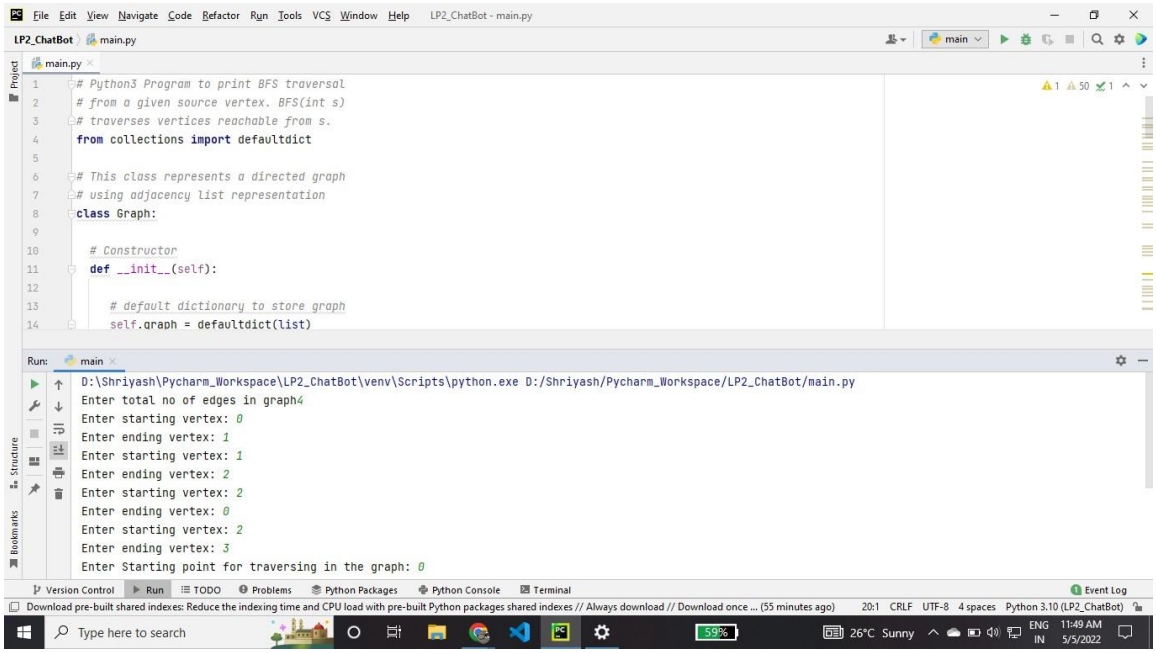
Practical no 1 Code

BFS:-checked working

```
# Python3 Program to print BFS traversal
# from a given source vertex. BFS(int s)
# traverses vertices reachable from s.
from collections import defaultdict

# This class represents a directed graph
# using adjacency list representation
class Graph:

 # Constructor
 def __init__(self):

    # default dictionary to store graph
    self.graph = defaultdict(list)

 # function to add an edge to graph
 def addEdge(self,u,v):
    """

    :rtype: object
    """
    self.graph[u].append(v)

 # Function to print a BFS of graph
 def BFS(self, s):

    # Mark all the vertices as not visited
    visited = [False] * (max(self.graph) + 1)

    # Create a queue for BFS
    queue = []

    # Mark the source node as
    # visited and enqueue it
    queue.append(s)
    visited[s] = True

    while queue:

       # Dequeue a vertex from
```

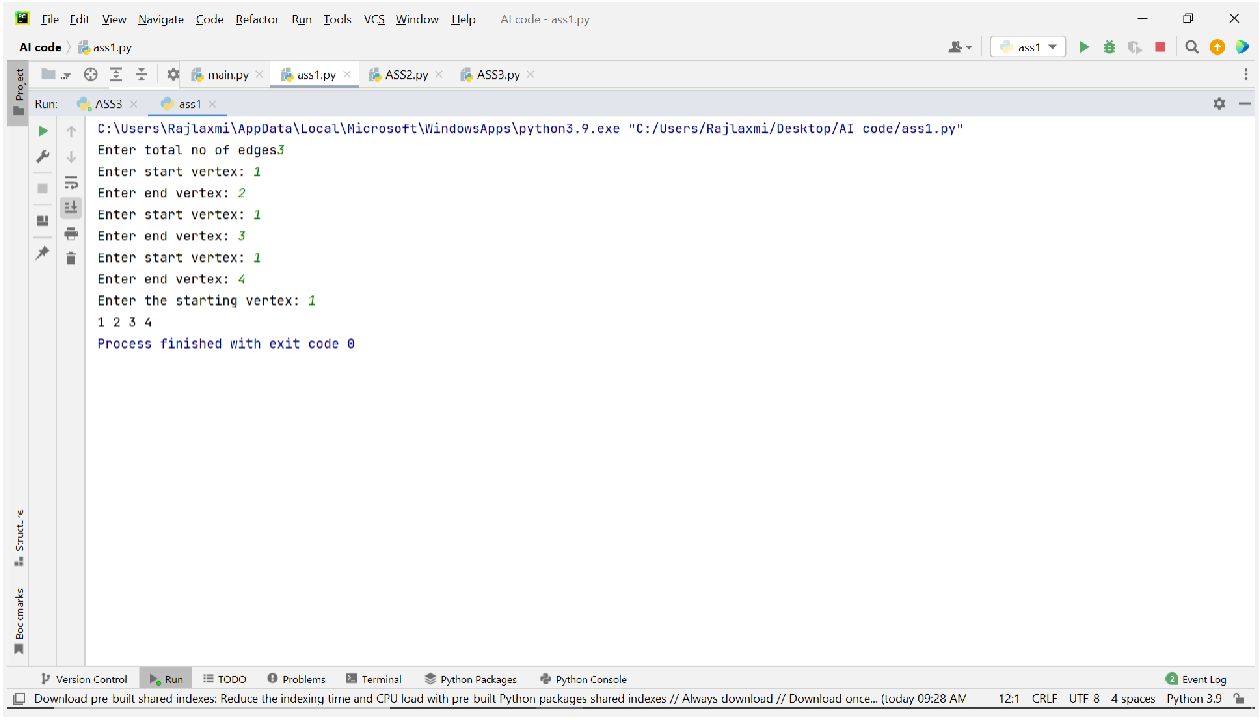
```
        # queue and print it
        s = queue.pop(0)
        print (s, end = " ")

        # Get all adjacent vertices of the
        # dequeued vertex s. If a adjacent
        # has not been visited, then mark it
        # visited and enqueue it
        for i in self.graph[s]:
            if visited[i] == False:
                queue.append(i)
                visited[i] = True

# Driver code

# Create a graph given in
# the above diagram
g = Graph();

n=int(input("Enter total no of edges in graph"))

for i in range(0,n):
 u=int(input("Enter starting vertex: "))
 v=int(input("Enter ending vertex: "))
 g.addEdge(u,v)

s=int(input("Enter Starting point for traversing in the graph: "))
g.BFS(s)
```



DFS:-

```
# Python3 program to print DFS traversal
# from a given given graph
from collections import defaultdict


# This class represents a directed graph using
# adjacency list representation


class Graph:

    # Constructor
    def __init__(self):

        # default dictionary to store graph
        self.graph = defaultdict(list)

    # function to add an edge to graph
    def addEdge(self, u, v):
        self.graph[u].append(v)

    # A function used by DFS
    def DFSUtil(self, v, visited):

        # Mark the current node as visited
        # and print it
        visited.add(v)
        print(v, end=' ')

        # Recur for all the vertices
        # adjacent to this vertex
        for neighbour in self.graph[v]:
            if neighbour not in visited:
                self.DFSUtil(neighbour, visited)

    # The function to do DFS traversal. It uses
