PRACTICAL FILE

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE (ITMDC02)

Master of Technology
in
Mobile Communication and Network Technology

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Exp 1- Tic-Tac-Toe

Code:

```
def print_board(board):
 def print_board(board):
    for row in board:
        print(" | ".join(row))
        print("-" * 9)
def check_winner(board, player):
    for row in board:
        if all(cell == player for cell in row):
            return True
    for col in range(3):
        if all(board[row][col] == player for row in
range(3)):
            return True
    if all(board[i][i] == player for i in range(3))
or all(board[i][2 - i] == player for i in range(3)):
        return True
    return False

def is_board_full(board):
```

```
    return all(cell != " " for row in board for cell
in row)
def main():
board = [[" " for _ in range(3)] for _ in range(3)]
    current_player = "X"
print("Welcome to Tic Tac Toe!")
    print_board(board)
while True:
  row = int(input(f"Player {current_player},
enter row (0-2): "))
        col = int(input(f"Player {current_player},
enter column (0-2): "))

        if row < 0 or row > 2 or col < 0 or col > 2
or board[row][col] != " ":
            print("Invalid move. Try again.")
            continue
```

```
        board[row][col] = current_player
        print_board(board)

        if check_winner(board, current_player):
            print(f"Player {current_player} wins!")
            break
        elif is_board_full(board):
            print("It's a tie!")
            break

        current_player = "O" if current_player ==
"X" else "X"

if __name__ == "__main__":
    main()
```

Output:

```
Welcome to Tic Tac Toe!
  |   |
---------
  |   |
---------
  |   |
---------
Player X, enter row (0-2): 0
Player X, enter column (0-2): 0
X |   |
---------
  |   |
---------
  |   |
---------
Player O, enter row (0-2): 2
Player O, enter column (0-2): 2
X |   |
---------
  |   |
---------
  |   | O
---------
Player X, enter row (0-2): 1
Player X, enter column (0-2): 0
X |   |
---------
X |   |
```

```
Player X, enter row (0-2): 1
Player X, enter column (0-2): 0
X |   |
---------
X |   |
---------
  |   | O
---------
Player O, enter row (0-2): 1
Player O, enter column (0-2): 2
X |   |
---------
X |   | O
---------
  |   | O
---------
Player X, enter row (0-2): 2
Player X, enter column (0-2): 0
X |   |
---------
X |   | O
---------
X |   | O
---------
Player X wins!


...Program finished with exit code 0
Press ENTER to exit console.
```

Implementation of Tile Slide Puzzle using Minimize heuristic

Code:

```
class
Node:
        def __init__(self,data,level,fval):
            """ Initialize the node with the data, level of the node and the calculated
     fvalue """
            self.data = data
            self.level = level
            self.fval = fval


        def generate_child(self):
            """ Generate child nodes from the given node by moving the blank space
                either in the four directions {up,down,left,right} """
            x,y = self.find(self.data,'_')
            """ val_list contains position values for moving the blank space in either of
                the 4 directions [up,down,left,right] respectively. """
            val_list = [[x,y-1],[x,y+1],[x-1,y],[x+1,y]]
            children = []
            for i in val_list:
                child = self.shuffle(self.data,x,y,i[0],i[1])
                if child is not None:
                    child_node = Node(child,self.level+1,0)
                    children.append(child_node)
            return children

        def shuffle(self,puz,x1,y1,x2,y2):
            """ Move the blank space in the given direction and if the position value are out
                of limits the return None """
            if x2 >= 0 and x2 < len(self.data) and y2 >= 0 and y2 < len(self.data):
                temp_puz = []
                temp_puz = self.copy(puz)
                temp = temp_puz[x2][y2]
                temp_puz[x2][y2] = temp_puz[x1][y1]
                temp_puz[x1][y1] = temp
                return temp_puz
            else:
                return None



        def copy(self,root):
            """ Copy function to create a similar matrix of the given node"""
```

```
        temp = []
        for i in root:
            t = []
            for j in i:
                t.append(j)
            temp.append(t)
        return temp

    def find(self,puz,x):
        """ Specifically used to find the position of the blank space """
        for i in range(0,len(self.data)):
            for j in range(0,len(self.data)):
                if puz[i][j] == x:
                    return i,j




class Puzzle:
    def __init__(self,size):
        """ Initialize the puzzle size by the specified size,open and closed lists to
empty """
        self.n = size
        self.open = []
        self.closed = []


    def accept(self):
        """ Accepts the puzzle from the user """
        puz = []
        for i in range(0,self.n):
            temp = input().split(" ")
            puz.append(temp)
        return puz


    def f(self,start,goal):
        """ Heuristic Function to calculate hueristic value f(x) = h(x) + g(x) """
        return self.h(start.data,goal)+start.level


    def h(self,start,goal):
        """ Calculates the different between the given puzzles """
        temp = 0
        for i in range(0,self.n):
            for j in range(0,self.n):
                if start[i][j] != goal[i][j] and start[i][j] != '_':
                    temp += 1
```

```python
        return temp



    def process(self):
        """ Accept Start and Goal Puzzle state"""
        print("Enter the start state matrix \n")
        start = self.accept()
        print("Enter the goal state matrix \n")
        goal = self.accept()


        start = Node(start,0,0)
        start.fval = self.f(start,goal)
        """ Put the start node in the open list"""
        self.open.append(start)
        print("\n\n")
        while True:
            cur = self.open[0]
            print("")
            print("  | ")
            print("  | ")
            print(" \\\'/ \n")
            for i in cur.data:
                for j in i:
                    print(j,end=" ")
                print("")
            """ If the difference between current and goal node is 0 we have reached the
goal node"""
            if(self.h(cur.data,goal) == 0):
                break
            for i in cur.generate_child():
                i.fval = self.f(i,goal)
                self.open.append(i)
            self.closed.append(cur)
            del self.open[0]


            """ sort the opne list based on f value """
            self.open.sort(key = lambda x:x.fval,reverse=False)




puz = Puzzle(3)
puz.process()
```

Output:

```
Shell                                                    Clear
Enter the start state matrix

1 2 3
_ 4 5
6 7 8
Enter the goal state matrix

1 2 3
4 7 5
6 8 _
|
  |
 \'/

1 2 3
_ 4 5
6 7 8

  |
|
 \'/

1 2 3
4 _ 5
6 7 8

  |
  |
 \'/

1 2 3
4 7 5
6 _ 8

  |
  |
 \'/

1 2 3
4 7 5
6 8 _
```

Implementation of Water Jug Problem

Code:

```
from collections import defaultdict
jug1 = int(input("Water in jug1: "))
jug2 = int(input("Water in jug2: "))
aim = int(input("Required Water in jug: "))
print("Steps:" ,jug1,"L"," ", jug2, "L")
visited = defaultdict(lambda: False)
def waterJugSolver(amt1, amt2):
	if (amt1 == aim and amt2 == 0) or (amt2 == aim and amt1 == 0):
		print(amt1, amt2)
		return True

	if visited[(amt1, amt2)] == False:
		print(amt1, amt2)
		visited[(amt1, amt2)] = True
		return (waterJugSolver(0, amt2) or
				waterJugSolver(amt1, 0) or
				waterJugSolver(jug1, amt2) or
				waterJugSolver(amt1, jug2) or
				waterJugSolver(amt1 + min(amt2, (jug1-amt1)),
				amt2 - min(amt2, (jug1-amt1))) or
				waterJugSolver(amt1 - min(amt1, (jug2-amt2)),
				amt2 + min(amt1, (jug2-amt2))))
	else:
		return False
```

```
if jug1 >= jug2:
    waterJugSolver(0, 0)
elif jug1 <= jug2:
    jug1, jug2 = jug2, jug1
    waterJugSolver(0, 0)
waterJugSolver(0, 0)
```

