**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-1**

**Coding Details**

**(September 14, 2017)**

*Instruction: Type the details precisely and neatly*

1. ID \_\_\_\_\_\_\_\_Maitri Shastri\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name \_\_\_\_\_\_\_\_2014B2A70220P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Mention the names of Submitted files :
   1. <filename.ext>FinalAssign.py
   2. <filename.ext>
   3. <filename.ext>
   4. <filename.ext>
   5. <filename.ext>
   6. <filename.ext>
   7. <filename.ext>
2. Total number of submitted files: \_\_1\_\_\_\_\_\_\_\_\_
3. Name of the folder :\_\_\_\_\_\_2014B2A70220AIassign\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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 using a class that contains 2 atributes: The matrix representing the state of the room using a list of lists and the position of the vacuum cleaner using a list
   2. How is the Initial state generated? Initial state is generated using dirtgeneratorrandom function that randomly picks up dirty tiles. The starting position is generated using another function that generates the starting position randomly.
   3. What is the goal state? Goal state is a d dimensional matrix of zeros and the position of vacuum cleaner is in either of the 4 corners
   4. Are there more than one goal states? 4 goal states
   5. If yes, then describe all the goal states

1)d dimensional matrix of all zeros and vacuum cleaner position in(0, d-1)

2)d dimensional matrix of all zeros and vacuum cleaner position(0,0)

3) d dimensional matrix of all zeros and vacuum cleaner position in(d-1, d-1)

4)d dimensional matrix of all zeros and vacuum cleaner position in(d-1,0)

* 1. State representation in Python (name the construct and give one small example of a state)

Initial state is described as follows :-

Initial room condition

[[1, 1, 1, 1, 1, 0, 0, 1, 1, 0], [0, 0, 1, 0, 1, 1, 0, 0, 1, 1], [1, 1, 0, 1, 0, 1, 0, 0, 0, 0], [0, 0, 0, 0, 0, 0, 1, 0, 0, 1], [0, 1, 0, 1, 0, 1, 1, 1, 0, 0], [1, 1, 1, 1, 1, 1, 1, 0, 0, 1], [1, 0, 0, 1, 0, 0, 0, 0, 1, 1], [1, 1, 0, 1, 1, 1, 0, 0, 1, 0], [1, 0, 1, 0, 1, 1, 1, 0, 1, 1], [0, 0, 0, 0, 0, 0, 1, 0, 1, 0]]

Starting position[9, 0]

1. Successor function description

Legal moves function returns a list of all legal moves. The successor function then uses this list to generate tuples of the form(newstate, action, cost) where action=legal move, cost=2 for up, down, right, left and cost=0 for suck operation and newstate is formed using result function.

1. Uninformed Search Technique (T1) details
   1. Technique used for search: DFS(Graph Version)

* 1. Reason for selecting this technique over the other two: The memory requirements for both BFS and Iterative Deepening were huge leading to system crashes. Graph version of DFS worked for higher dimensional matrices also and very high dirt percentages taking significantly less time.

* 1. Is the search applied on tiles or on states? Search is applied on states
  2. Error handling and reporting (yes/No): Currently not giving errors with usual test cases
  3. List the errors handled:Invalid percentage value, Invalid value of option, Converting number of tiles to integer value
  4. Data Structure description for the tree node (in maximum two lines):

Stack (LIFO) structure was used to keep a track of nodes for expansion

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

DFS-Implemented Fully with relevant statistics

Greedy Best First Search-Implemented Fully with statistics

GUI-Implemented partially shows only room status and action path

Analysis Module-Graphs not implemented

1. Informed search Technique (T2) details:
   1. Technique used for search: Greedy Best First Search
   2. Reason for selecting this technique over others: Since the environment was partially observable,I decided to use Greedy best first search.
   3. Does this technique look at a tile?

This technique looks at the tile and also at its successors and visible neighbors of successors.

* 1. Does this technique use a state?

Yes, it uses a state

* 1. Code status (implemented fully/ partially/ not done) implemented fully
  2. Define the heuristics (in words) used in your program
     1. h1 :If tile is dirty then the algorithm adds only 'suck' successor to the fringe.If the tile is clean ,then it adds only neighbouring dirty tiles. If no neighbouring tile is dirty it adds those tiles having dirty neighbours(checks 2 neighbours in visible region)and if everything above fails all other tiles are added to the fringe. If a tile is a corner tile it is always added to the fringe.
     2. h2 :If tile is dirty then the algorithm adds only 'suck' successor to the fringe. If the tile is clean ,then it adds only neighbouring dirty tiles. If no neighbouring tile is dirty, it adds all other tiles to the fringe.
  3. Compute the heuristic values for the following windows with dirt in the neighborhood of the centre position of the vacuum cleaner.