    # recursive DFSUtil()
    def DFS(self, v):

        # Create a set to store visited vertices
        visited = set()
```

```
        # Call the recursive helper function
        # to print DFS traversal
        self.DFSUtil(v, visited)


# Driver code

g = Graph()

n = int(input("Enter total no of edges"))
for i in range(0, n):
    u = int(input("Enter start vertex: "))
    v = int(input("Enter end vertex: "))
    g.addEdge(u, v)
    g.addEdge(v, u)

g.DFS(int(input("Enter the starting vertex: ")))
```



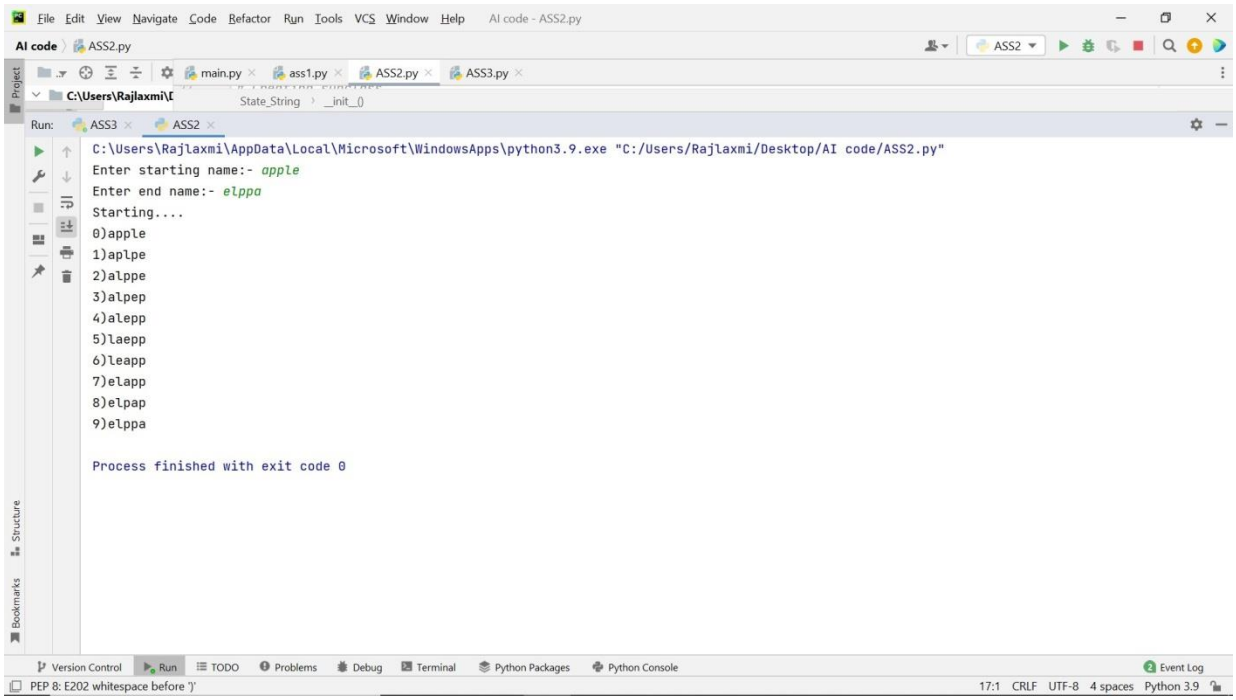
Practical no 2 Code

[A-Star Algorithm Python Tutorial - An Introduction To A* Algorithm In Python (simplifiedpython.net)]

A* algorithm:-

```
from queue import PriorityQueue

#Creating Base Class
class State(object):
   def __init__(self, value, parent, start = 0, goal = 0):
       self.children = []
       self.parent = parent
       self.value = value
       self.dist = 0
       if parent:
           self.start = parent.start
           self.goal = parent.goal
           self.path = parent.path[:]
           self.path.append(value)

       else:
           self.path = [value]
           self.start = start
           self.goal = goal

   def GetDistance(self):
       pass
   def CreateChildren(self):
       pass


# Creating subclass
class State_String(State):
   def __init__(self, value, parent, start = 0, goal = 0 ):
       super(State_String, self).__init__(value, parent, start, goal)
       self.dist = self.GetDistance()

   def GetDistance(self):
           if self.value == self.goal:
               return 0
           dist = 0
           for i in range(len(self.goal)):
               letter = self.goal[i]
               dist += abs(i - self.value.index(letter))
           return dist

   def CreateChildren(self):
           if not self.children:
               for i in range(len(self.goal)-1):
```

```
                    val = self.value
                    val = val[:i] + val[i+1] + val[i] + val[i+2:]
                    child = State_String(val, self)
                    self.children.append(child)

# Creating a class that hold the final magic
class A_Star_Solver:
    def __init__(self, start, goal):
        self.path = []
        self.vistedQueue =[]
        self.priorityQueue = PriorityQueue()
        self.start = start
        self.goal = goal

    def Solve(self):
        startState = State_String(self.start,0,self.start,self.goal)

        count = 0
        self.priorityQueue.put((0,count, startState))
        while(not self.path and self.priorityQueue.qsize()):
