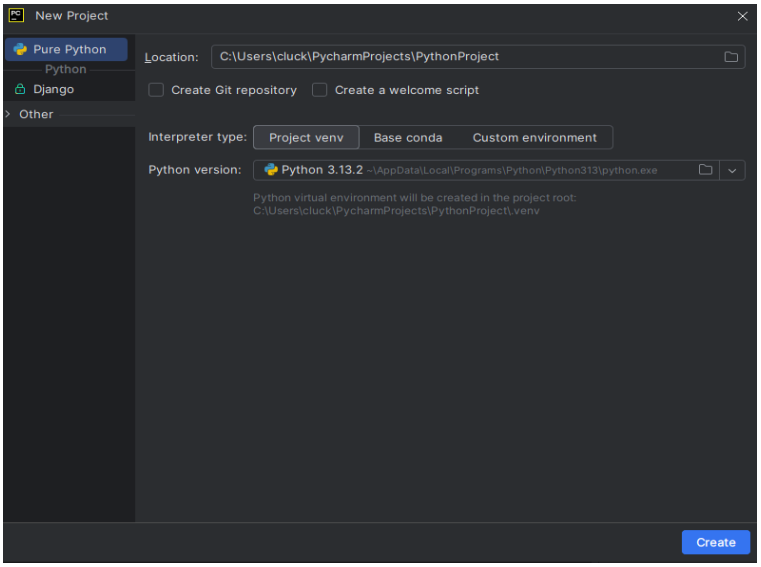
- 2.4 Get the project working in Pycharm
  - Installation of Pycharm takes a long time. I tried opening the project in on Pycharm with my other PC and had python interpreter problems. It is probably better to create a new project and transfer files over. I think it is because git ignored my env file?
  - After Pycharm is installed and set up, create a new project.



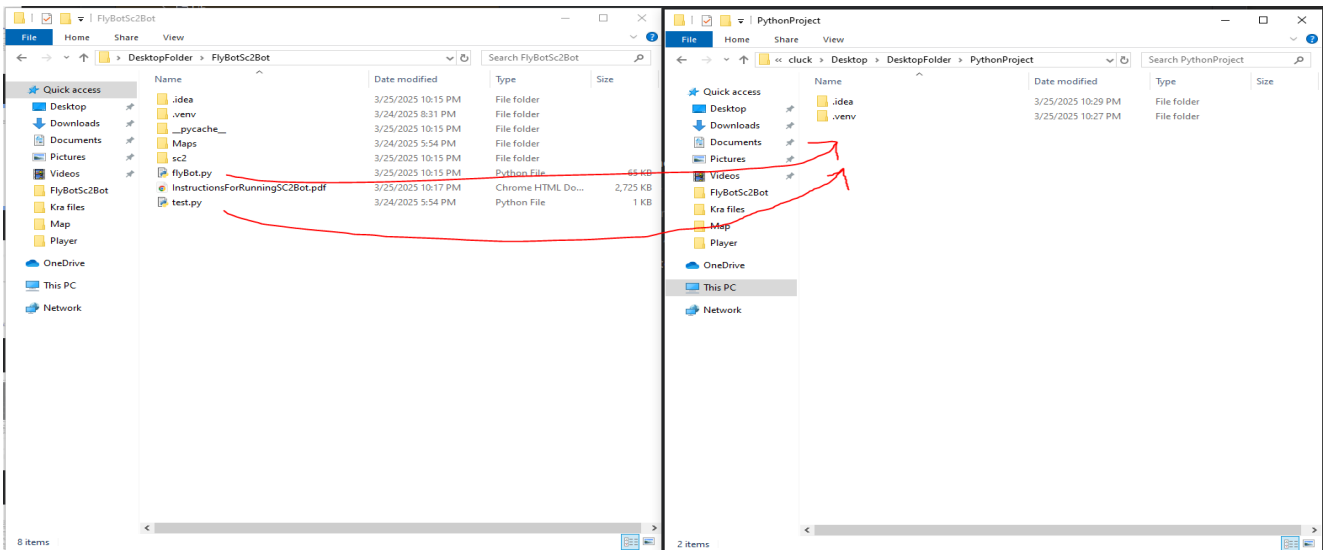
    - The ui for starting a new project is different in done while a different project is open.



