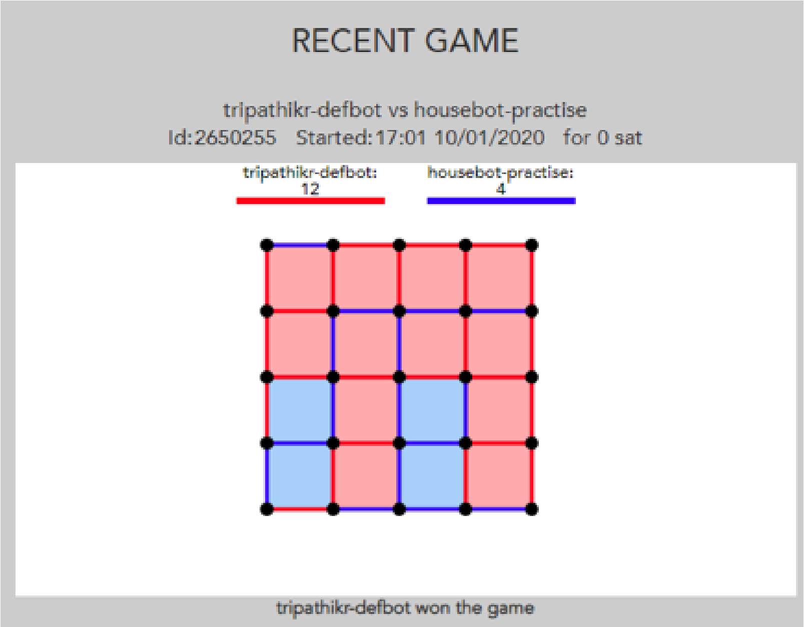
Assignment 2 (Deadline: Friday 24 April 2020)

1. Introduction



RECENT GAME

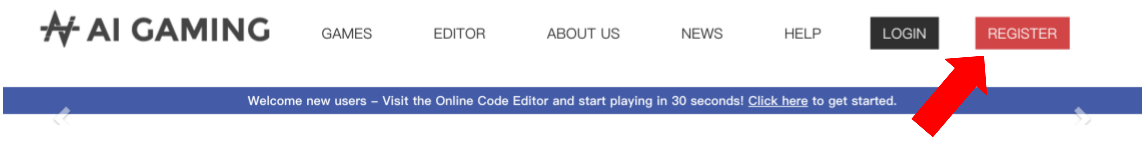
tripathikr-defbot vs housebot-practise
Id:2650255 Started:17:01 10/01/2020 for 0 sat

tripathikr-defbot won the game

In this assignment, you will code your AI bots in **Python** for playing the game called '**Dots And Boxes**'. This game is played on a rectangular grid of dots. Players alternate drawing a horizontal or a vertical line between adjacent dots - if they complete a box then they score 1 point (per box) and get another turn. The player with the most points once all of the boxes have been completed wins.

1.1 Sign up an Account and View Game Details

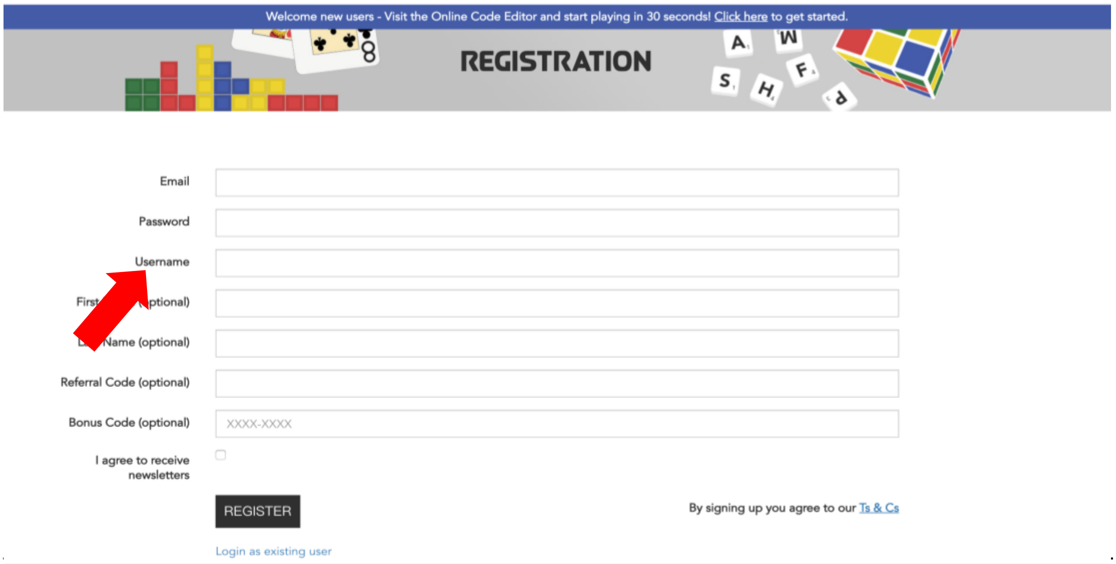
1) Go to the webpage https://www.aigaming.com/ and click on the **REGISTER** button in the upper right corner to sign up an account.