Output:

```
Shell                                                    Clear
Water in jug1: 5
Water in jug2: 4
Required Water in jug: 2
Steps: 5 L   4 L
0 0
5 0
5 4
0 4
4 0
4 4
5 3
0 3
3 0
3 4
5 2
0 2
>
```

EXPERIMENT 4: Rat in a Maze

CODE:

```
def isValid(n, maze, x, y, res):
    if 0 <= x < n and 0 <= y < n and maze[x][y] == 1 and res[x][y] == 0:
        return True
    return False


def RatMaze(n, maze, move_x, move_y, x, y, res):
    if x == n - 1 and y == n - 1:
        return True

    for i in range(4):
        x_new = x + move_x[i]
        y_new = y + move_y[i]
        if isValid(n, maze, x_new, y_new, res):
            res[x_new][y_new] = 1
            if RatMaze(n, maze, move_x, move_y, x_new, y_new, res):
                return True
            res[x_new][y_new] = 0
    return False


def solveMaze(maze):
    n = len(maze)
    res = [[0 for _ in range(n)] for _ in range(n)]
    res[0][0] = 1

    move_x = [-1, 1, 0, 0]
    move_y = [0, 0, -1, 1]
```

```
    if RatMaze(n, maze, move_x, move_y, 0, 0, res):
        for i in range(n):
            for j in range(n):
                print(res[i][j], end=' ')
            print()
    else:
        print('Solution does not exist')


if __name__== "__main__":
    n = int(input("Enter the number of rows and columns for the maze: "))
     maze = []
    print("Enter the maze elements:")
    for _ in range(n):
        row = list(map(int, input().split()))
        maze.append(row)
    print("Initial Stage :")
    for row in maze:
        for col in row:
            print(col, end=" ")
        print()
    print()
    print("Final Stage :")
    solveMaze(maze)
```

Output:

```
Enter the number of rows and columns for the maze: 4
Enter the maze elements:
1 0 0 0
1 1 0 1
0 1 0 0
1 1 1 1
Initial Stage :
1 0 0 0
1 1 0 1
0 1 0 0
1 1 1 1

Final Stage :
1 0 0 0
1 1 0 0
0 1 0 0
0 1 1 1
>
```

Experiment 5

Implementation of Rat in a maze using Systematic Generate and Test

Code :

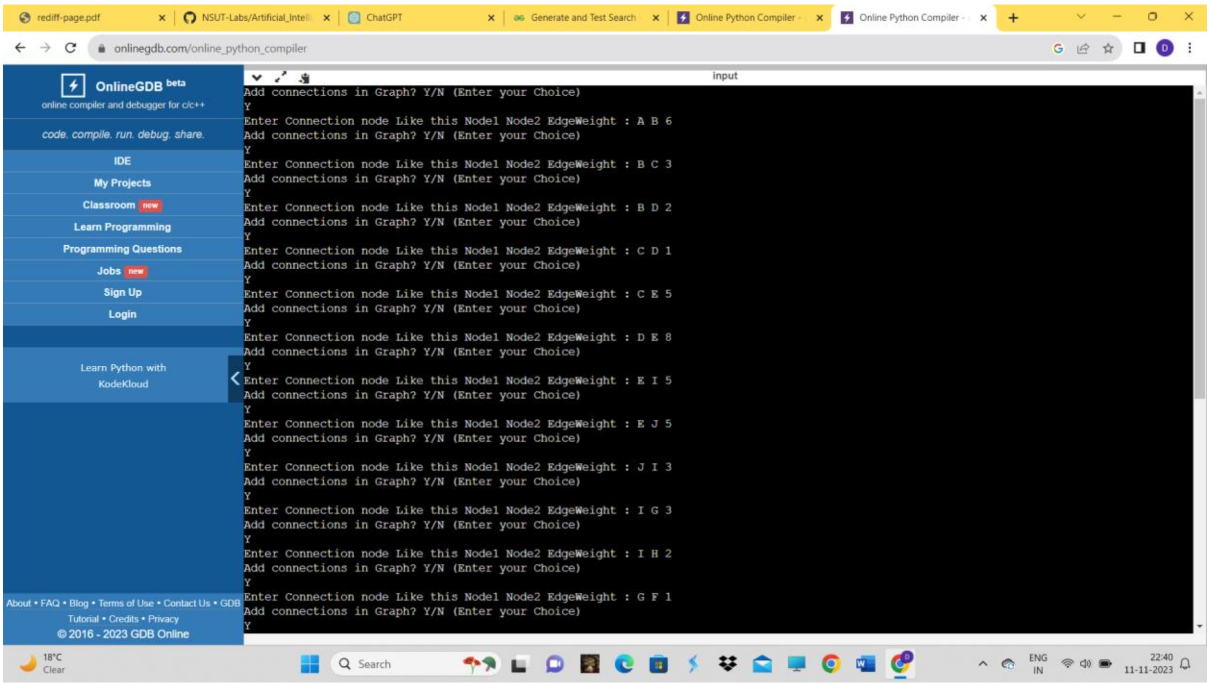
```
class Graph:
  def _init_(self, graph_dict=None, directed=True):
    self.graph_dict = graph_dict or {}
    self.directed = directed
    if not directed:
      self.make_undirected()

  def make_undirected(self):
    for a in list(self.graph_dict.keys()):
      for (b, dist) in self.graph_dict[a].items():
        self.graph_dict.setdefault(b, {})[a] = dist

  def connect(self, A, B, distance=1):
    self.graph_dict.setdefault(A, {})[B] = distance
    if not self.directed:
      self.graph_dict.setdefault(B, {})[A] = distance

  def get(self, a, b=None):
    links = self.graph_dict.setdefault(a, {})
    if b is None:
      return links
    else:
      return links.get(b)

  def nodes(self):
    s1 = set([k for k in self.graph_dict.keys()])
```