               closesetChild = self.priorityQueue.get()[2]
               closesetChild.CreateChildren()
               self.vistedQueue.append(closesetChild.value)
               for child in closesetChild.children:
                   if child.value not in self.vistedQueue:
                    count += 1
                    if not child.dist:
                       self.path = child.path
                       break
                    self.priorityQueue.put((child.dist,count,child))
        if not self.path:
            print("Goal Of  is not possible !" + self.goal )
        return self.path

# Calling all the existing stuffs
if __name__== "__main__":
    start1 = str(input("Enter starting name:- "))
    goal1 = str(input("Enter end name:- "))
    print("Starting.....")
    a = A_Star_Solver(start1,goal1)
    a.Solve()
    for i in range(len(a.path)):
        print("{0}){1}".format(i,a.path[i]))
```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AI code - ASS2.py
AI code
ASS2.py
ASS2
main.py
ass1.py
ASS2.py
ASS3.py
Project
C:\Users\Rajlaxmi\
State_String
__init__()
Run:
ASS3
ASS2
C:\Users\Rajlaxmi\AppData\Local\Microsoft\WindowsApps\python3.9.exe "C:/Users/Rajlaxmi/Desktop/AI code/ASS2.py"
Enter starting name:- apple
Enter end name:- elppa
Starting....
0)apple
1)aplpe
2)alppe
3)alpep
4)alepp
5)laepp
6)leapp
7)elapp
8)elpap
9)elppa
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Structure
Bookmarks
Version Control
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Problems
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Python Packages
Python Console
Event Log
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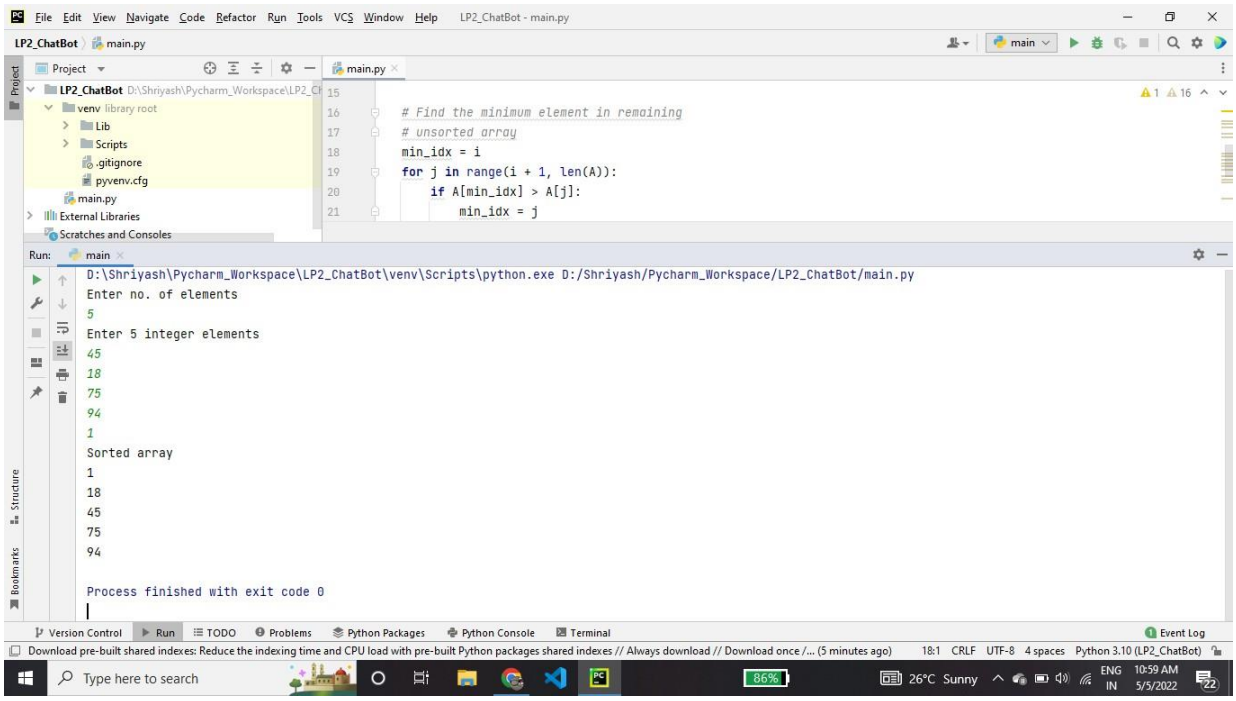
Python 3.9

Practical No 3 Code

1. Selection sort:-

```
# Python program for implementation of Selection
# Sort
import sys

print("Enter no. of elements")
a=int(input())
print("Enter",a,"integer elements")
array=[]
for i in range(a):
  array.append(int(input()))
A=array

# Traverse through all array elements
for i in range(len(A)):

    # Find the minimum element in remaining
    # unsorted array
    min_idx = i
    for j in range(i + 1, len(A)):
        if A[min_idx] > A[j]:
            min_idx = j

    # Swap the found minimum element with
    # the first element
    A[i], A[min_idx] = A[min_idx], A[i]

# Driver code to test above
print("Sorted array")
for i in range(len(A)):
    print("%d" % A[i]),
```


File Edit View Navigate Code Refactor Run Tools VCS Window Help LP2_ChatBot - main.py
LP2_ChatBot main.py