Welcome new users – Visit the Online Code Editor and start playing in 30 seconds! Click here to get started.

Then follow the instructions to sign up an account. The account **username** that you sign up should have the **format 4386_20B_XXXX,** meaning that it should have the prefix **4386_20B_** and followed by XXXX which are the **last 4 digits of your student ID** (e.g., if your student ID is 56781234, then your username should be **4386_20B_1234**).

Please remember your username and password.



Welcome new users - Visit the Online Code Editor and start playing in 30 seconds! Click here to get started.

REGISTRATION

Email

Password

Username

First (optional)

Name (optional)

Referral Code (optional)

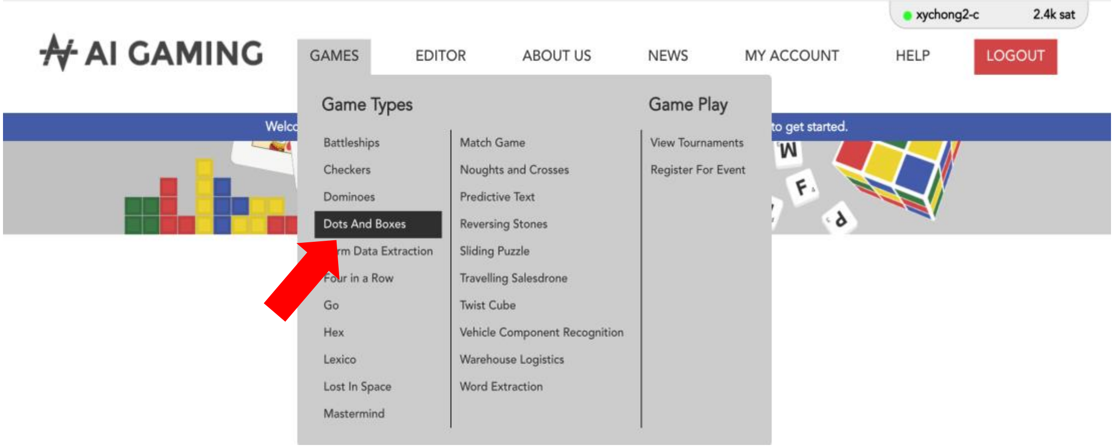
Bonus Code (optional) XXXX-XXXX

I agree to receive newsletters □

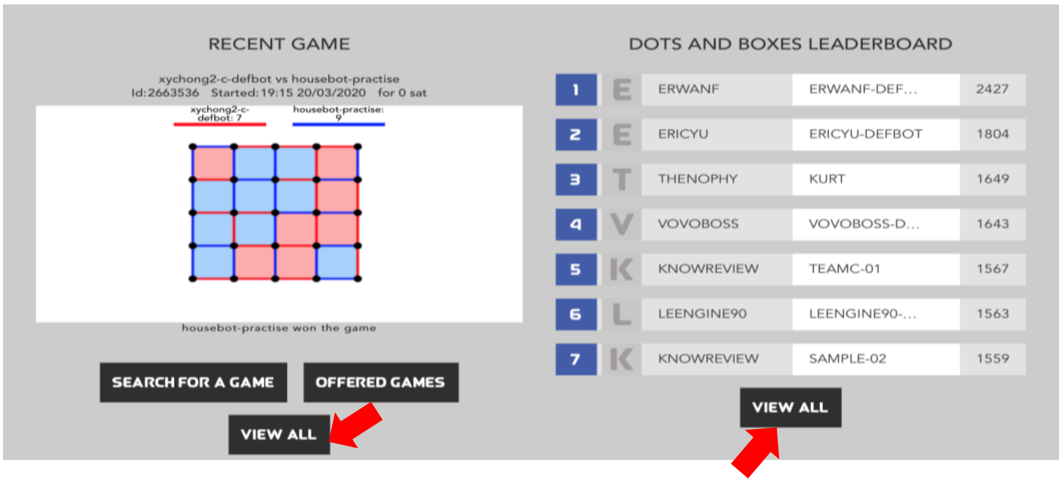
By signing up you agree to our Ts & Cs

Login as existing user

2) After login, click on GAMES → Dots And Boxes.



Then you will get the information of this game. You can watch the game video (left), and check the leaderboard of this game (right). If you click on VIEW ALL, you will see all the battle history or the whole leaderboard.



