**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**

**DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION SYSTEMS**

**Artificial Intelligence (BITS F444/ CS F407)**

**I Semester 2017-18**

**Programming Assignment-2**

**Coding Details**

**(October 3, 2017)**

*Instruction: Type the details precisely and neatly*

1. ID 2015A1PS791P

Name Kabir Ahuja

1. Mention the names of Submitted files :
   1. <kabir\_driver.py>
   2. <kabir\_assignment2.py>
   3. <kabir\_comparitive.py>
   4. <2015A1PS0791P.docx>
2. Total number of submitted files: 4
3. Name of the folder :2015A1PS0791P
4. Have you checked that all the files you are submitting have your name in the top?(yes/no) yes
5. Have you checked that all the files you are submitting are in the folder as specified in 4 (and no subfolder exists)?(yes/no) yes
6. Problem formulation
   1. State representation: State is represented as the the game board, an object containing a 2D matrix and other helpful functions. Initially all the elements of the matrix are 0 and the move of player 1(MAX) is filled as 1 in the matrix and 2 for the player 2
   2. Pseudo code of your successor function

function move(player,action):

col = action

row = find\_row(col)

state[row][col] = player

function successor\_function(state,action,player):

new\_state = copy(state)

move(new\_state,player,action)

return new\_state

#Please note that successor function is defined slightly differently i.e it also takes the action as argument which is done so that at a time only one child node is created.

* 1. Terminal states generation process

Whenever a new move is made it is checked whether that move resulted in win or not which is done by checking the neighbouring tiles of the position where the coin has been placed recently

* 1. Data structure to store terminal states

Terminal states are not stored, instead checking whether the state is terminal or not is done.

* 1. Method to access terminal states and corresponding utility values

Terminal\_test(player,row,col) defined in align3 class.

If it returns true in MinVal function, then it means max has won and hence +1 is returned and -1 otherwise, checking for draw is also done along with them.

1. Minimax Technique details
   1. Node structure: Node contains the state only, it was discovered that defining any other values were redundant and were removed

* 1. Method to ensure the correctness of terminal test (describe in maximum 4 lines)

Create a 4x4 matrix (2d list), create any state by setting some values as 1(player 1) and some as 2(player2). Then create an object of the class align3 by writing, game = align3(mat), where mat is the matrix you created. Then use Terminal\_test method of this object and it will return True if its a terminal state and false if not. game and give it the arguments player(1 or 2), last column and row index filled, Terminal\_test(player,row,col). It is defined like this for faster check.

* 1. Total number of nodes generated to play one game: 611385 (This number is comparatively less due to some modifications like not checking further states if +1 reward is observed)

* 1. Write the statistics here as asked

R1 = 611385 R2 = 73bytes R3 =16

R4 = 48.84 R5=0.0156

* 1. Code status (implemented fully/ partially/ not done) implemented fully

1. Alpha Beta technique details:
   1. Explain the logic used for pruning (in maximum four lines)

2 variables alpha and beta are initialized, alpha contains the minimum possible utility of a state and beta represents maximum possible value. These values are constantly updated in MinVal and MaxVal functions. If a value of a child node of MAX is greater than beta, we dont explore further and if a child node of MIN is less than alpha it isnt explored further

* 1. Total number of nodes generated to play one game 122500
  2. Write the statistics here as asked

R6 = 122500 R7 = 0.799 R8 =17.069

1. Code status (implemented fully/ partially/ not done) fully done

1. Comparative analysis

Fill in the following information based of 10 independent games

|  |  |  |
| --- | --- | --- |
|  | Minimax Algorithm | Alpha Beta Pruning |
| Average number of nodes created | 611385 | 122500 |
| Average time taken | 48.84 | 17.069 |
| Number of times machine wins (player M) | 10 | 10 |

1. GUI details
   1. Created the GUI (yes/ No): yes
   2. Have created it according to the specifications?(yes/No) yes
   3. Which module of Python is used for creating graphics? turtle
   4. Is this under the standard Python library or not? yes
   5. If not, why?
2. Graphics details:
   1. Is turtle graphics working fine for displaying the board and coins? yes
   2. How have you calibrated the board and accepted human input to play the game? yes
   3. How are you showing the base line? as a blue line above the board
   4. How are you showing the move of the machine? as a blue dot
   5. How are you showing the move of the human player? as a green triangle
3. Compilation Details:
   1. Code Compiles (Yes/ No):Yes
   2. Mention the .py files that do not compile:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Any specific function that does not compile:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. Ensured the compatibility of your code with the specified Python version(yes/no) yes
   5. Instructions for compilation of your files mentioning the multi file compilation process used by you (We may use the replica of these for compiling your files while evaluating your code) only kabir\_driver.py is to be used for execution, but it uses functions and classes defined in kabir\_assignment2.py so they both must be present in same folder. comparitive.py is an optional file if you want to run it run it with the same directory as kabir\_assignment2.py
4. Driver Details: Does it take care of the options specified earlier(yes/no): yes it asks the user for which option to run
5. Execution status (describe in maximum 2 lines)

The program is running without any error.

1. Declaration: I, Kabir Ahuja (name) declare that I have put my genuine efforts in creating the python code for the given programming assignment and have submitted only the code developed by me. I have not copied any piece of code from any source. If the code is found plagiarized in any form or degree, I understand that a disciplinary action as per the institute rules will be taken against me and I will accept the penalty as decided by the department of Computer Science and Information Systems, BITS, Pilani.

ID 2015A1PS0791P Name: Kabir Ahuja

Date: 2 October 2017

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