main
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venv library root
Lib
Scripts
.gitignore
pyvenv.cfg
main.py
External Libraries
Scratches and Consoles
main.py
# Find the minimum element in remaining
# unsorted array
min_idx = i
for j in range(i + 1, len(A)):
if A[min_idx] > A[j]:
min_idx = j
Run: main
D:\Shriyash\Pycharm_Workspace\LP2_ChatBot\venv\Scripts\python.exe D:/Shriyash/Pycharm_Workspace/LP2_ChatBot/main.py
Enter no. of elements
5
Enter 5 integer elements
45
18
75
94
1
Sorted array
1
18
45
75
94
Process finished with exit code 0
Version Control Run TODO Problems Python Packages Python Console Terminal Event Log
Download pre-built shared indexes: Reduce the indexing time and CPU load with pre-built Python packages shared indexes // Always download // Download once /... (5 minutes ago)
18:1 CRLF UTF-8 4 spaces Python 3.10 (LP2_ChatBot)
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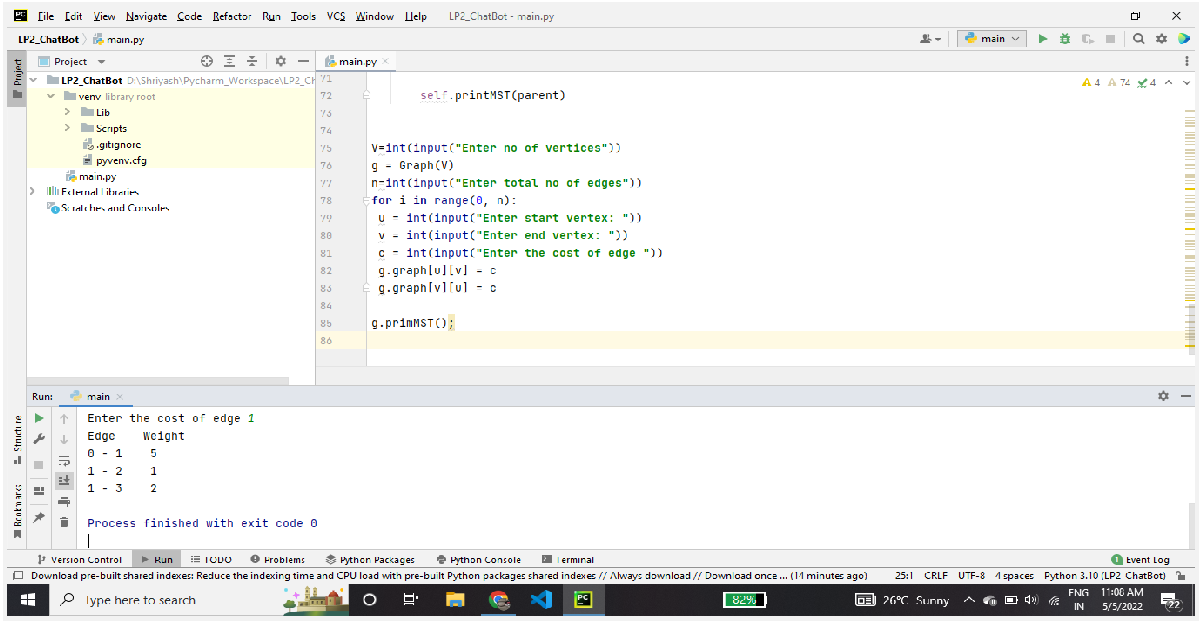
ENG IN
10:59 AM 5/5/2022

2. Minimum Spanning Tree

```
# A Python program for Prim's Minimum Spanning Tree (MST) algorithm.
# The program is for adjacency matrix representation of the graph

import sys  # Library for INT_MAX


class Graph():

    def __init__(self, vertices):
        self.V = vertices
        self.graph = [[0 for column in range(vertices)]
                      for row in range(vertices)]

    # A utility function to print the constructed MST stored in parent[]
    def printMST(self, parent):
        print("Edge \tWeight")
        for i in range(1, self.V):
            print(parent[i], "-", i, "\t", self.graph[i][parent[i]])

    # A utility function to find the vertex with
    # minimum distance value, from the set of vertices
    # not yet included in shortest path tree
    def minKey(self, key, mstSet):

        # Initialize min value
        min = sys.maxsize

        for v in range(self.V):
            if key[v] < min and mstSet[v] == False:
                min = key[v]
                min_index = v

        return min_index

    # Function to construct and print MST for a graph
    # represented using adjacency matrix representation
    def primMST(self):

        # Key values used to pick minimum weight edge in cut
        key = [sys.maxsize] * self.V
        parent = [None] * self.V  # Array to store constructed MST
        # Make key 0 so that this vertex is picked as first vertex
        key[0] = 0
        mstSet = [False] * self.V

        parent[0] = -1  # First node is always the root of

        for cout in range(self.V):
```