RECENT GAME

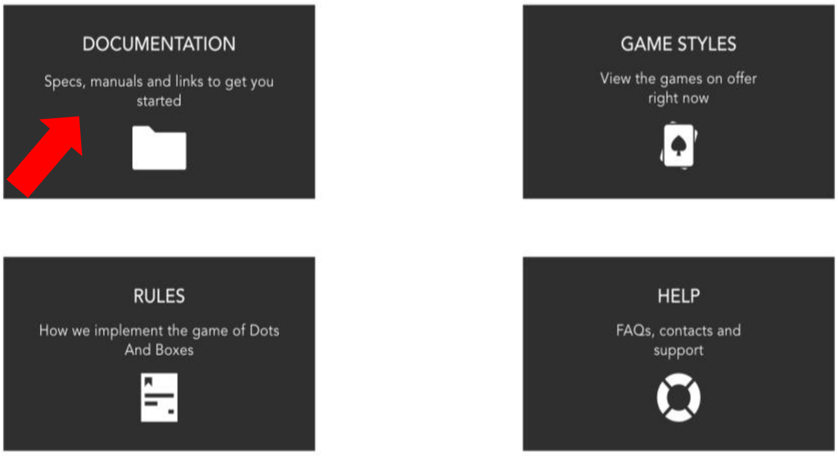
xychong2-c-defbot vs housebot-practise
Id:2663536 Started:19:15 20/03/2020 for 0 sat

housebot-practise won the game

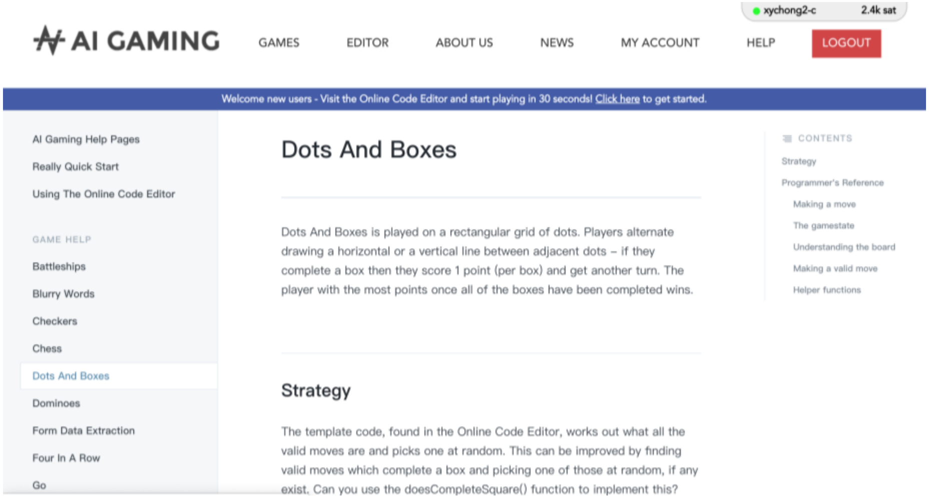
DOTS AND BOXES LEADERBOARD

1	E	ERWANF	ERWANF-DEF...	2427
2	E	ERICYU	ERICYU-DEFBOT	1804
3	T	THENOPHY	KURT	1649
4	V	VOVOBOSS	VOVOBOSS-D...	1643
5	K	KNOWREVIEW	TEAMC-01	1567
6	L	LEENGINE90	LEENGINE90-...	1563
7	K	KNOWREVIEW	SAMPLE-02	1559

Scroll down the page, you can get the documentation and rules of this game.


DOCUMENTATION
Specs, manuals and links to get you started
GAME STYLES
View the games on offer right now
RULES
How we implement the game of Dots And Boxes
HELP
FAQs, contacts and support

By clicking on DOCUMENTATION, you can get the detailed game rules, game strategy and programmers' reference (how to **make a move, gamestate, etc.**). You should read the information carefully, which is very helpful for you to design your own bot.