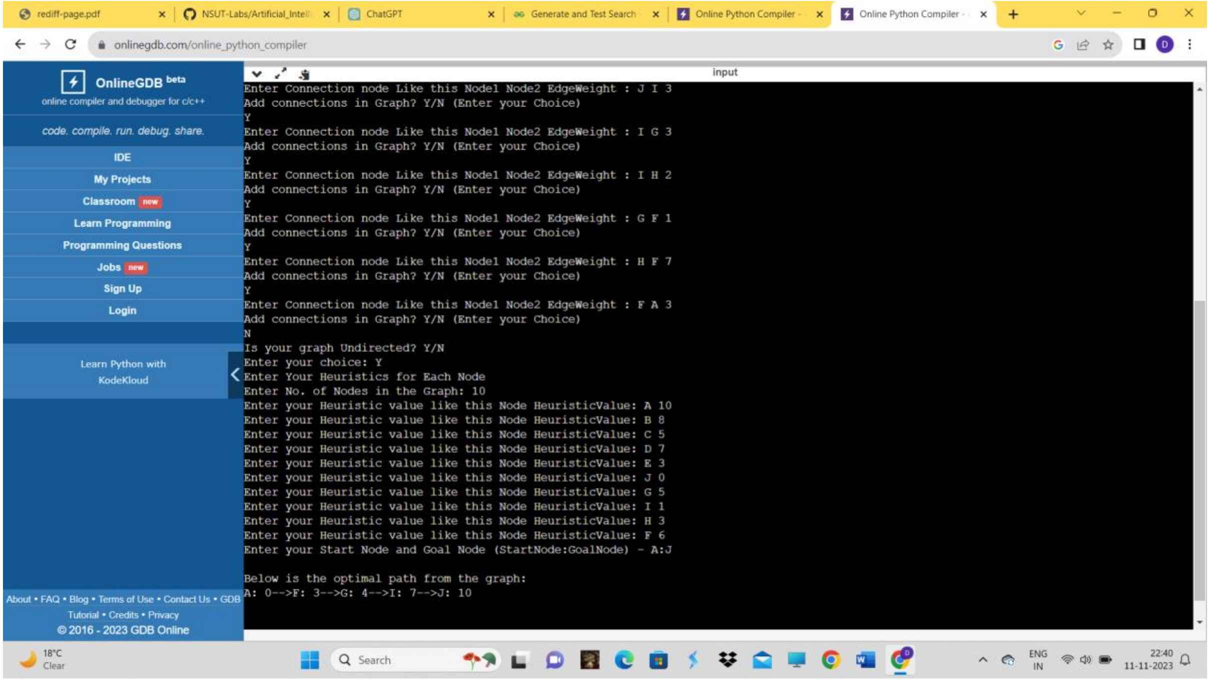
```
        s2 = set([k2 for v in self.graph_dict.values() for k2, v2 in v.items()])
        nodes = s1.union(s2)
        return list(nodes)

class Node:
    def _init_(self, name:str, parent:str):
        self.name = name
        self.parent = parent
        self.g = 0 # Distance to the start node
        self.h = 0 # Distance to the goal node
        self.f = 0 # Total cost

    def _eq_(self, other):
        return self.name == other.name

    def _lt_(self, other):
        return self.f < other.f

    def _repr_(self):
        return '({0},{1})'.format(self.name, self.f)

def astar_search(graph, heuristics, start, end):
    open_nodes = []
    closed_nodes = []
    start_node = Node(start, None)
    goal_node = Node(end, None)
    open_nodes.append(start_node)
    while len(open_nodes) > 0:

        open_nodes.sort()
        current_node = open_nodes.pop(0)
```

```
        closed_nodes.append(current_node)

        if current_node == goal_node:
            path = []
            while current_node != start_node:
                path.append(current_node.name + ': ' + str(current_node.g))
                current_node = current_node.parent
            path.append(start_node.name + ': ' + str(start_node.g))

            return path[::-1]

        neighbors = graph.get(current_node.name)

        for key, value in neighbors.items():
            neighbor = Node(key, current_node)
            if neighbor in closed_nodes:
                continue
            neighbor.g = current_node.g + graph.get(current_node.name, neighbor.name)
            neighbor.h = heuristics.get(neighbor.name)
            neighbor.f = neighbor.g + neighbor.h
            if add_to_open(open_nodes, neighbor):
                open_nodes.append(neighbor)
    return None

def add_to_open(open_nodes, neighbor):
    for node in open_nodes:
        if neighbor.name == node.name and neighbor.f > node.f:
            return False
    return True

def main():
```

```
graph = Graph()
while True:
    print("Add connections in Graph? Y/N (Enter your Choice)")
    choice = input()
    if choice == 'Y':
        graph_node_connection = input("Enter Connection node Like this Node1 Node2 EdgeWeight : 
")
        connection = graph_node_connection.split()
        if len(connection) == 3:
            graph.connect(connection[0], connection[1], int(connection[2]))
        else:
            print("Enter a Valid Connection between Edges")
    elif choice == 'N':
        break
    else:
        print("Enter a valid choice")

print("Is your graph Undirected? Y/N")
choice = input("Enter your choice: ")
if choice == 'Y':
    graph.make_undirected()

heuristics = {}
print("Enter Your Heuristics for Each Node")
nodes = int(input("Enter No. of Nodes in the Graph: "))

for i in range(0, nodes):
    heuristic_value = input("Enter your Heuristic value like this Node HeuristicValue: ")
    heuristic = heuristic_value.split()
    heuristics[heuristic[0]] = int(heuristic[1])
```

```
    start_and_goal_node = input("Enter your Start Node and Goal Node (StartNode:GoalNode) - ")
    start_and_goal = start_and_goal_node.split(sep=':')
    path = astar_search(graph, heuristics, start_and_goal[0], start_and_goal[1])
    print("\nBelow is the optimal path from the graph:")
    for i in range(len(path)):
        if i == len(path) - 1:
            print(path[i])
        else:
            print(path[i], end='-->')
if _name_ == "_main_":
    main()
```





```
Enter Connection node Like this Node1 Node2 EdgeWeight : J I 3
Add connections in Graph? Y/N (Enter your Choice)
Y
Enter Connection node Like this Node1 Node2 EdgeWeight : I G 3
Add connections in Graph? Y/N (Enter your Choice)
Y
Enter Connection node Like this Node1 Node2 EdgeWeight : I H 2
Add connections in Graph? Y/N (Enter your Choice)
Y
Enter Connection node Like this Node1 Node2 EdgeWeight : G F 1
Add connections in Graph? Y/N (Enter your Choice)
Y
Enter Connection node Like this Node1 Node2 EdgeWeight : H F 7
Add connections in Graph? Y/N (Enter your Choice)
Y
Enter Connection node Like this Node1 Node2 EdgeWeight : F A 3
Add connections in Graph? Y/N (Enter your Choice)
N
Is your graph Undirected? Y/N
Enter your choice: Y
Enter Your Heuristics for Each Node
Enter No. of Nodes in the Graph: 10
Enter your Heuristic value like this Node HeuristicValue: A 10
Enter your Heuristic value like this Node HeuristicValue: B 8
Enter your Heuristic value like this Node HeuristicValue: C 5
Enter your Heuristic value like this Node HeuristicValue: D 7
Enter your Heuristic value like this Node HeuristicValue: E 3
Enter your Heuristic value like this Node HeuristicValue: J 0
Enter your Heuristic value like this Node HeuristicValue: G 5
Enter your Heuristic value like this Node HeuristicValue: I 1
Enter your Heuristic value like this Node HeuristicValue: H 3
Enter your Heuristic value like this Node HeuristicValue: F 6
Enter your Start Node and Goal Node (StartNode:GoalNode) - A:J

Below is the optimal path from the graph:
A: 0-->F: 3-->G: 4-->I: 7-->J: 10
```