```
            # Pick the minimum distance vertex from
            # the set of vertices not yet processed.
            # u is always equal to src in first iteration
            u = self.minKey(key, mstSet)

            # Put the minimum distance vertex in
            # the shortest path tree
            mstSet[u] = True

            # Update dist value of the adjacent vertices
            # of the picked vertex only if the current
            # distance is greater than new distance and
            # the vertex in not in the shortest path tree
            for v in range(self.V):

                # graph[u][v] is non zero only for adjacent vertices of m
                # mstSet[v] is false for vertices not yet included in MST
                # Update the key only if graph[u][v] is smaller than
key[v]
                if self.graph[u][v] > 0 and mstSet[v] == False and key[v]
> self.graph[u][v]:
                    key[v] = self.graph[u][v]
                    parent[v] = u

        self.printMST(parent)


V=int(input("Enter no of vertices"))
g = Graph(V)
n=int(input("Enter total no of edges"))
for i in range(0, n):
 u = int(input("Enter start vertex: "))
 v = int(input("Enter end vertex: "))
 c = int(input("Enter the cost of edge "))
 g.graph[u][v] = c
 g.graph[v][u] = c

g.primMST();
```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External Libraries
Scratches and Consoles
main.py
self.printMST(parent)
V=int(input("Enter no of vertices"))
g = Graph(V)
n=int(input("Enter total no of edges"))
for i in range(0, n):
u = int(input("Enter start vertex: "))
v = int(input("Enter end vertex: "))
c = int(input("Enter the cost of edge "))
g.graph[u][v] = c
g.graph[v][u] = c
g.primMST();
Run: main
Enter the cost of edge 1
Edge Weight
0 - 1 5
1 - 2 1
1 - 3 2
Process finished with exit code 0
Version Control
Run
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Problems
Python Packages
Python Console
Terminal
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3. Single-Source shortest path problem

```
# Python program for Dijkstra's single
# source shortest path algorithm. The program is
# for adjacency matrix representation of the graph
class Graph():

 def __init__(self, vertices):
    self.V = vertices
    self.graph = [[0 for column in range(vertices)]
                  for row in range(vertices)]

 def printSolution(self, dist):
    print("Vertex \t Distance from Source: ")
    for node in range(self.V):
       print(node, "\t\t", dist[node])

 # A utility function to find the vertex with
 # minimum distance value, from the set of vertices
 # not yet included in shortest path tree
 def minDistance(self, dist, sptSet):

    # Initialize minimum distance for next node
    min = 1e7

    # Search not nearest vertex not in the
    # shortest path tree
    for v in range(self.V):