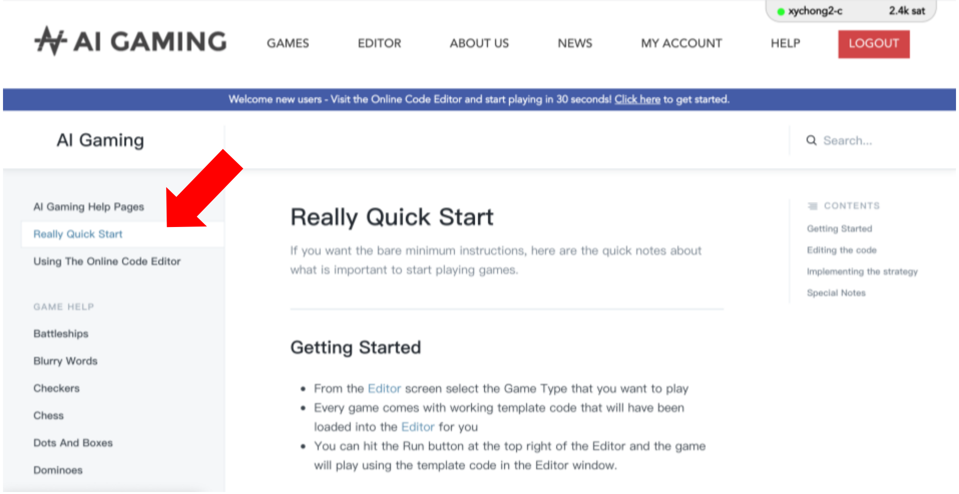
Dots And Boxes

Dots And Boxes is played on a rectangular grid of dots. Players alternate drawing a horizontal or a vertical line between adjacent dots – if they complete a box then they score 1 point (per box) and get another turn. The player with the most points once all of the boxes have been completed wins.

Strategy

The template code, found in the Online Code Editor, works out what all the valid moves are and picks one at random. This can be improved by finding valid moves which complete a box and picking one of those at random, if any exist. Can you use the doesCompleteSquare() function to implement this?

If you are familiar with this game or website, you can click on 'Really Quick Start' (left column) to get the bare minimum instructions.



Really Quick Start

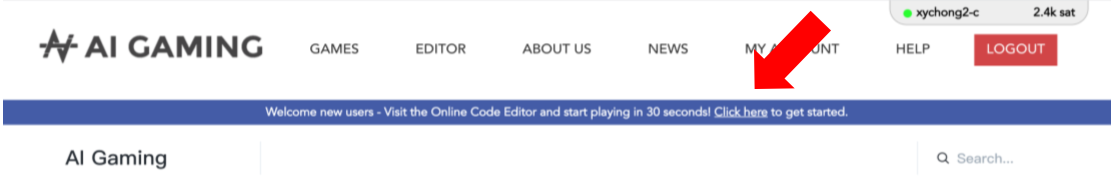
If you want the bare minimum instructions, here are the quick notes about what is important to start playing games.

Getting Started

- From the Editor screen select the Game Type that you want to play
- Every game comes with working template code that will have been loaded into the Editor for you
- You can hit the Run button at the top right of the Editor and the game will play using the template code in the Editor window.

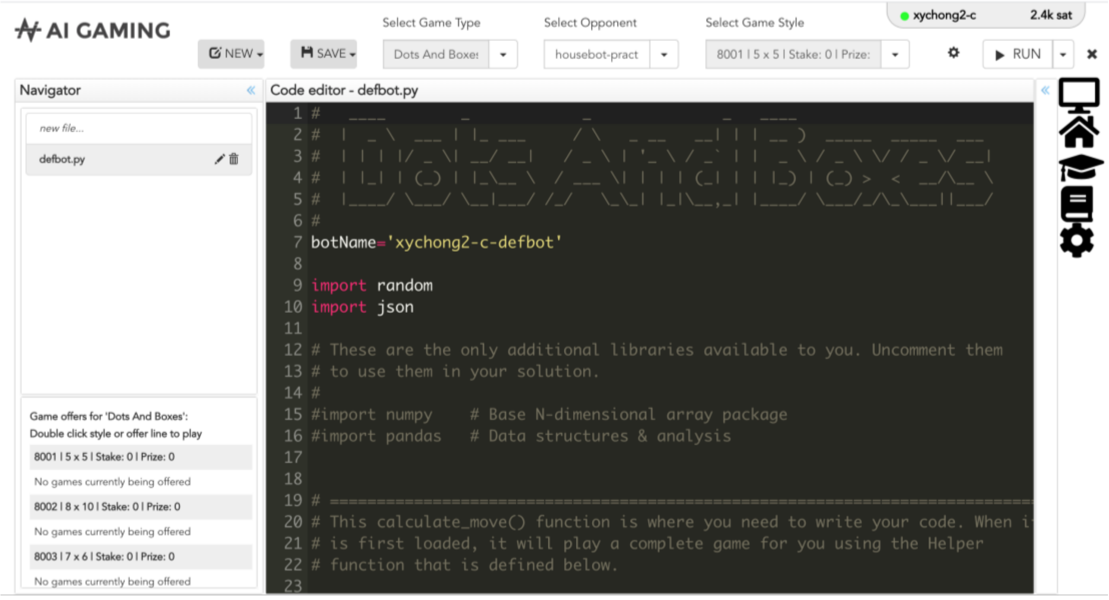
1.2 Getting started by online editor

After we know the above information, we can start coding using online editor. You can click on Click here (in the upper corner of every page) to enter the editor.



