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

Batch No. :

**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 2015A7PS0102P

Name K S Sanjay Srivastav

1. Mention the names of Submitted files :
   1. GUI.py
   2. modules.py
   3. main.py
   4. 2015A7PS0102P.docx
2. Total number of submitted files: 4
3. Name of the folder : 2015A7PS0102P
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:

A tuple consisting of a 4X4 matrix and the x position and y position of the last move played on the board.

* 1. Pseudo code of your successor function

v=-infinity

for each i in successors(state):

v1=max(v,Min\_value(i));

if v1 is not v:

bestchild=i

v=v1

return bestchild

* 1. Terminal states generation process

Since I have the last moved position in my state representation, I can just check the 3X3 neighborhood of the current position and check if any pattern exists and proceed to finalize who won.

* 1. Data structure to store terminal states

No data structure is required to store as it is just comparing the state with the given position of last placed coin.

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

Terminal state is checked dynamically and thus no explicit access as such. Utility value is the determined based on who called this terminal test function and decide the outcome utility value of either 1 or -1 in case the terminal test returns True.

1. Minimax Technique details
   1. Node structure: A state representation as described earlier with 4 children states is the implicit node.
   2. Method to ensure the correctness of terminal test (describe in maximum 4 lines): Since I am only checking the last moved position, it will never fail because had it reached a terminal state earlier it wouldn’t have come till this point and hence is right.
   3. Total number of nodes generated to play one game: 562320
   4. Write the statistics here as asked

R1 = 562320 nodes R2 = 88 Bytes R3 = 16 (length of max stack)

R4 = 14.51 sec R5= 0.039 nodes/ microsec

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

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

For a max node, the children min nodes will prune their children using alpha value based on the condition that if one of the child of the min node’s utility is lesser than the current running value of alpha , other children of it are not evaluated and hence are pruned and vice versa for min node.

* 1. Total number of nodes generated to play one game: 14297
  2. Write the statistics here as asked

R6 = 14297 nodes R7 = 0.975 R8 = 0.408 sec

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

1. Comparative analysis

Fill in the following information based of 10 independent games

|  |  |  |
| --- | --- | --- |
|  | Minimax Algorithm | Alpha Beta Pruning |
| Average number of nodes created | 562320 | 14297 |
| Average time taken | 12.309 sec | 0.439 sec |
| 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

* 1. How have you calibrated the board and accepted human input to play the game?

Yes

* 1. How are you showing the base line?

Using a red line at the top

* 1. How are you showing the move of the machine?

Using a green coin

* 1. How are you showing the move of the human player?

Using a blue coin

1. 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: No
   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)”python main.py”
2. Driver Details: Does it take care of the options specified earlier(yes/no):yes
3. Execution status (describe in maximum 2 lines) Working fine as per the rules mentioned in the problem statement. Human has to take care that he clicks properly after the machine move is done to prevent any absurd results (if any).

1. Declaration: I, K S Sanjay Srivastav (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 2015A7PS0102P Name: K S Sanjay Srivastav

Date: 03-10-2017

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