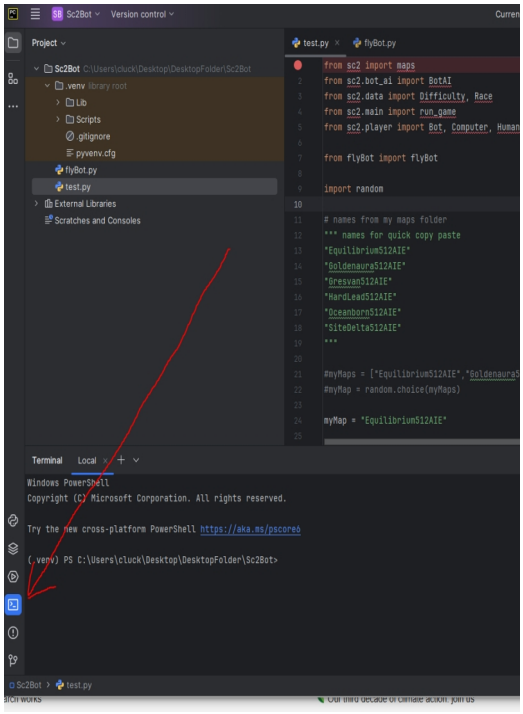
  - "Python version:" should be set to a valid python version.



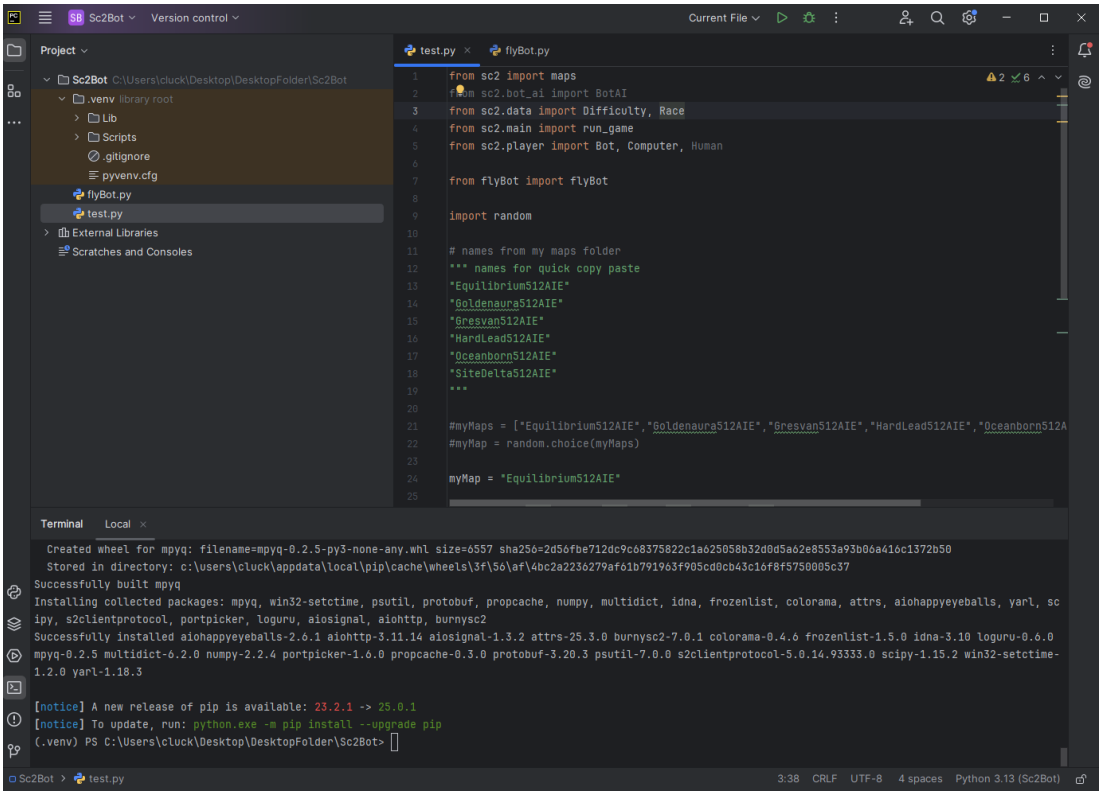
- Move the files from the project submission to the project folder.