Welcome new users - Visit the Online Code Editor and start playing in 30 seconds! Click here to get started.

The editor looks like this:



Select Game Type: Dots And Boxes

Select Opponent: housebot-pract

Select Game Style: 8001 | 5 x 5 | Stake: 0 | Prize:

Game offers for 'Dots And Boxes':
Double click style or offer line to play

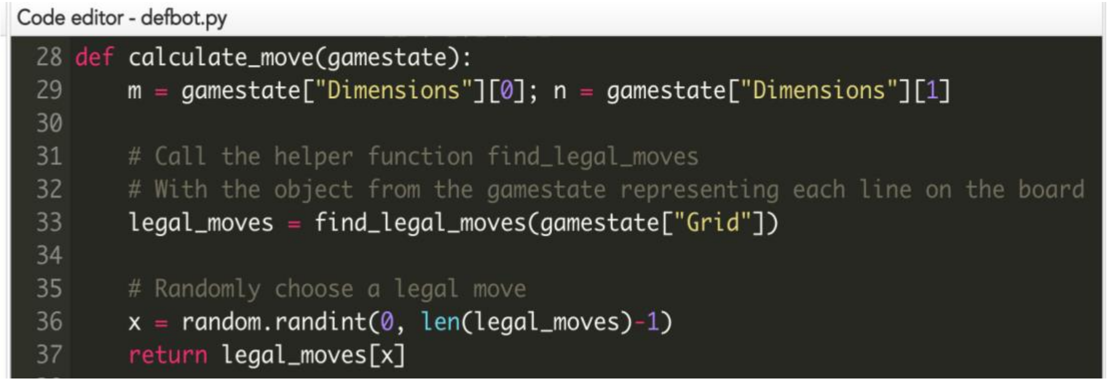
8001 | 5 x 5 | Stake: 0 | Prize: 0
No games currently being offered
8002 | 8 x 10 | Stake: 0 | Prize: 0
No games currently being offered
8003 | 7 x 6 | Stake: 0 | Prize: 0
No games currently being offered

Code editor - defbot.py

```
#   ____        _            _              _ ____
#  |  _ \  ___ | |_ ___     / \   _ __   __| | __ )  _____  _____  ___
#  | | | |/ _ \| __/ __|   / _ \ | '_ \ / _` |  _ \ / _ \ \/ / _ \/ __|
#  | |_| | (_) | |_\__ \  / ___ \| | | | (_| | |_) | (_) >  <  __/\__ \
#  |____/ \___/ \__|___/ /_/   \_\_| |_|\__,_|____/ \___/_/\_\___||___/
#
botName='xychong2-c-defbot'

import random
import json

# These are the only additional libraries available to you. Uncomment them
# to use them in your solution.
#
#import numpy    # Base N-dimensional array package
#import pandas   # Data structures & analysis


# ==========================================================================
# This calculate_move() function is where you need to write your code. When i
# is first loaded, it will play a complete game for you using the Helper
# function that is defined below.

```

1.3 How to modify the starter bot?

The starter bot gives the easiest way to find a move. In the calculate_move() function, we can see that, in each turn, the starter bot randomly chooses a legal move x and then return it.



Code editor - defbot.py

```
def calculate_move(gamestate):
    m = gamestate["Dimensions"][0]; n = gamestate["Dimensions"][1]

    # Call the helper function find_legal_moves
    # With the object from the gamestate representing each line on the board
    legal_moves = find_legal_moves(gamestate["Grid"])

    # Randomly choose a legal move
    x = random.randint(0, len(legal_moves)-1)
    return legal_moves[x]
```

To write your own bot, you need to change the following line:

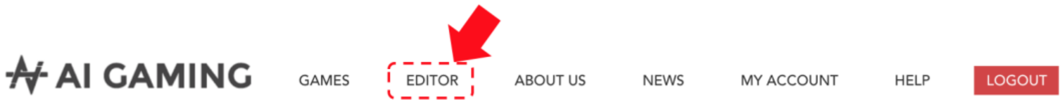
x=random.randint(0,len(legal_moves)-1) to your own AI codes.

Please note that timeout for each turn is 5000 ms. Hence you must make a move within 5000 ms.

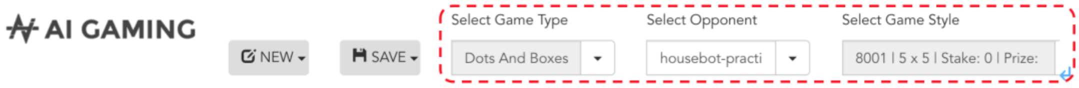
2.Test your bot

2.1 Test your bot online

1) Click on the '**EDITOR**' button on the top.