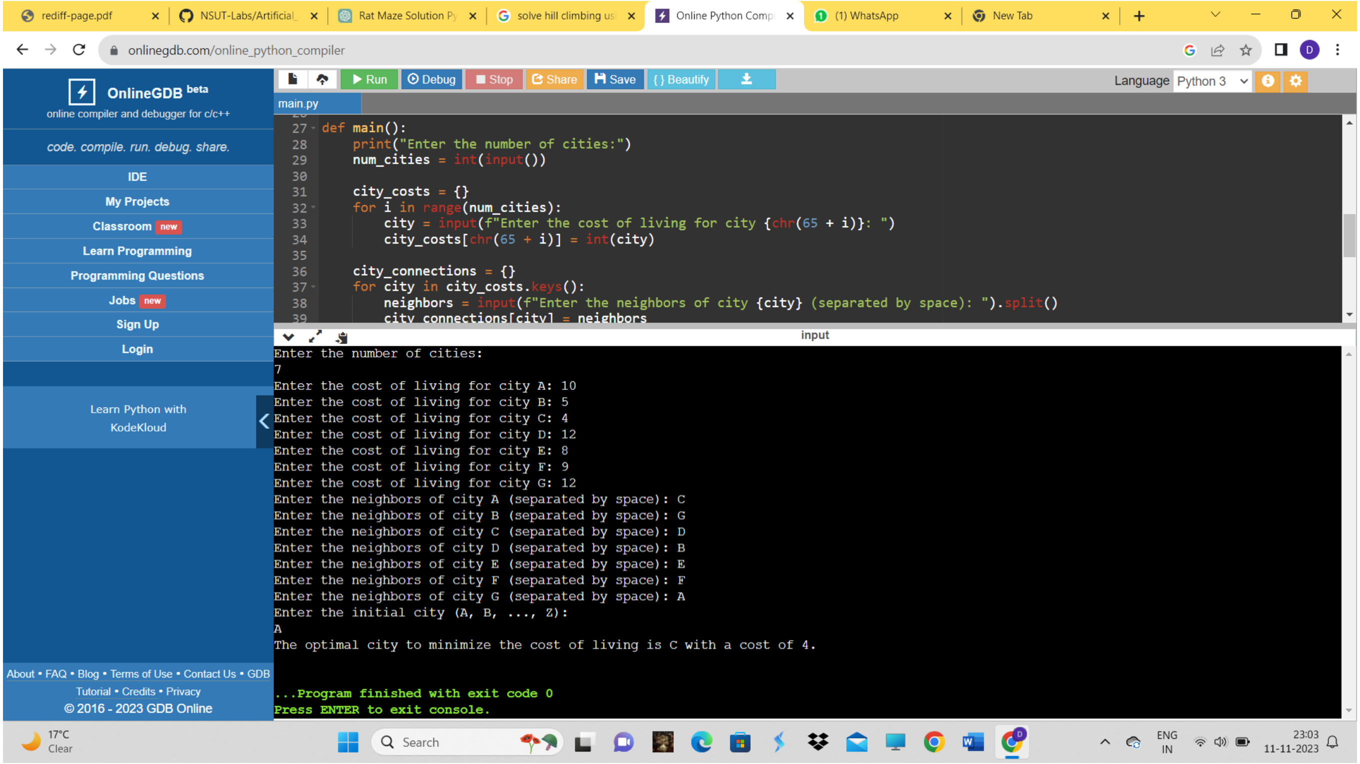
Experiment 6

Implementation of Minimize cost of Living using Hill Climbing

Code:

```
def cost_of_living(city_costs, current_city):
    return city_costs[current_city]

def get_neighbors(city_connections, current_city):
    return city_connections[current_city]

def hill_climbing(initial_city, city_costs, city_connections):
    current_city = initial_city
    current_cost = cost_of_living(city_costs, current_city)

    while True:
        neighbors = get_neighbors(city_connections, current_city)

        if not neighbors:
            break  # No more neighbors to explore

        next_city = min(neighbors, key=lambda city: cost_of_living(city_costs, city))

        if cost_of_living(city_costs, next_city) >= current_cost:
            break

        current_city = next_city
        current_cost = cost_of_living(city_costs, current_city)

    return current_city, current_cost
```

```
def main():
    print("Enter the number of cities:")
    num_cities = int(input())

    city_costs = {}
    for i in range(num_cities):
        city = input(f"Enter the cost of living for city {chr(65 + i)}: ")
        city_costs[chr(65 + i)] = int(city)

    city_connections = {}
    for city in city_costs.keys():
        neighbors = input(f"Enter the neighbors of city {city} (separated by space): ").split()
        city_connections[city] = neighbors

    print("Enter the initial city (A, B, ..., Z):")
    initial_city = input().upper()

    if initial_city not in city_costs:
        print("Invalid city. Please enter a valid city.")
        return

    final_city, final_cost = hill_climbing(initial_city, city_costs, city_connections)

    print(f"The optimal city to minimize the cost of living is {final_city} with a cost of {final_cost}.")

if _name_ == "_main_":
    main()
```



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Run
Debug
Stop
Share
Save
{ } Beautify
Language Python 3
main.py
def main():
    print("Enter the number of cities:")
    num_cities = int(input())

    city_costs = {}
    for i in range(num_cities):
        city = input(f"Enter the cost of living for city {chr(65 + i)}: ")
        city_costs[chr(65 + i)] = int(city)

    city_connections = {}
    for city in city_costs.keys():
        neighbors = input(f"Enter the neighbors of city {city} (separated by space): ").split()
        city_connections[city] = neighbors
input
Enter the number of cities:
7
Enter the cost of living for city A: 10
Enter the cost of living for city B: 5
Enter the cost of living for city C: 4
Enter the cost of living for city D: 12
Enter the cost of living for city E: 8
Enter the cost of living for city F: 9
Enter the cost of living for city G: 12
Enter the neighbors of city A (separated by space): C
Enter the neighbors of city B (separated by space): G
Enter the neighbors of city C (separated by space): D
Enter the neighbors of city D (separated by space): B
Enter the neighbors of city E (separated by space): E
Enter the neighbors of city F (separated by space): F
Enter the neighbors of city G (separated by space): A
Enter the initial city (A, B, ..., Z):
A
The optimal city to minimize the cost of living is C with a cost of 4.
...Program finished with exit code 0
Press ENTER to exit console.

Experiment 7

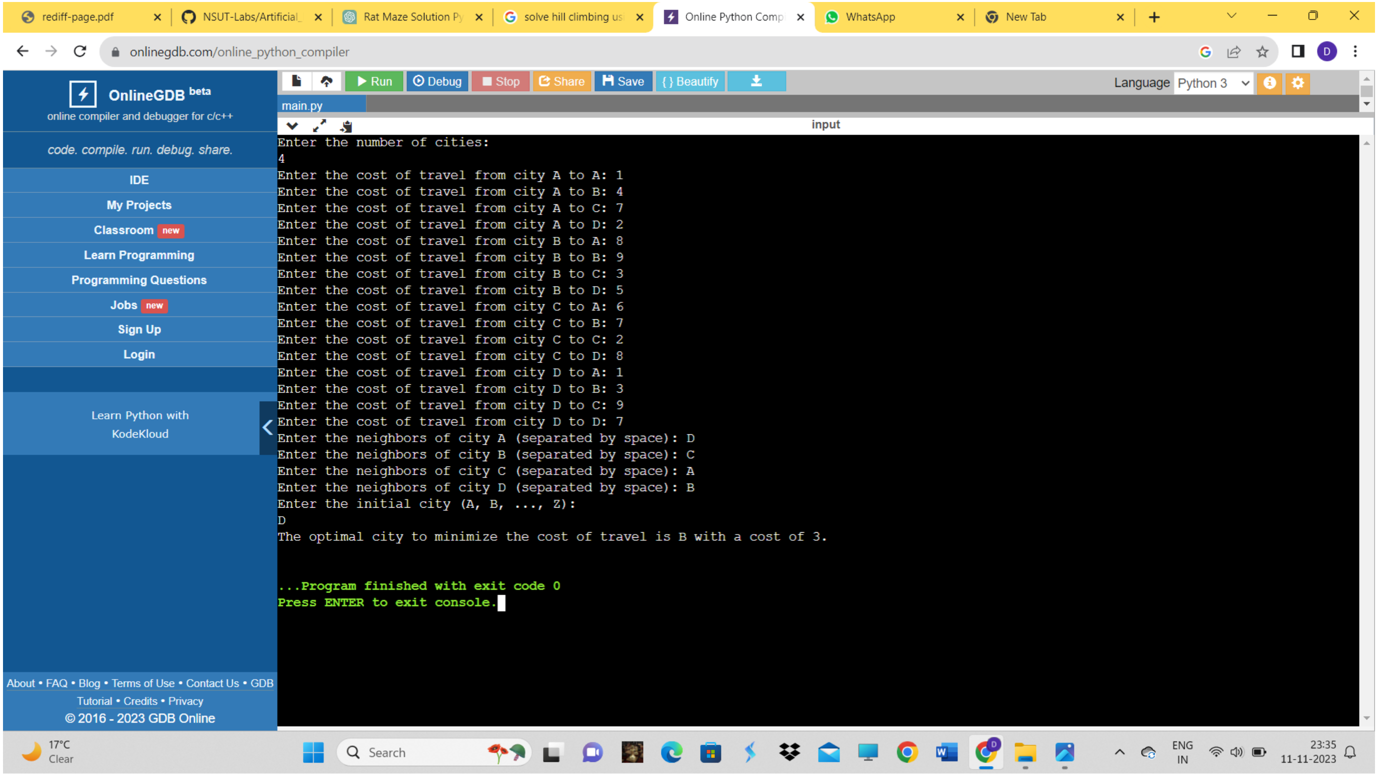
Implementation of Minimize cost of travel using Steepest Ascent Hill Climbing