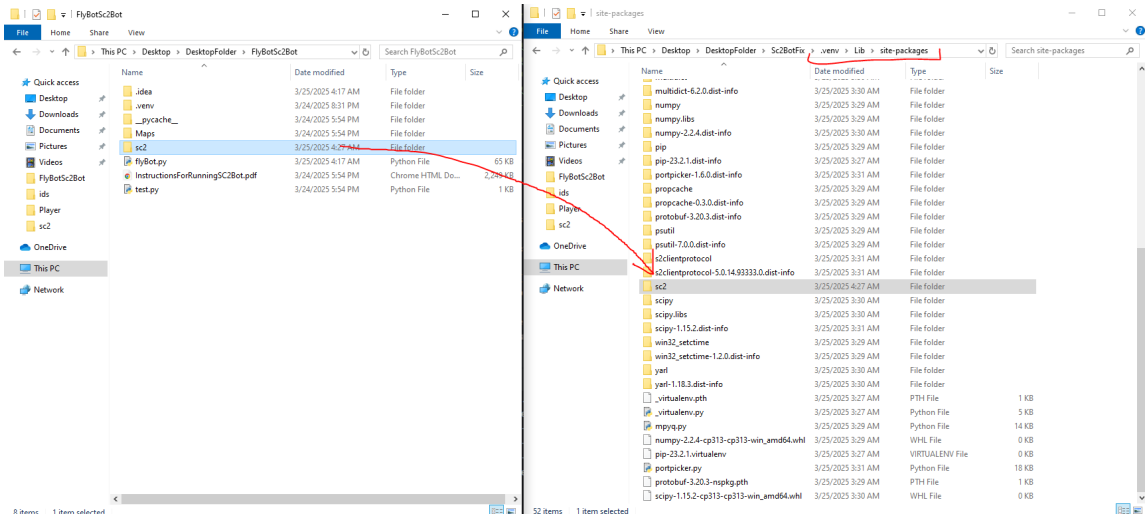
- There is an unresolved import issue at this point.
- To resolve the issue of the sc2 bot making api missing, click terminal.



- While in the terminal, type “pip install --upgrade burnysc2”
  - This command installs python sc2, and its dependencies. This is the github where the bot making api is located at for reference. “https://github.com/BurnySc2/python-sc2”
  - The pip command and updates to python interpreter take forever. Python interpreter updates should be blue bar at the bottom?
  - It should fix the missing import problem.
- At this point in the directions, the project should be run-able and it should crash. It will give an error relating to some kind of Unit/Ability/Buff Id.

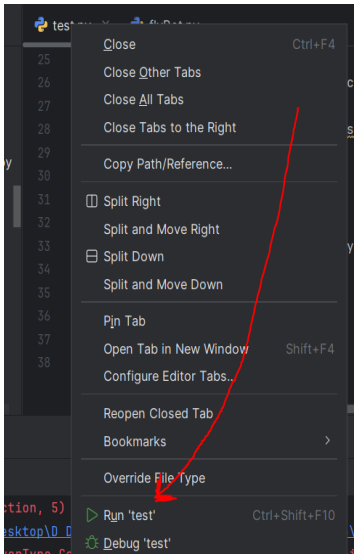


- The reason why it gives the error and crashes is because the api has a list of Id constants that reference things. The constants are extracted from Starcraft 2 when a script called generate_ids.py is run. That script didn't work correctly on my test pc, so I'm not going to use it in the directions. Most of the time blizzard updates their game, the constants change. The normal way to update id constants is to run that script. It makes the api Ids match the game Ids. The mismatch of Ids is why the previously stated crash should happen.
- Instead of generating Ids the correct way, it possible to just replace the entire sc2 folder. The correct way didn't work on the test pc, so now we use the "hammer nail" approach. I have a folder in the project submission named sc2. There is another folder named sc2 that was installed with the pip install. It exists in file directory under (project path) → .venv\Lib\site-packages\. Replace the sc2 folder with the working one.



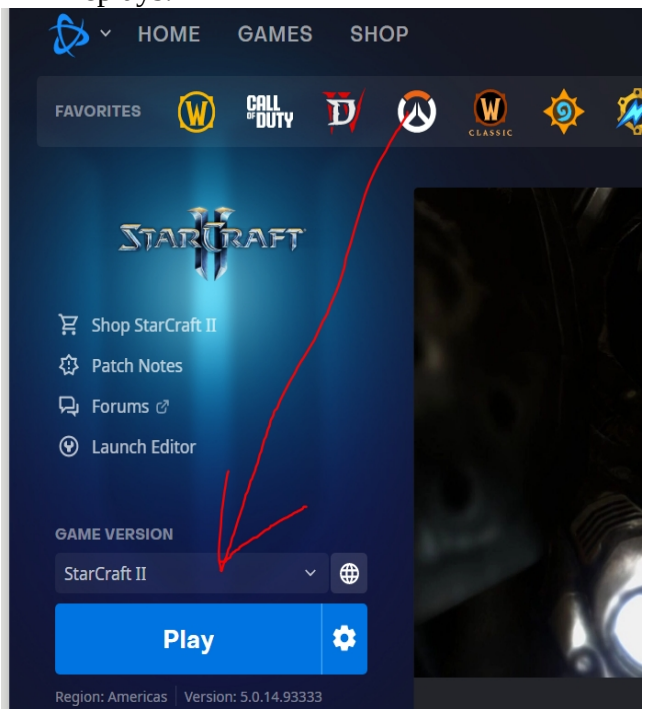
3 Change and Run the Test Script.