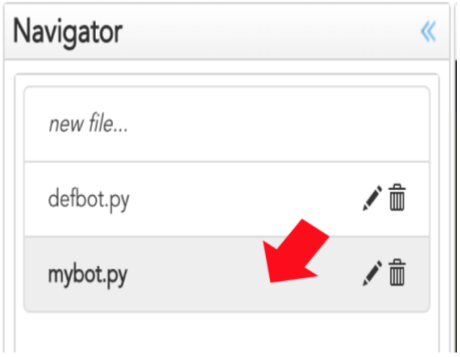


2) This page is The Code Editor. It lets you develop your game playing bots and test your bots online. Please make sure that the **game type** you select is **'Dots and Boxes'.** You could use 'housebot-practice' as your opponent, which is the easiest one or other people by selecting the **Anyone** option from the Select Opponent dropdown. This option means that your bot will play against any compatible bot that is running **at the same time**. If you know another person's bot name, or if you want to compete against a friend, you can **specify their bot name**. You do this by typing their bot name into the field at the top of the Select Opponent dropdown. For the game style, you should choose '**8001|5*5|Stake:0|Prize:0**'. And the programming language you use **MUST** be **Python**.



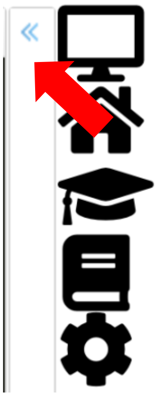
Select Game Type: Dots And Boxes
Select Opponent: housebot-practi
Select Game Style: 8001 | 5 x 5 | Stake: 0 | Prize:

3) Choose the bot you want to test on navigator and click on the '**RUN**' button (upper right corner).

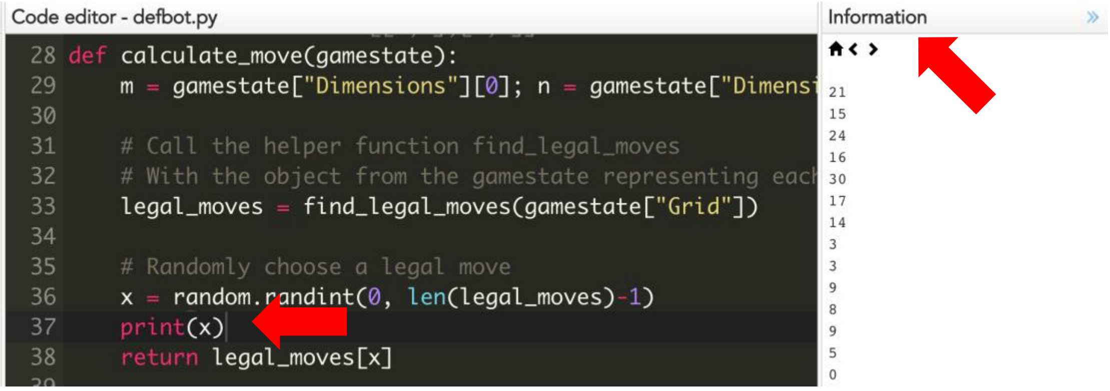


Even without changing the codes, you can click on the ‘**RUN**’ button to submit your bot. Then you can check your ranking in the leaderboard. In my test, if I submit the starter bot without any changes, I can rank around 80th in the leaderboard. Therefore, your bot MUST rank higher than the starter bot.

4) You can click on the blue sign ‘<<’ to check the console output.



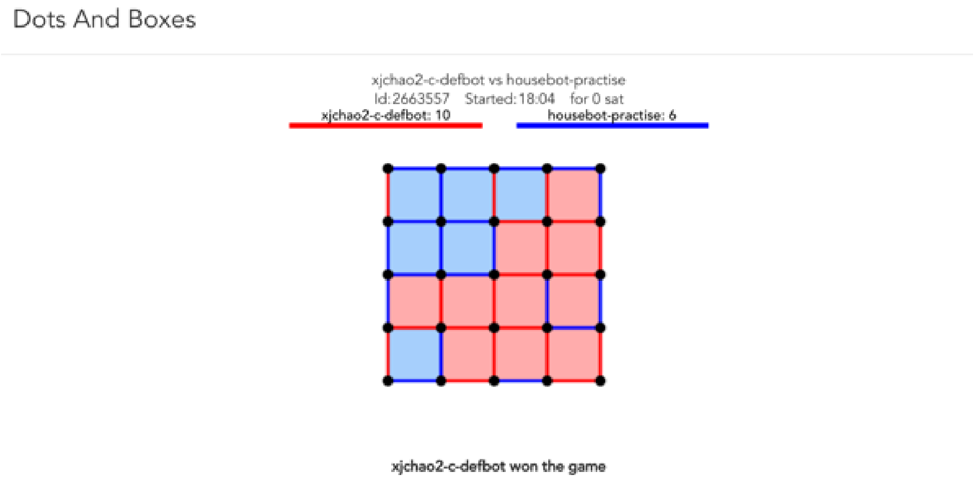
If you want to know the content of a variable, you can use the **print() function** and see the outputs under ‘Information’, which is very useful for debugging.



```
def calculate_move(gamestate):
    m = gamestate["Dimensions"][0]; n = gamestate["Dimensi

    # Call the helper function find_legal_moves
    # With the object from the gamestate representing each
    legal_moves = find_legal_moves(gamestate["Grid"])

    # Randomly choose a legal move
    x = random.randint(0, len(legal_moves)-1)
    print(x)
    return legal_moves[x]
```

```
21
15
24
16
30
17
14
3
3
9
8
9
5
0
```