Code:

```
def cost_of_travel(city_costs, current_city, next_city):
    return city_costs[current_city][next_city]

def get_neighbors(city_connections, current_city):
    return city_connections[current_city]

def steepest_ascent_hill_climbing(initial_city, city_costs, city_connections):
    current_city = initial_city
    current_cost = float('inf')  # Initialize with infinity to ensure the first neighbor is chosen

    while True:
        neighbors = get_neighbors(city_connections, current_city)

        if not neighbors:
            break  # No more neighbors to explore

        # Find the neighbor with the minimum cost
        next_city = min(neighbors, key=lambda city: cost_of_travel(city_costs, current_city, city))

        # Calculate the cost of traveling to the next city
        next_cost = cost_of_travel(city_costs, current_city, next_city)

        # Break if no improvement in cost
        if next_cost >= current_cost:
            break
```

```
        current_city = next_city
        current_cost = next_cost

    return current_city, current_cost

def main():
    print("Enter the number of cities:")
    num_cities = int(input())

    city_costs = {}
    for i in range(num_cities):
        city_costs[chr(65 + i)] = {}
        for j in range(num_cities):
            cost = int(input(f"Enter the cost of travel from city {chr(65 + i)} to {chr(65 + j)}: "))
            city_costs[chr(65 + i)][chr(65 + j)] = cost

    city_connections = {}
    for city in city_costs.keys():
        neighbors = input(f"Enter the neighbors of city {city} (separated by space): ").split()
        city_connections[city] = neighbors

    print("Enter the initial city (A, B, ..., Z):")
    initial_city = input().upper()

    if initial_city not in city_costs:
        print("Invalid city. Please enter a valid city.")
        return

    final_city, final_cost = steepest_ascent_hill_climbing(initial_city, city_costs, city_connections)
```

```
    print(f"The optimal city to minimize the cost of travel is {final_city} with a cost of {final_cost}.")


if _name_ == "_main_":
    main()
```



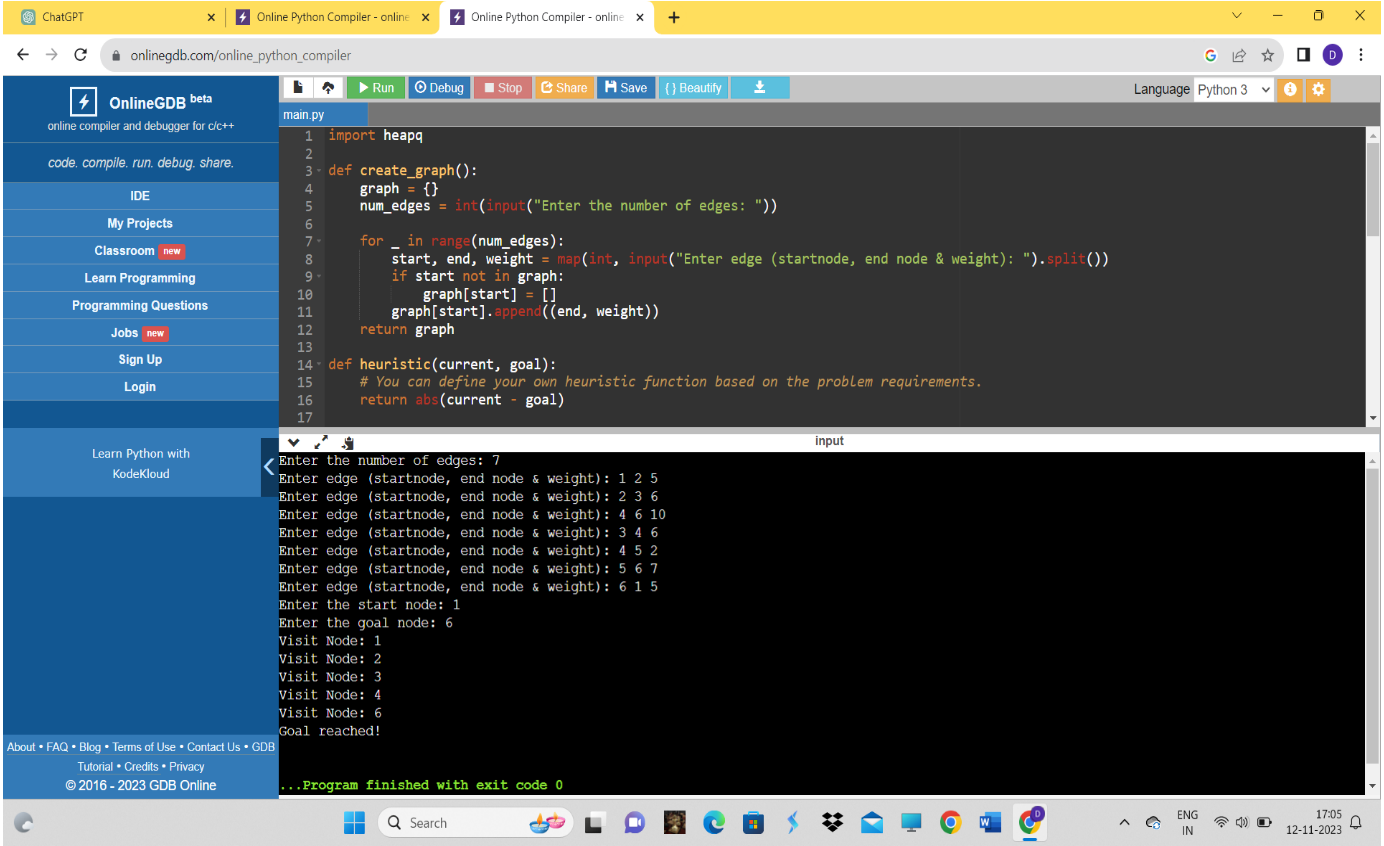
Experiment 8

Implementation of Best First Search using Shortest path

Code:

```
import heapq

def create_graph():
    graph = {}
    num_edges = int(input("Enter the number of edges: "))

    for _ in range(num_edges):
        start, end, weight = map(int, input("Enter edge (startnode, end node & weight): ").split())
        if start not in graph:
            graph[start] = []
        graph[start].append((end, weight))
    return graph

def heuristic(current, goal):
    # You can define your own heuristic function based on the problem requirements.
    return abs(current - goal)

def best_first_search(graph, start, goal):
    visited = set()
    priority_queue = [(0, start)]  # (heuristic value, node)

    while priority_queue:
        cost, current_node = heapq.heappop(priority_queue)

        if current_node in visited:
            continue
```

```
        print(f"Visit Node: {current_node}")

        visited.add(current_node)

        if current_node == goal:
            print("Goal reached!")
            break

        neighbors = graph.get(current_node, [])

        for neighbor, weight in neighbors:
            if neighbor not in visited:
                heuristic_value = heuristic(neighbor, goal)
                heapq.heappush(priority_queue, (heuristic_value, neighbor))

# Example Usage
graph = create_graph()
start_node = int(input("Enter the start node: "))
goal_node = int(input("Enter the goal node: "))

best_first_search(graph, start_node, goal_node)
```


onlinegdb.com/online_python_compiler
OnlineGDB beta
online compiler and debugger for c/c++
code. compile. run. debug. share.
IDE
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Sign Up
Login
Learn Python with KodeKloud
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Language Python 3
main.py
import heapq
def create_graph():
    graph = {}
    num_edges = int(input("Enter the number of edges: "))
    for _ in range(num_edges):
        start, end, weight = map(int, input("Enter edge (startnode, end node & weight): ").split())
        if start not in graph:
            graph[start] = []
        graph[start].append((end, weight))
    return graph
def heuristic(current, goal):
    # You can define your own heuristic function based on the problem requirements.
    return abs(current - goal)
input
Enter the number of edges: 7
Enter edge (startnode, end node & weight): 1 2 5
Enter edge (startnode, end node & weight): 2 3 6
Enter edge (startnode, end node & weight): 4 6 10
Enter edge (startnode, end node & weight): 3 4 6
Enter edge (startnode, end node & weight): 4 5 2
Enter edge (startnode, end node & weight): 5 6 7
Enter edge (startnode, end node & weight): 6 1 5
Enter the start node: 1
Enter the goal node: 6
Visit Node: 1
Visit Node: 2
Visit Node: 3
Visit Node: 4
Visit Node: 6
Goal reached!
...Program finished with exit code 0
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17:05
12-11-2023

