**Project 2 Artificial Intelligence :CSCE 5210 – Fall 2021**

**Distributed: Tuesday, September 28**

**Due: Tuesday October 19**

Q1) We need a queue and tree data structure to support the minimization of movement between divisions.

**Queue** in linear data structure to save the current division node that we visited, so we can record the path and find the shortest path from this recorded queue.

**Tree** in non-linear data structure to create the map of this binary tree which is a bi-directional movement.

Q2) Outline the procedure :

1. Creating the customer orders’ data set for this project
   1. Creating **the division number** in the range 1 to 15.
   2. Creating **the shelves locations** in the range 1 to 63 which are generated that represent the shelf numbers where the items are located.
   3. **The number of items** which is represented by **k**, and every customer can order 3 items per order, top.
   4. Creating **m** which is represented as **the node (the shelves)** in the division, and the lowest level of each node has two children numbered 2m and 2m+1 respectively.
   5. **Heuristic search** - Creating **the cost of moving** inside the shelves and divisions which is a constant step cost of 1. This cost will add up whenever the robot moves from any parent node to any one of its child nodes.

**Note :** Every item will be distributed randomly in the shelves and divisions.

1. Creating the queue to store the current division node that we visited.
2. Creating the tree to store the value on above
   1. Division binary tree [Main tree]
      1. Parent node
         1. two children nodes(left and right) per one parent node
      2. Level of the node : 4
      3. Path cost between each node : 10, 20,30, 40
      4. Label node with the number : 1-15
      5. Current\_node : Current position of the robot
      6. Tail node [the last node] : 8 nodes
   2. Shelf binary tree [Sub Tree]
      1. Parent node
         1. two children nodes(left and right) per one parent node
      2. Level of the node : 6
      3. Path cost between each node : 1
      4. Label node with the number : 1-63
      5. Current position of the robot
      6. Tail node[the last node] : 32 nodes

Q3) Please see the code

Q4) Please see the code

Q5) Please see the code

Q6) 1. Please see the code

2.Print out the length of the shortest and longest paths across the N orders that you generated.

The shortest division path of length 0: []

The longest division path of length 15: [1, 2, 4, 8, 9, 5, 10, 11, 3, 6, 12, 13, 7, 14, 15]

The shortest shelf path of length 0: []

The longest shelf path of length 57: [7, 14, 28, 56, 57, 29, 58, 59, 15, 30, 60, 61, 31, 62, 63, 3, 6, 12, 24, 48, 49, 25, 50, 51, 13, 26, 52, 53, 27, 54, 55, 1, 2, 4, 8, 16, 32, 33, 17, 34, 35, 9, 18, 36, 37, 19, 38, 39, 5, 10, 20, 40, 41, 21, 42, 43, 11]