5) When your game has finished, you'll be able to see the output.



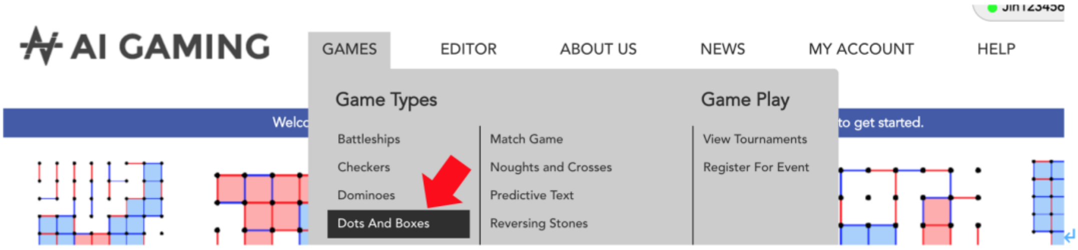
Dots And Boxes

xjchao2-c-defbot vs housebot-practise
Id: 2663557 Started: 18:04 for 0 sat
xjchao2-c-defbot: 10 housebot-practise: 6

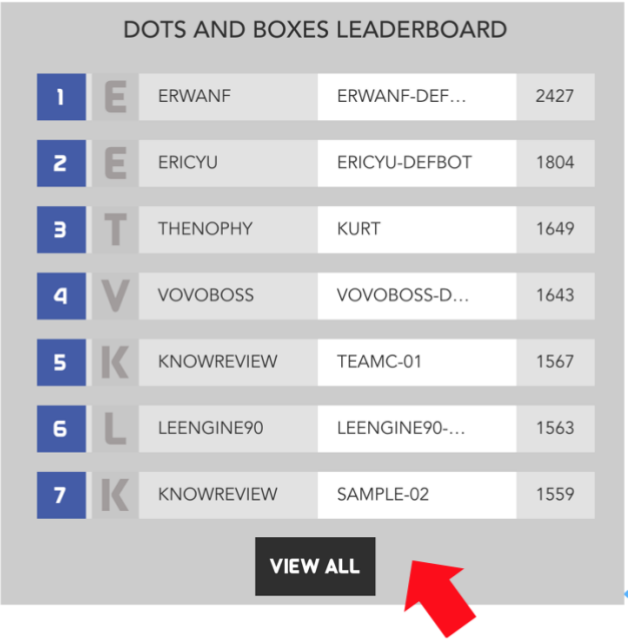
xjchao2-c-defbot won the game

2.2 Check the rankings

1) Back to the main page, click on GAMES and choose Dots and Boxes.



2) Click on the VIEW ALL button on DOTS AND BOXES LEADERBOARD part to see the rankings.



DOTS AND BOXES LEADERBOARD

1	E	ERWANF	ERWANF-DEF...	2427
2	E	ERICYU	ERICYU-DEFBOT	1804
3	T	THENOPHY	KURT	1649
4	V	VOVOBOSS	VOVOBOSS-D...	1643
5	K	KNOWREVIEW	TEAMC-01	1567
6	L	LEENGINE90	LEENGINE90-...	1563
7	K	KNOWREVIEW	SAMPLE-02	1559

3. Assignment Submission

3.1 Preparation

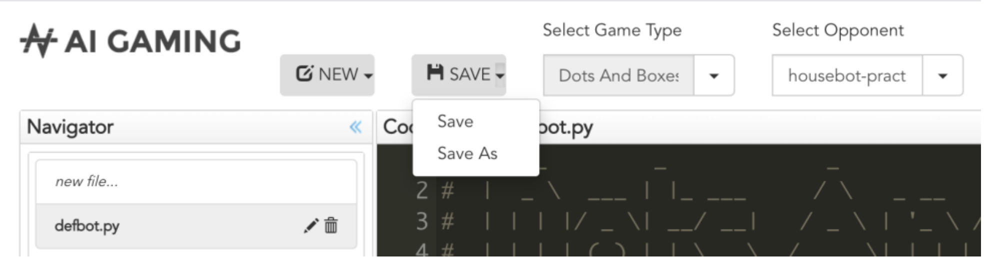
a) Source code

- At the beginning of **ALL** your python files, add the following comments to your code:

```
##############################

##CS4386 Semester B, 2019-2020
```

```
##Assignment 2
##Name: [Your name]
##Student ID: [Your student ID]
###########################
```