- It gets a little bit complicated. It is not as complicated as part 2.
- 3.1 There are things that can be changed in the test script
  - If you don't want to change the test script, skip step 3.1.
  - Things that can be changed in the test script:
    - I have a variable named "myMap". myMap is a string for the map that is being run. It references a file name in the map folders previously mentioned in step 2.1. The map has to exist in the "Maps" folder from step 2.1. The file extension is "SC2Map". Do not include the ".SC2Map" at the end of the filename. I have some commented out code for playing on random maps. That requires having those maps in the maps folder.
    - I have a variable named enemyFaction. That is the faction the enemy plays.
      - The game has main 3 factions and a 4th option called "Random". The enemy faction shows up on the loading Screen. Although there are technically 3 factions to choose from, if random is chosen it displays as random on the load screen and is quarried as random in the api.
    - There is a line that reads "c = Computer(enemyFaction, Difficulty.VeryHard)". Difficulty can be changed to a different difficulty. I believe there is a bug in the api with difficulty. High difficulties are one higher. VeryHard → Elite
    - Inside of the method being called named "run_game", there is a thing called realtime. It is set to true or false. It is the most massive thing that can be changed in the test script. "realtime" changes how "async def on_step(self, iteration):" from the bot class works. There are 22.4 game steps per second in Starcraft 2. When realtime is set to false, the game runs at the same speed that the bot and game process iterations. If the bot is written optimally, "realtime=false" will run faster than "realtime=true". Having it set to false also makes it so that bot performance is more consistent because it has the bot calculations linked to to the game step. My bot uses specific timings to make units group together better before attacking. Having it set to "realtime=true" makes it play at normal speed which ruins that timing. "true" is better for humans. It is bad for bots because the timing isn't linked to game step anymore.
    - Do you want to play against the bot?
      - I have some commented out code underneath my test script. It is set up for human vs bot. It's not part of the scope of the project and the quality is going to be low but it is an option.
- 3.2 Run the test script.
  - I like to right click the test script and then click to run it.

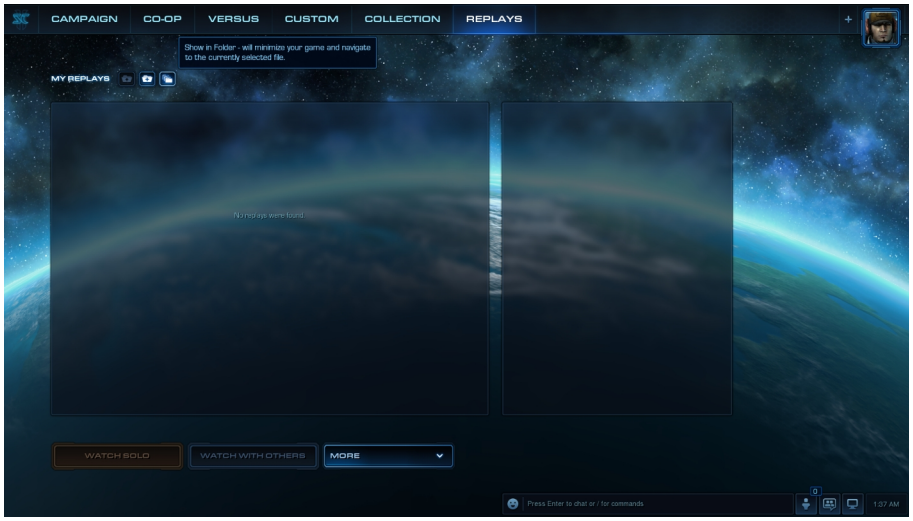


4 Replays

- The advantage of realtime=true for bot vs bot/computer games is that it is more human viewable. Replays are an alternative for this. Bots perform better on realtime=false. Re-watching using the replay feature in sc2 allows for watching in realtime without compromising the bots performance. It also allows for a higher level analysis detail.
- 4.1 Finish one or more games.
  - I think replays only save if the game finishes and they save in a weird place.
- 4.2 Open Starcraft II the actual game.
  - Open Starcraft II from battlenet. See step 1.1. Opening Starcraft II is required for watching replays.