Experiment 9

Implementation of A* Algorithm using Shortest path

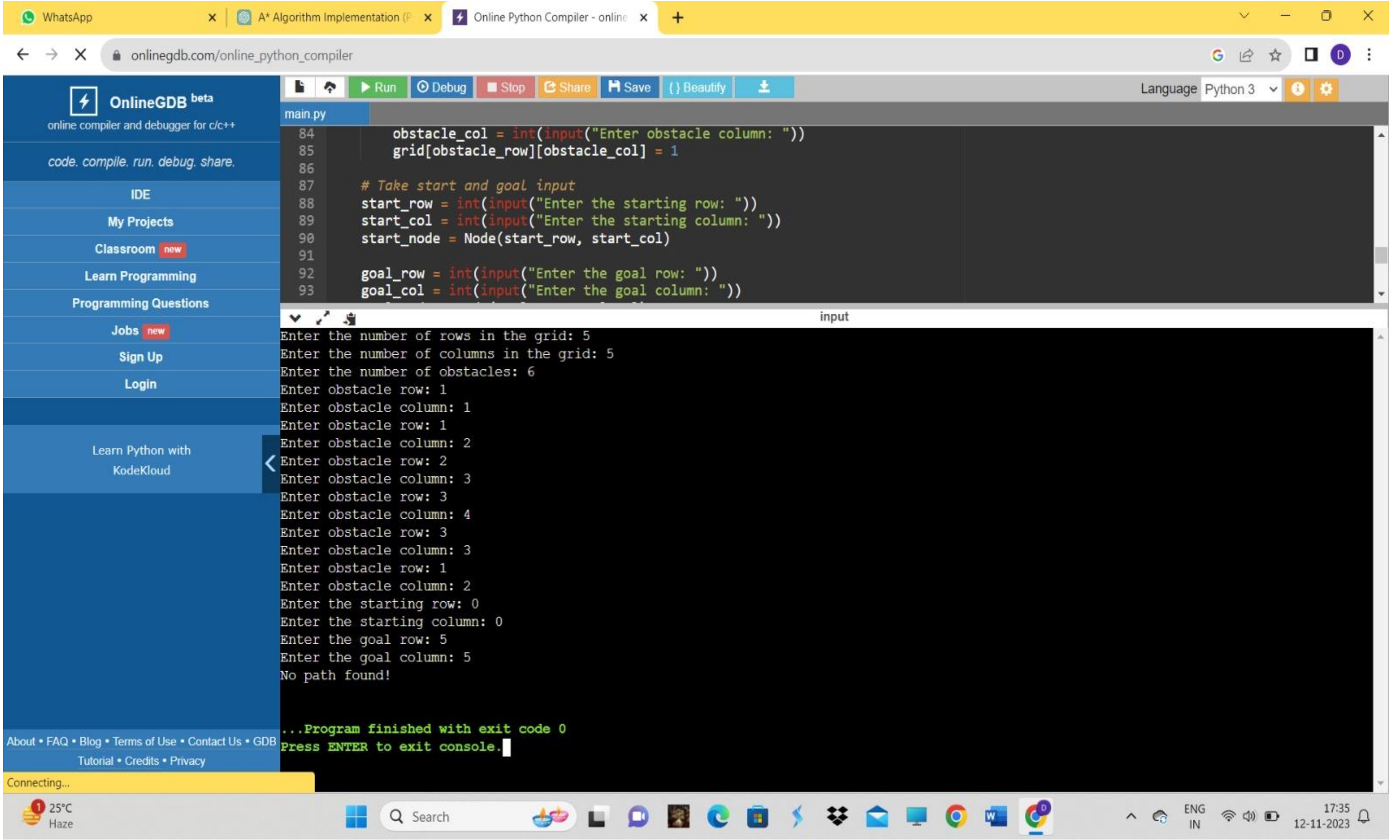
Code:

```
import heapq


class Node:
    def _init_(self, x, y):
        self.x = x
        self.y = y
        self.g = float('inf')  # Initial cost from start node
        self.h = 0  # Heuristic cost to goal node
        self.parent = None  # Parent node in the path

    def _lt_(self, other):
        return (self.g + self.h) < (other.g + other.h)

    def _eq_(self, other):
        return self.x == other.x and self.y == other.y


def heuristic(node, goal):
    # Manhattan distance heuristic
    return abs(node.x - goal.x) + abs(node.y - goal.y)


def get_neighbors(node, grid):
    neighbors = []
    directions = [(0, 1), (1, 0), (0, -1), (-1, 0)]  # Possible movement directions (up, right, down, left)

    for dx, dy in directions:
        nx, ny = node.x + dx, node.y + dy
```

```python
            if 0 <= nx < len(grid) and 0 <= ny < len(grid[0]) and grid[nx][ny] != 1:
                neighbors.append(Node(nx, ny))

    return neighbors

def a_star(start, goal, grid):
    open_set = [start]
    closed_set = set()

    while open_set:
        current_node = heapq.heappop(open_set)
        if current_node == goal:
            path = []
            while current_node:
                path.insert(0, (current_node.x, current_node.y))
                current_node = current_node.parent
            return path

        closed_set.add((current_node.x, current_node.y))

        for neighbor in get_neighbors(current_node, grid):
            if (neighbor.x, neighbor.y) in closed_set:
                continue

            tentative_g = current_node.g + 1  # Assuming uniform cost for simplicity

            if tentative_g < neighbor.g:
                neighbor.g = tentative_g
                neighbor.h = heuristic(neighbor, goal)
                neighbor.parent = current_node
```

```
            if neighbor not in open_set:
                heapq.heappush(open_set, neighbor)

    return None  # No path found

def print_grid_with_path(grid, path):
    for i in range(len(grid)):
        for j in range(len(grid[0])):
            if (i, j) in path:
                print("P", end=" ")  # Path
            elif grid[i][j] == 1:
                print("X", end=" ")  # Obstacle
            else:
                print(".", end=" ")  # Empty
        print()

def get_user_input():
    rows = int(input("Enter the number of rows in the grid: "))
    cols = int(input("Enter the number of columns in the grid: "))

    grid = [[0] * cols for _ in range(rows)]

    # Take obstacle input
    num_obstacles = int(input("Enter the number of obstacles: "))
    for _ in range(num_obstacles):
        obstacle_row = int(input("Enter obstacle row: "))
        obstacle_col = int(input("Enter obstacle column: "))
        grid[obstacle_row][obstacle_col] = 1

    # Take start and goal input
    start_row = int(input("Enter the starting row: "))
```

```
    start_col = int(input("Enter the starting column: "))
    start_node = Node(start_row, start_col)

    goal_row = int(input("Enter the goal row: "))
    goal_col = int(input("Enter the goal column: "))
    goal_node = Node(goal_row, goal_col)

    return grid, start_node, goal_node

def main():
    grid, start_node, goal_node = get_user_input()

    path = a_star(start_node, goal_node, grid)

    if path:
        print("Shortest Path:")
        print_grid_with_path(grid, path)
    else:
        print("No path found!")

if _name_ == "_main_":
    main()
```


onlinegdb.com/online_python_compiler
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Language Python 3
main.py
obstacle_col = int(input("Enter obstacle column: "))
grid[obstacle_row][obstacle_col] = 1
# Take start and goal input
start_row = int(input("Enter the starting row: "))
start_col = int(input("Enter the starting column: "))
start_node = Node(start_row, start_col)
goal_row = int(input("Enter the goal row: "))
goal_col = int(input("Enter the goal column: "))
input
Enter the number of rows in the grid: 5
Enter the number of columns in the grid: 5
Enter the number of obstacles: 6
Enter obstacle row: 1
Enter obstacle column: 1
Enter obstacle row: 1
Enter obstacle column: 2
Enter obstacle row: 2
Enter obstacle column: 3
Enter obstacle row: 3
Enter obstacle column: 4
Enter obstacle row: 3
Enter obstacle column: 3
Enter obstacle row: 1
Enter obstacle column: 2
Enter the starting row: 0
Enter the starting column: 0
Enter the goal row: 5
Enter the goal column: 5
No path found!
...Program finished with exit code 0
Press ENTER to exit console.
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Experiment 10