       if dist[v] < min and sptSet[v] == False:
          min = dist[v]
          min_index = v

    return min_index

 # Function that implements Dijkstra's single source
 # shortest path algorithm for a graph represented
 # using adjacency matrix representation
 def dijkstra(self, src):

    dist = [1e7] * self.V
    dist[src] = 0
    sptSet = [False] * self.V

    for cout in range(self.V):

       # Pick the minimum distance vertex from
       # the set of vertices not yet processed.
       # u is always equal to src in first iteration
       u = self.minDistance(dist, sptSet)
```

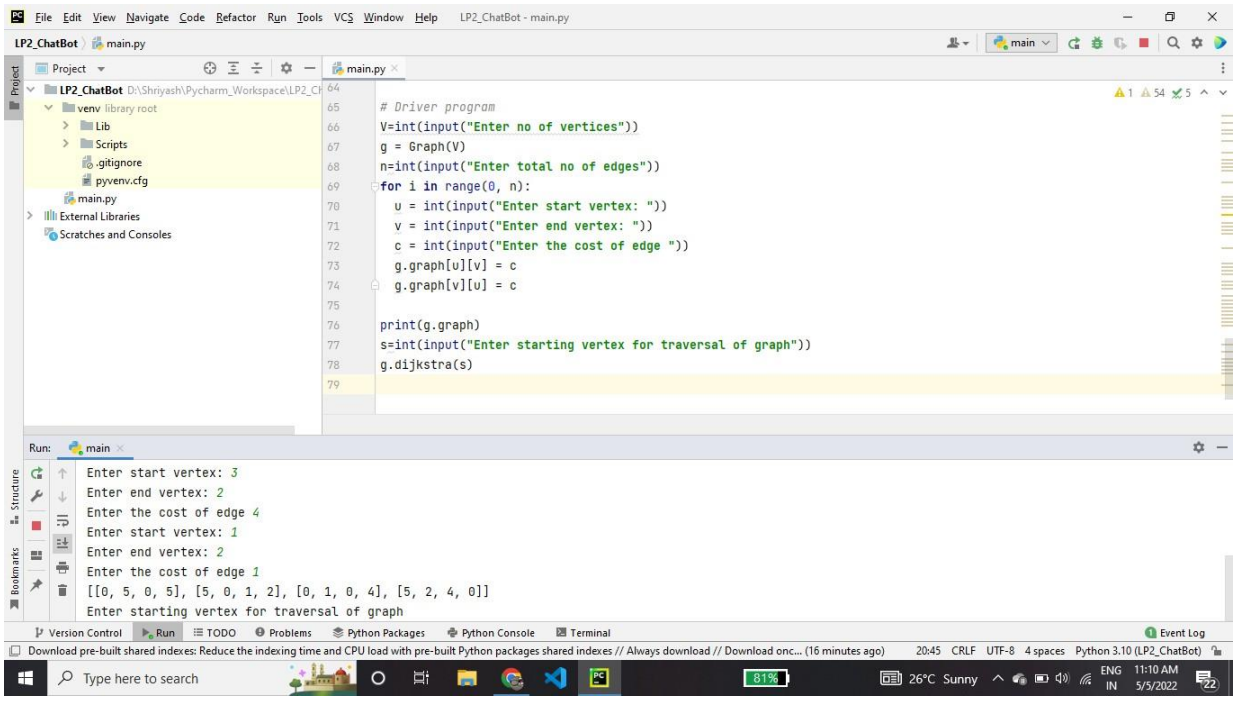
```
        # Put the minimum distance vertex in the
        # shortest path tree
        sptSet[u] = True

        # Update dist value of the adjacent vertices
        # of the picked vertex only if the current
        # distance is greater than new distance and
        # the vertex in not in the shortest path tree
        for v in range(self.V):
            if (self.graph[u][v] > 0 and
            sptSet[v] == False and
            dist[v] > dist[u] + self.graph[u][v]):
                dist[v] = dist[u] + self.graph[u][v]

    self.printSolution(dist)

# Driver program
V=int(input("Enter no of vertices"))
g = Graph(V)
n=int(input("Enter total no of edges"))
for i in range(0, n):
  u = int(input("Enter start vertex: "))
  v = int(input("Enter end vertex: "))
  c = int(input("Enter the cost of edge "))
  g.graph[u][v] = c
  g.graph[v][u] = c

print(g.graph)
s=int(input("Enter starting vertex for traversal of graph"))
g.dijkstra(s)
```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venv library root
Lib
Scripts
.gitignore
pyvenv.cfg
main.py
External Libraries
Scratches and Consoles
main.py
# Driver program
V=int(input("Enter no of vertices"))
g = Graph(V)
n=int(input("Enter total no of edges"))
for i in range(0, n):
u = int(input("Enter start vertex: "))
v = int(input("Enter end vertex: "))
c = int(input("Enter the cost of edge "))
g.graph[u][v] = c
g.graph[v][u] = c
print(g.graph)
s=int(input("Enter starting vertex for traversal of graph"))
g.dijkstra(s)
Run: main
Enter start vertex: 3
Enter end vertex: 2
Enter the cost of edge 4
Enter start vertex: 1
Enter end vertex: 2
Enter the cost of edge 1
[[0, 5, 0, 5], [5, 0, 1, 2], [0, 1, 0, 4], [5, 2, 4, 0]]
Enter starting vertex for traversal of graph
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20:45 CRLF UTF-8 4 spaces Python 3.10 (LP2_ChatBot)
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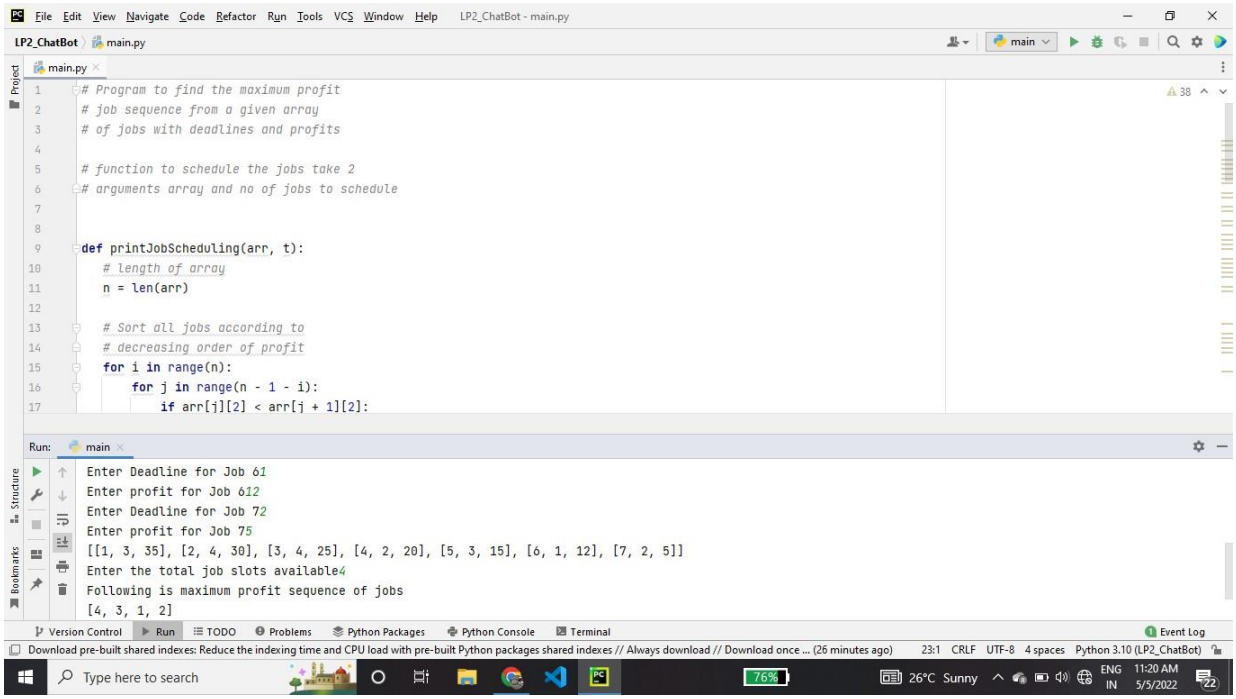
4. Job Scheduling Problems

```
# Program to find the maximum profit
# job sequence from a given array
# of jobs with deadlines and profits

# function to schedule the jobs take 2
# arguments array and no of jobs to schedule


def printJobScheduling(arr, t):
    # length of array
    n = len(arr)