  - If you get to the load screen you should be fine. With clicking from file explorer.
- 4.3 Watch replay
  - There are two ways I know how to watch replays. Both require step 4.2. The normal way is to open starcraft2 and click “Show in folder - …”. It will open the file explorer. It is also possible to manually open file explorer. After finding the file, double click it.



- Finding the file is more complicated than it should be. I do not know the correct terminology but the local data is in a different place than the game files. The local files which include replays and account data are located in “\Documents\StarCraft II” for me. It is a different file location than where Starcraft II was installed.
- You may have noticed from my previous image but, the replay files are not displayed on the Starcraft II game under replays. That is fine and expected. The reason why is because the file system is complicated. It is displaying player replays.
  - On my PC, Human replays are located here “C:\Users\spenc\Documents\StarCraft II\Accounts\880887116\1-S2-1-13247786\Replays”
  - On my PC, Bot replays are located here “C:\Users\spenc\Documents\StarCraft II\Replays”
  - I can speculate on why it saves them in two different places. I’m trying to be objective, so I’m not speculating. “It is what it is”

5 What have I not finished yet?

- I think I accomplished most of what I agreed to do.

NF1: Adhere to bot rules.	Some Bot Rules were posted later in the document
NF2: Installability	Bot needs to be packaged in a way that makes it runnable on any machine that has same IDE, programming language, and Starcraft II installed
NF3: Usability	Bot must be simple and easy to run
NF4: Reliability	Bot must run without crashing over 90% of the time.
NF5: Security	Bot must not do anything beyond playing Starcraft II
NF6: Performance	Bot must run at a speed that is same speed or faster than game speed steps.
NF7: Adaptability(Map Tolerance)	Bot can play on any ladder map with normal functionality.
NF8: Adaptability(Enemy Tolerance)	Bot can play against each other faction with normal functionality
F1A: Beat in game bot	Bot must be able to beat at least one in game bot difficulty.
F1B: Beat difficulty Hard	Bot must be able to beat hard difficulty bot
F1C: Beat difficulty Harder	Bot must be able to beat harder difficulty bot
F1D: Beat difficulty Very Hard	Bot must be able to beat very hard difficulty bot
F1E: Beat difficulty Elite	Bot must be able to beat elite difficulty bot
F2: Unit tier	Bot must tech into at least one max tier unit(s).
F3: Upgrades	Bot must research unit upgrades
F4: Expansion	Bot must expand based on strategic factors.
F5: Unit Mirco	Units must react to nearby stimuli such as enemies.
F6: Buildings/replacing structures	Bot must build structures when needed.
F7: Produce units	Buildings that can produce units produce units when needed.
F8: Scouting	Bot must be able to deduce enemy location trough scouting or other means.
F9: Rally	Bot must be able to send most units to go to location for various reasons.

  - Most of usability issues come from the required set up. I could write better directions to make it more usable. The only other way I could make set up easier would be if I set up a script to install maps, Starcraft 2, a development environment. I can not do that because it is extremely sketchy. It would be a violation of Non-functional requirement 5.
  - I can test for Adaptability(Map Tolerance) by testing more maps. I only have 6 maps in my map pool. One map has a ramp that doesn't work and the bot adapts to the map not working. There are more chaotic maps I can use. I do not have red shift in my map pool which is one of the most controversial ladder maps ever added. Red shift is a wild map. People hate it.
- My bot still has weakness and I can fix those weaknesses.
  - I had a lot of trouble setting up my test pc. I need to improve the deployment. I can probably do a better job researching why I had issues and not having those issues.
  - My bot is weak to early rushes.
    - This is acceptable because of game theory. My bot should lose to early rushes. Most multiplayer games have some kind of rock paper scissors mechanic. In starcraft2, early rush beats eco rush, eco rush beats standard, and standard beats early rush. My bot is a macro/eco bot, so it is weak to rushes. There are things I can do to make it play closer to standard and defend better early.
      - My bot builds 2nd stargate too soon. I can delay it.
      - My bot wait until tier 2 unit to scout. I could change my gateway unit and adapt. To scouting with a tier 1 unit.
  - My bot tends to have a few workers over saturation at 3 bases. I can either change the worker production logic or expansion logic.
  - My bot still builds too close to mineral line.

- My bot still occasionally walls itself off by building bad.
  - Nexus have warp and that is a band aid solution to units getting stuck
- Bot needs to overreact less. That needs to be patched.
  - Sends a few too many workers when doing a worker defend
  - Attack nearest army macro logic needs to be refined. One zergling is not worth sending the whole army.