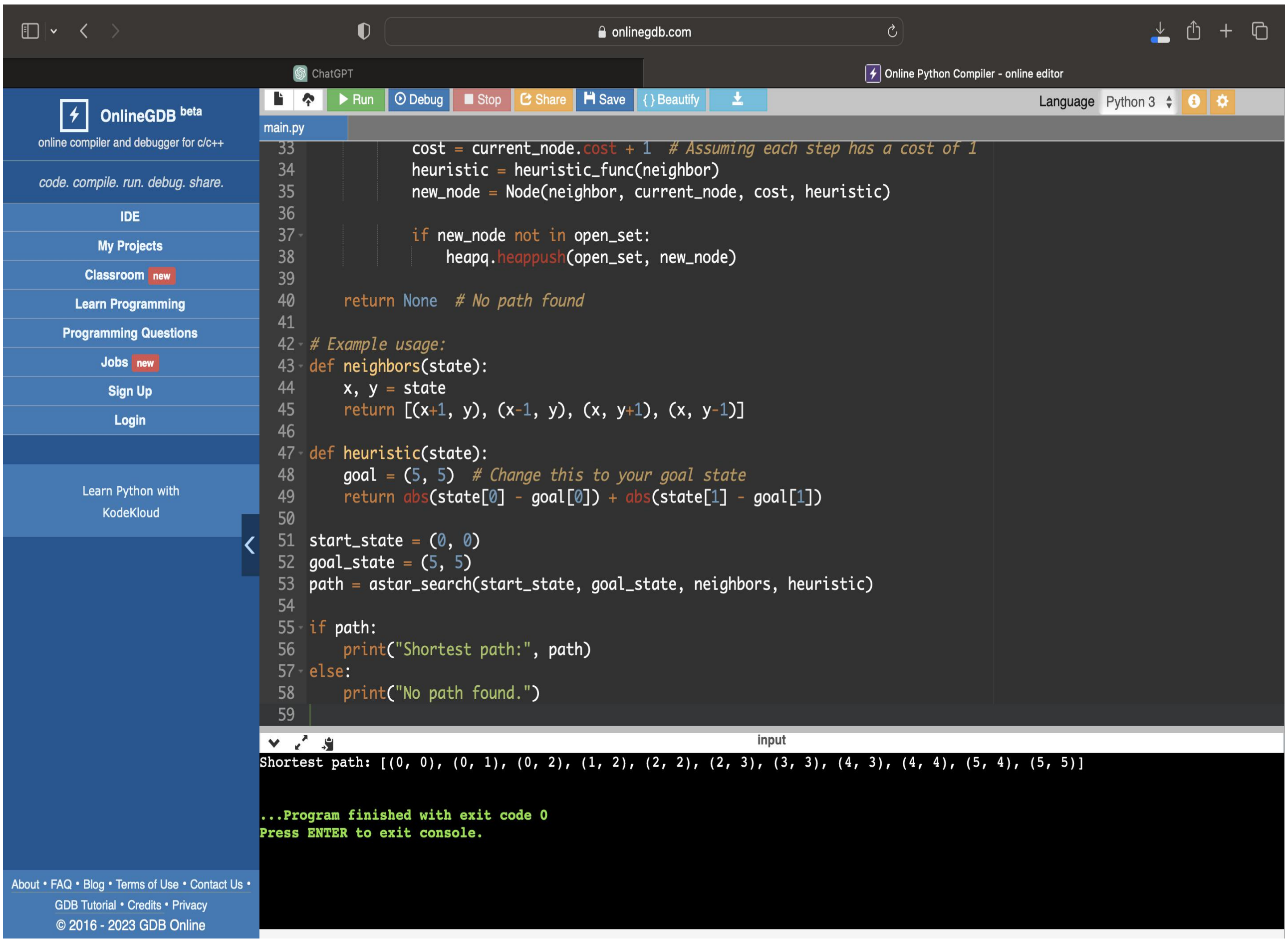
Implementation of AO* Algorithm using Shortest path

Code :

```
import heapq

class Node:
    def _init_(self, state, parent=None, cost=0, heuristic=0):
        self.state = state
        self.parent = parent
        self.cost = cost
        self.heuristic = heuristic

    def _lt_(self, other):
        return (self.cost + self.heuristic) < (other.cost +
other.heuristic)

def astar_search(start, goal, neighbors_func, heuristic_func):
    open_set = [Node(start, None, 0, heuristic_func(start))]
    closed_set = set()

    while open_set:
        current_node = heapq.heappop(open_set)

        if current_node.state == goal:
            path = []
            while current_node:
                path.insert(0, current_node.state)
                current_node = current_node.parent
            return path

        closed_set.add(current_node.state)

        for neighbor in neighbors_func(current_node.state):
            if neighbor in closed_set:
                continue

            cost = current_node.cost + 1  # Assuming each step has
a cost of 1
            heuristic = heuristic_func(neighbor)
```

```
            new_node = Node(neighbor, current_node, cost, heuristic)

            if new_node not in open_set:
                heapq.heappush(open_set, new_node)

    return None  # No path found

# Example usage:
def neighbors(state):
    x, y = state
    return [(x+1, y), (x-1, y), (x, y+1), (x, y-1)]

def heuristic(state):
    goal = (5, 5)  # Change this to your goal state
    return abs(state[0] - goal[0]) + abs(state[1] - goal[1])

start_state = (0, 0)
goal_state = (5, 5)
path = astar_search(start_state, goal_state, neighbors, heuristic)

if path:
    print("Shortest path:", path)
else:
    print("No path found.")
```

Output:



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Share
Save
{ } Beautify
Language
Python 3
main.py
            cost = current_node.cost + 1 # Assuming each step has a cost of 1
            heuristic = heuristic_func(neighbor)
            new_node = Node(neighbor, current_node, cost, heuristic)

            if new_node not in open_set:
                heapq.heappush(open_set, new_node)

    return None # No path found

# Example usage:
def neighbors(state):
    x, y = state
    return [(x+1, y), (x-1, y), (x, y+1), (x, y-1)]

def heuristic(state):
    goal = (5, 5) # Change this to your goal state
    return abs(state[0] - goal[0]) + abs(state[1] - goal[1])

start_state = (0, 0)
goal_state = (5, 5)
path = astar_search(start_state, goal_state, neighbors, heuristic)

if path:
    print("Shortest path:", path)
else:
    print("No path found.")
input
Shortest path: [(0, 0), (0, 1), (0, 2), (1, 2), (2, 2), (2, 3), (3, 3), (4, 3), (4, 4), (5, 4), (5, 5)]
...Program finished with exit code 0
Press ENTER to exit console.