    # Sort all jobs according to
    # decreasing order of profit
    for i in range(n):
        for j in range(n - 1 - i):
            if arr[j][2] < arr[j + 1][2]:
                arr[j], arr[j + 1] = arr[j + 1], arr[j]

    # To keep track of free time slots
    result = [False] * t

    # To store result (Sequence of jobs)
    job = ['-1'] * t

    # Iterate through all given jobs
    for i in range(len(arr)):

        # Find a free slot for this job
        # (Note that we start from the
        # last possible slot)
        for j in range(min(t - 1, arr[i][1] - 1), -1, -1):

            # Free slot found
            if result[j] is False:
                result[j] = True
                job[j] = arr[i][0]
                break

    # print the sequence
    print(job)


# Driver Code

t = int(input("Enter the total no of jobs"))

arr=[]
```

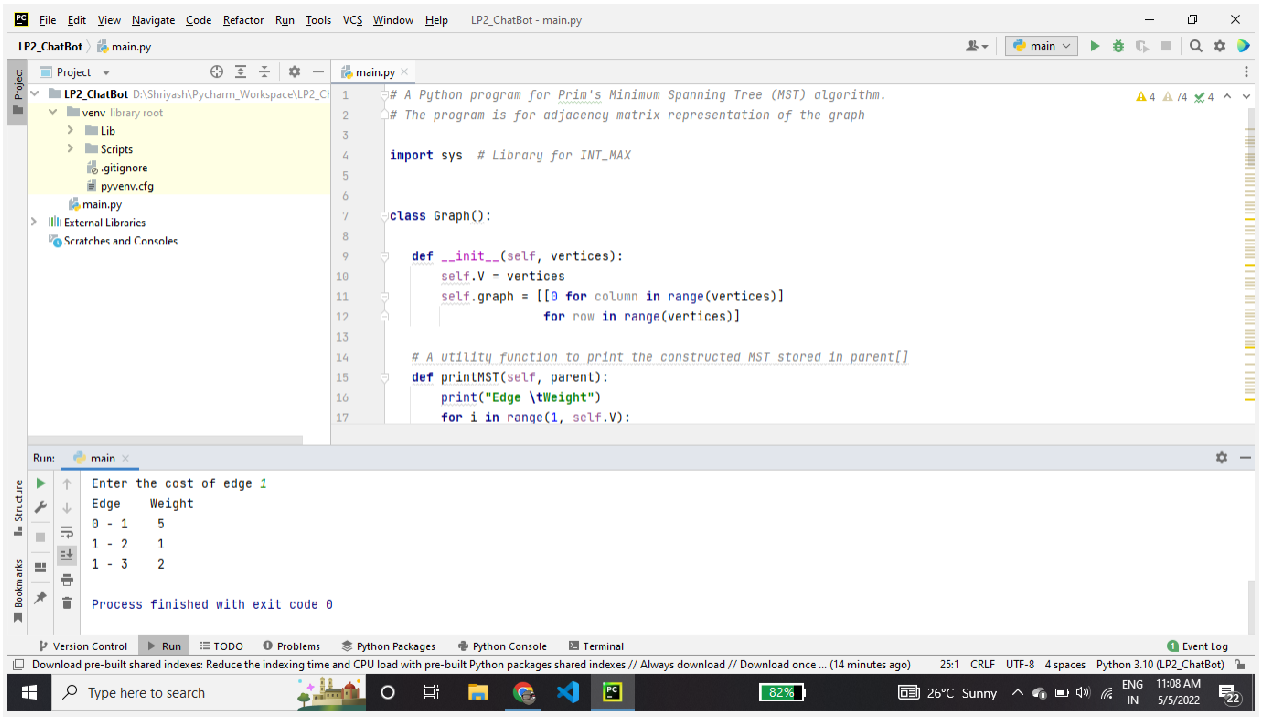
```
for i in range(t):
    col = []
    col.append(i+1)
    col.append(int(input("Enter Deadline for Job "+str(i+1))))
    col.append(int(input("Enter profit for Job "+str(i+1))))
    arr.append(col)
print(arr)

# Function Call
s=int(input("Enter the total job slots available"))
print("Following is maximum profit sequence of jobs")
printJobScheduling(arr, s)
```



5. Prim’s minimal Spanning Tree Algorithm

```
# A Python program for Prim's Minimum Spanning Tree (MST) algorithm.
# The program is for adjacency matrix representation of the graph

import sys  # Library for INT_MAX


class Graph():

    def __init__(self, vertices):
        self.V = vertices
        self.graph = [[0 for column in range(vertices)]
                      for row in range(vertices)]

    # A utility function to print the constructed MST stored in parent[]
    def printMST(self, parent):
        print("Edge \tWeight")
        for i in range(1, self.V):
            print(parent[i], "-", i, "\t", self.graph[i][parent[i]])

    # A utility function to find the vertex with
    # minimum distance value, from the set of vertices
    # not yet included in shortest path tree
    def minKey(self, key, mstSet):

        # Initialize min value
        min = sys.maxsize

        for v in range(self.V):
            if key[v] < min and mstSet[v] == False:
                min = key[v]
                min_index = v

        return min_index

    # Function to construct and print MST for a graph
    # represented using adjacency matrix representation
    def primMST(self):

        # Key values used to pick minimum weight edge in cut
        key = [sys.maxsize] * self.V
        parent = [None] * self.V  # Array to store constructed MST
        # Make key 0 so that this vertex is picked as first vertex
        key[0] = 0
        mstSet = [False] * self.V

        parent[0] = -1  # First node is always the root of

        for cout in range(self.V):
```

