

Assignment 1

Instructor: Le Nguyen

Date: Friday, January 29, 2019

Due Date: February 13, 2019

Total marks: 40.

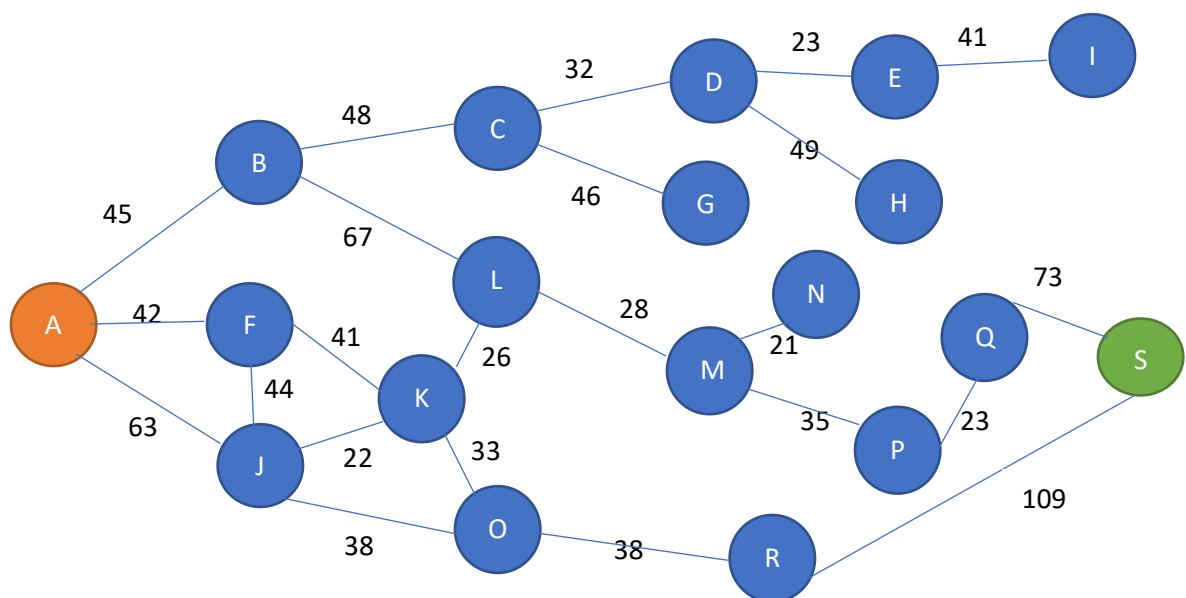
1. AI approaches. **(2 marks)**

- Briefly summarize the four major approaches in AI. You have to provide an discussion on the main focus of each approach.
- What is the difference between weak AI and Strong AI?

2. Task environment **(2 marks)**

- For each of the following activities, give a PEAS description of the task environment and characterize it in term of the properties.
 - Playing soccer
 - Playing tennis match

3. Informed and Uninformed Search. **Draw a search tree and list the order of nodes visited** and show to queue information at each depth **(12 marks)**



In this question, A to S are cities. The numbers are the distances for one city to another. Start from A to S.

a. Breath First search. The expansion of the nodes is from left to right.

(6 marks)

- i. Write down the solution.
- ii. Can it find optimal solution? Explain your answer.

b. A* search. **(6 marks)**

Straight line distance is used for heuristic function.

City	SLD to S	City	SLD to S	City	SLD to S
A	184.39	G	107.70	M	100.00
B	161.25	H	101.98	N	89.44
C	145.60	I	100.00	O	111.80
D	141.42	J	144.22	P	78.10
E	140.00	K	128.06	Q	67.08
F	148.66	L	113.14	R	101.98
				S	0.00

- i. Write down the solution.
- ii. Can it find optimal solution? Explain your answer.

4. Implement 8 Puzzle problem in Java for Search Tree using the following search strategies: (24 marks)

a. Breadth first search.

i. Node expansion should be in order **LEFT, RIGHT, UP, DOWN**.

b. A* search with the following **heuristic functions h1 and h2** that discussed in the class.

i. Number of misplaced tiles. (h1)

ii. Manhattan distance (h2)

There are **several java interfaces and classes** provided to help you with the implementation. Note: Please do not alter **these classes**.

- i. **GenericAction**: This interface provides a template to define action associated with 8-puzzle problem.
- ii. **GenericProblem**: This interface provides a template to define the problem.
- iii. **GenericState**: This interface provides a template to construct a state of a problem.
- iv. **Node**: It is a basic from which the search tree is constructed.

You are **to implement and submit** the following classes: (DO NOT USE ANY PACKAGE)

i. **EightPuzzleAction.java**

- a. This class should implement **GenericAction**. It must define the actions: LEFT,RIGHT,UP,DOWN. These can be used to move or change the board state.

ii. **EightPuzzleProblem.java**

- a. This class should implement **GenericProblem**. It must provide the implementation that define in the interface.
- b. Node expands in order of action (LEFT,RIGHT, UP, DOWN).

iii. **EightPuzzleBoard.java**

- a. This class should implement the **GenericState**. It should provide the implementation that defined in the interface. It should also provide the heuristic functions calculation needed for the A* search.

iv. **EightPuzzleSearchAgent.java**

- a. This class should implement the treeSearch.
 - i. Breadth First Search.
 - ii. A* Search with the above heuristic functions
 - 1. Note: When the node have the same value for evaluation function, they are visited in FIFO order.

It is used to **launch the search agent** that load the initial state and goal state from a file. A file has a format. Each digit is separated by a space or new line.

Initial State:

1 2 3

4 5 6

7 8 0

Goal State:

0 8 7

6 5 4

3 2 1

- b. Your program should display the following information.
 - i. The nodes that are generated and its state, g (path cost), h (heuristic value), f (value).
 - ii. The number of nodes on the tree.
 - iii. The solution. (Path to the solution)
 - iv. Display the summary of the search strategies.
- c. Discuss the reason why one search strategy is better than another.
 - i. Case 1: Breath First Search vs. A* Search
 - ii. Case 2: A* Search with h1 vs. A* Search with h2.
 - iii. Is h1 is admissible? What happen when it is not admissible? Give an example.

Run your program

C:\> java EightPuzzleBoard StateFile

Initial State

0 1 2

3 4 5

6 7 8

Goal State

1 0 2

3 4 5

6 7 8

Breadth First Search:

Action = RIGHT

$g = 0.0$, $h = 1$, $f = 1$

1 0 2

3 4 5

6 7 8

Number of nodes on the tree = 2.

Solution:

Initial State

0 1 2

3 4 5

6 7 8

Action = RIGHT

$g = 0.0$, $h = 1$, $f = 1$

1 0 2

3 4 5

6 7 8

A* Search with h1

.....

A* Search with h2

.....

After the search is done it should display.

Depth	Search Cost (Number of nodes generated)		
	A*(h1)	A*(h2)	Breadth First Search
1	2	2	2
.....

Submission:

Codes that cannot compile will receive a zero mark. Please make sure it can compile and it should work on windows and linux. Java 8 is used to mark the assignment.

Please submit the following files:

1. A1.pdf.
2. README File
3. The Code:
 - a. EightPuzzleAction.java
 - b. EightPuzzleSearchAgent.java
 - c. EightPuzzleProblem.java
 - d. EightPuzzleBoard.java