Experiment 11

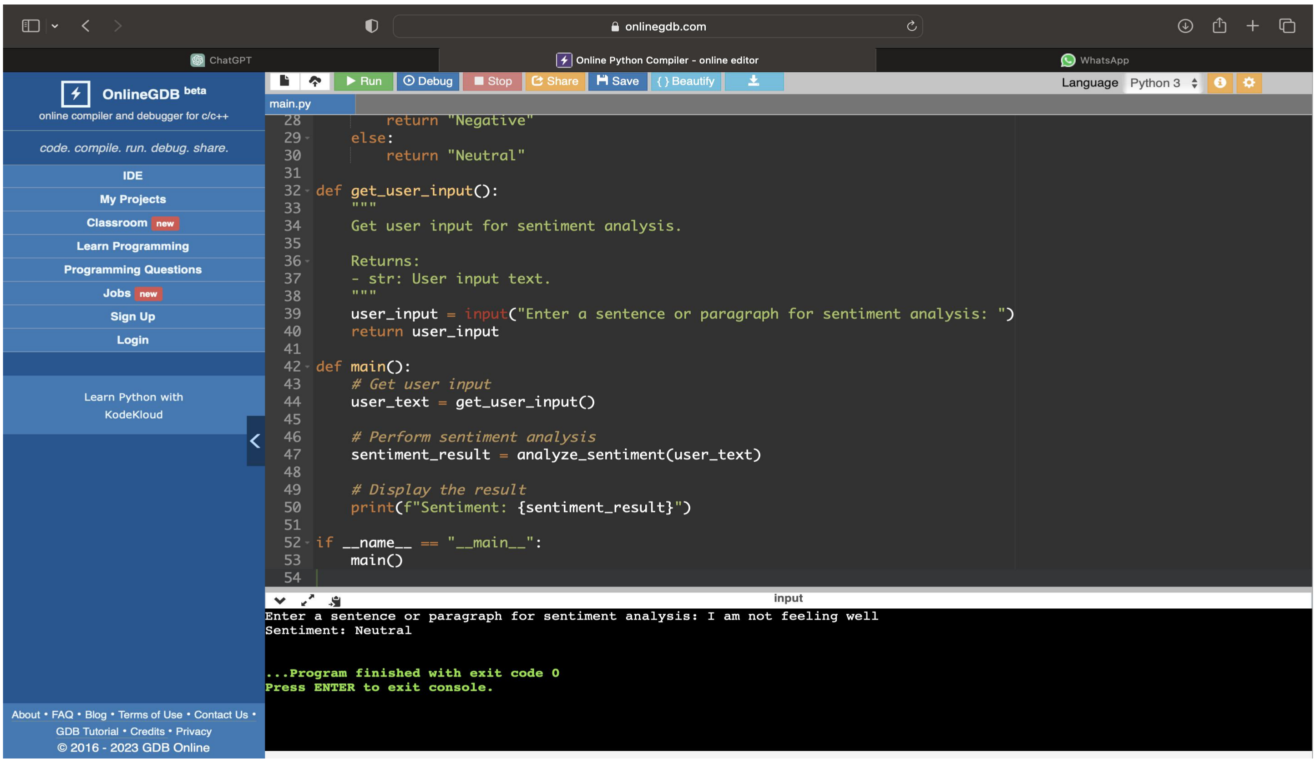
Implementation of NLP using Sentiment Analysis

Code :

```
def analyze_sentiment(text):
    """
    Analyze sentiment of the given text using a simple rule-based
approach.

    Parameters:
    - text (str): The input text for sentiment analysis.

    Returns:
    - str: The sentiment label ('Positive', 'Negative', 'Neutral').
    """
    # You can customize these words/phrases based on your
specific needs
    positive_keywords = ["good", "great", "excellent", "positive"]
    negative_keywords = ["bad", "poor", "negative"]

    # Tokenize the input text
    words = text.lower().split()

    # Check for positive and negative keywords
    positive_count = sum(word in positive_keywords for word in
words)
    negative_count = sum(word in negative_keywords for word in
words)

    # Define a threshold for sentiment classification
    sentiment_threshold = 2  # Adjust as needed

    if positive_count >= sentiment_threshold:
        return "Positive"
    elif negative_count >= sentiment_threshold:
        return "Negative"
    else:
        return "Neutral"

def get_user_input():
```

```
    """
    Get user input for sentiment analysis.

    Returns:
    - str: User input text.
    """
    user_input = input("Enter a sentence or paragraph for
sentiment analysis: ")
    return user_input

def main():
    # Get user input
    user_text = get_user_input()

    # Perform sentiment analysis
    sentiment_result = analyze_sentiment(user_text)

    # Display the result
    print(f"Sentiment: {sentiment_result}")

if _name_ == "_main_":
    main()
```

Output:



Experiment 12

Implementation of Tic Tac Toe using Minimax with α-β pruning

Code:

```
import math

def print_board(board):
    for row in board:
        print(" ".join(row))
    print()

def is_winner(board, player):
    # Check rows, columns, and diagonals for a win
    for i in range(3):
        if all(board[i][j] == player for j in range(3)) or
all(board[j][i] == player for j in range(3)):
            return True
    if all(board[i][i] == player for i in range(3)) or
all(board[i][2 - i] == player for i in range(3)):
        return True
    return False

def is_board_full(board):
    return all(board[i][j] != ' ' for i in range(3) for j in
range(3))

def evaluate_board(board):
    if is_winner(board, 'X'):
        return 1
    elif is_winner(board, 'O'):
        return -1
    elif is_board_full(board):
        return 0
    else:
        return None
```

```
def minimax(board, depth, maximizing_player, alpha,
beta):
    score = evaluate_board(board)

    if score is not None:
        return score

    if maximizing_player:
        max_eval = -math.inf
        for i in range(3):
            for j in range(3):
                if board[i][j] == ' ':
                    board[i][j] = 'X'
                    eval = minimax(board, depth + 1, False,
alpha, beta)
                    board[i][j] = ' '  # Undo the move
                    max_eval = max(max_eval, eval)
                    alpha = max(alpha, eval)
                    if beta <= alpha:
                        break
        return max_eval
    else:
        min_eval = math.inf
        for i in range(3):
            for j in range(3):
                if board[i][j] == ' ':
                    board[i][j] = 'O'
                    eval = minimax(board, depth + 1, True,
alpha, beta)
                    board[i][j] = ' '  # Undo the move
                    min_eval = min(min_eval, eval)
                    beta = min(beta, eval)
                    if beta <= alpha:
                        break
        return min_eval
```

```
def find_best_move(board):
    best_val = -math.inf
    best_move = (-1, -1)

    for i in range(3):
        for j in range(3):
            if board[i][j] == ' ':
                board[i][j] = 'X'
                move_val = minimax(board, 0, False, -math.inf,
math.inf)
                board[i][j] = ' '  # Undo the move

                if move_val > best_val:
                    best_move = (i, j)
                    best_val = move_val

    return best_move

def play_tic_tac_toe():
    board = [[' ' for _ in range(3)] for _ in range(3)]
    player_turn = True

    while True:
        print_board(board)

        if player_turn:
            row = int(input("Enter row (0, 1, or 2): "))
            col = int(input("Enter column (0, 1, or 2): "))
            if board[row][col] == ' ':
                board[row][col] = 'O'
                player_turn = False
            else:
                print("Invalid move. Try again.")
        else:
            print("Computer's turn:")
            move = find_best_move(board)
            board[move[0]][move[1]] = 'X'
```

```
            player_turn = True

        winner = evaluate_board(board)
        if winner is not None:
            print_board(board)
            if winner == 1:
                print("Player wins!")
            elif winner == -1:
                print("Computer wins!")
            else:
                print("It's a tie!")
            break

if _name_ == "_main_":
    play_tic_tac_toe()
```

Output :