Heuristic was implemented as if else structure and not using compute heuristic value function.

1. GUI details
   1. Created the GUI (yes/ N0):Yes,partially
   2. Have created it according to the specifications?(yes/No)No
   3. Which module of Python used for creating graphics? Turtle
   4. Is this under the standard Python library or not?Yes
   5. If not, why?
   6. Are the window panes working independently?Yes ,each window pane is represented as an independent dot.
2. Graphics details:
   1. Is turtle graphics working fine for movement of the intelligent vacuum cleaner?Yes
   2. How are you creating the room tiles?Using Dots
   3. How are you showing the dirt?Using yellow dots for dirty tiles and black dots for clean tiles
   4. How are you showing the resting position of the vacuum cleaner?Vacuum cleaner represented by turtle
   5. Are you showing the movement of the vacuum cleaner (turtle cursor) as the execution of T1 goes on? Why?

No,the path is shown only after getting computed since we have to trace back to the parent pointers to get the path.

* 1. Are you showing the movement of the vacuum cleaner (turtle cursor) as the execution of T2 goes on? Why?

No, the path is shown only after getting computed since we have to trace back to the parent pointers to get the path.

1. Compilation Details:
   1. Code Compiles (Yes/ No):Yes\_\_\_\_\_\_\_\_\_\_\_
   2. Mention the .py files that do not compile:N.A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Any specific function that does not compile:\_N.A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   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 one single file is used
2. Driver Details: Does it take care of the options specified earlier(yes/no):\_\_yes\_\_\_\_\_\_\_\_\_
3. Execution status (describe in maximum 2 lines)

Code executing properly and displaying action path,statistics,computing different values on varying percentage dirt and room dimensions for greedy and dfs algorithms.Graphs have not been implemented.

1. Output Details
   1. Copy and paste the output of four graphs G1-G4 here

Not implemented

Write some more details here for the above graphs, if needed

* 1. Write the following values computed by you (refer the details of R1-R11 in the assignment document). Use appropriate units for the values

Enter the percentage of tiles to get dirt (integer value)50 for 10\*10 matrix

Initial room condition

[[0, 1, 1, 1, 1, 0, 0, 0, 0, 1], [1, 0, 1, 1, 0, 0, 0, 0, 1, 0], [1, 0, 1, 0, 0, 1, 1, 0, 0, 1], [0, 1, 0, 0, 1, 1, 1, 0, 0, 1], [1, 0, 1, 1, 0, 1, 0, 1, 1, 0], [0, 1, 0, 0, 0, 1, 0, 1, 1, 1], [1, 0, 1, 0, 0, 1, 0, 0, 1, 0], [0, 1, 0, 0, 1, 1, 1, 1, 1, 1], [0, 1, 1, 1, 0, 0, 0, 1, 0, 0], [0, 0, 1, 1, 1, 1, 1, 0, 0, 0]]

Starting position[0, 9]

R1: 3444 nodes R2: 72 bytes R3: 1211 nodes R4:872 units

R5: 9.94s

Initial room condition

[[1, 1, 1, 0, 1, 0, 0, 0, 1, 1], [1, 1, 0, 0, 1, 0, 1, 1, 1, 1], [0, 1, 1, 1, 0, 1, 0, 0, 0, 0], [0, 0, 1, 0, 1, 0, 0, 1, 1, 0], [0, 1, 1, 0, 0, 0, 1, 1, 1, 1], [0, 1, 0, 0, 1, 0, 1, 1, 0, 0], [0, 1, 0, 0, 0, 1, 0, 0, 0, 1], [1, 0, 1, 1, 0, 0, 1, 0, 1, 0], [0, 1, 1, 1, 0, 1, 1, 0, 1, 1], [0, 1, 0, 0, 0, 1, 1, 1, 0, 0]]

Starting position[0, 9]

R6: 894 R7: 72bytes R8:280 ,312 units

R9: 0.48s,0.57s R10: 24768(DFS),64897(T2) R11:855(DFS),329(Greedy)(10\*10)

1. Declaration: I, \_\_\_\_Maitri Shastri\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2014B2A70220P\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name:\_ Maitri Shastri\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_14/09/17\_\_\_\_\_\_\_\_\_\_\_\_

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