- Download **ALL** your python files from the online editor by clicking on SAVE→SAVE AS button:



Select Game Type: Dots And Boxe

Select Opponent: housebot-pract

- Rename the zip file that contains the related files of your AI bot source code as **CS4386_1920B_[studentID]_[name].zip**, where [studentID] is your student ID and [name] is your name. You need to submit this zip file to **Canvas**.

b) A report

- You should write a report to explain your AI bot.
- At the beginning of the report, include the following information:
  - The heading “CS4386 Assignment 2 (Semester B, 2019-2020)”
  - Your name
  - Your student ID
  - Your username on AI GAMING
- You should then describe your algorithm **as clearly as possible**. Feel free to use examples and add screenshots or other figures if it can help better illustrate your method.
- **If you adopt some part of your code from somewhere, you must fully acknowledge this and provide a reference to where you obtain the code. You must declare how much of your submitted code is obtained from someone/somewhere else and how much is indeed written by you.**

- At the end of your report, include the related references from where you have gathered useful information in working on your assignment
- Convert your report to a PDF file with the file name **CS4386_1920B_[studentID].pdf**, where [studentID] is your student ID.
- You need to submit this report together with your source code to Canvas.

3.2 Handing in

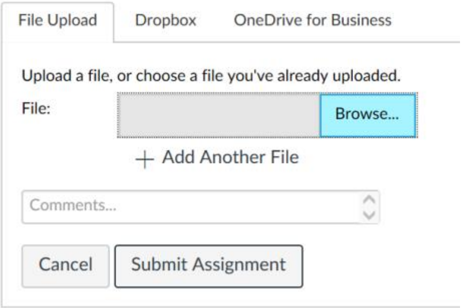
You should submit your **AI bot to BOTH AI GAMING AND Canvas** and **submit your report to Canvas** before the **assignment** deadline (**Friday 24 April 2020**).

a) AI GAMING Website:

- You should **upload** your last completed bot to AI GAMING website under your account and **run** it, as described in section 2.1.

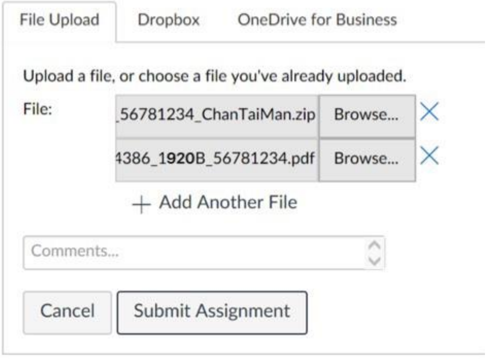
b) Canvas Website:

- You should upload the following 2 files to Canvas (under Assignment > Assignment 2)
  1. **CS4386_1920B_[studentID]_[name].zip**
  2. **CS4386_1920B_[studentID].pdf**
- Click Browse and select your zip file containing the source code of your AI bot:



Upload a file, or choose a file you've already uploaded.

- Click Add Another File, then click Browse and select your PDF file containing your report:



Upload a file, or choose a file you've already uploaded.

File: _56781234_ChanTaiMan.zip
4386_1920B_56781234.pdf

- After making sure that you have selected the 2 correct files, click 'Submit Assignment' to finalize your assignment submission on Canvas.

3.3 Grading Policy

The total score for this assignment is 20 marks with the following components:

a) **Offline Testing (10 marks)**

Our TAs will run your bot with all of the bots of your classmates one by one. This method is more reliable than the online leaderboard.

Note: If you do not submit your bot, you will get 0 for this part.

b) Report (5 marks)

Note: If you do not submit the report, you will get 0 for this part.

c) Algorithms in your Codes (5 marks)

Note: If your algorithm is the same as the starter bot (or similar to random selection), you will get 0.

4. References for the Algorithm

The following links contain some potential methods and sample codes that can be used for reference. Of course, you are also encouraged to try other algorithms.

Minimax

Code

https://github.com/benjamingorman/DeepBox

https://github.com/Armando8766/Dots-and-Boxes

5. Help Seeking

At any time if you are lost or if you have any question, you can post your question on CANVAS and our TAs (Xianjin CHAO and Xiaoya CHONG) will respond to your question as quickly as possible. Besides, please also feel free to send emails to the TA Xianjin CHAO (email: xjchao2-c@my.cityu.edu.hk) who will be very happy to help you.