```
            # Pick the minimum distance vertex from
            # the set of vertices not yet processed.
            # u is always equal to src in first iteration
            u = self.minKey(key, mstSet)

            # Put the minimum distance vertex in
            # the shortest path tree
            mstSet[u] = True

            # Update dist value of the adjacent vertices
            # of the picked vertex only if the current
            # distance is greater than new distance and
            # the vertex in not in the shortest path tree
            for v in range(self.V):

                # graph[u][v] is non zero only for adjacent vertices of m
                # mstSet[v] is false for vertices not yet included in MST
                # Update the key only if graph[u][v] is smaller than
key[v]
                if self.graph[u][v] > 0 and mstSet[v] == False and key[v]
> self.graph[u][v]:
                    key[v] = self.graph[u][v]
                    parent[v] = u

        self.printMST(parent)


V=int(input("Enter no of vertices"))
g = Graph(V)
n=int(input("Enter total no of edges"))
for i in range(0, n):
 u = int(input("Enter start vertex: "))
 v = int(input("Enter end vertex: "))
 c = int(input("Enter the cost of edge "))
 g.graph[u][v] = c
 g.graph[v][u] = c

g.primMST();
```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venv library root
Lib
Scripts
.gitignore
pyvenv.cfg
main.py
External Libraries
Scratches and Consoles
main.py
# A Python program for Prim's Minimum Spanning Tree (MST) algorithm.
# The program is for adjacency matrix representation of the graph
import sys # Library for INT_MAX
class Graph():
def __init__(self, vertices):
self.V = vertices
self.graph = [[0 for column in range(vertices)]
for row in range(vertices)]
# A utility function to print the constructed MST stored in parent[]
def printMST(self, parent):
print("Edge \tWeight")
for i in range(1, self.V):
Run: main
Enter the cost of edge 1
Edge Weight
0 - 1 5
1 - 2 1
1 - 3 2
Process finished with exit code 0
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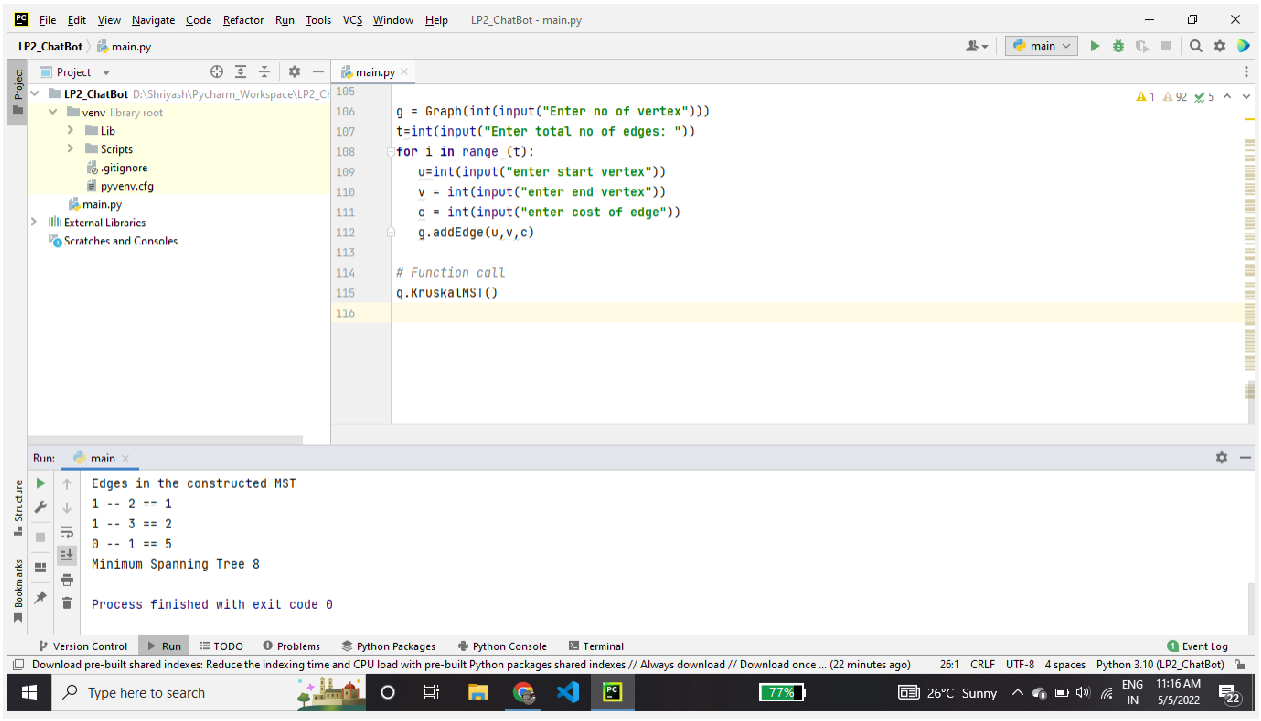
6. Kruskal's Minimal Spanning Tree algorithm

```
# Python program for Kruskal's algorithm to find
# Minimum Spanning Tree of a given connected,
# undirected and weighted graph

from collections import defaultdict


# Class to represent a graph


class Graph:

  def __init__(self, vertices):
      self.V = vertices  # No. of vertices
      self.graph = []  # default dictionary

  # to store graph

  # function to add an edge to graph
  def addEdge(self, u, v, w):
      self.graph.append([u, v, w])

  # A utility function to find set of an element i
  # (uses path compression technique)
  def find(self, parent, i):
      if parent[i] == i:
          return i
      return self.find(parent, parent[i])

  # A function that does union of two sets of x and y
  # (uses union by rank)
  def union(self, parent, rank, x, y):
      xroot = self.find(parent, x)
      yroot = self.find(parent, y)

      # Attach smaller rank tree under root of
      # high rank tree (Union by Rank)
      if rank[xroot] < rank[yroot]:
          parent[xroot] = yroot
      elif rank[xroot] > rank[yroot]:
          parent[yroot] = xroot

      # If ranks are same, then make one as root
      # and increment its rank by one
      else:
          parent[yroot] = xroot
          rank[xroot] += 1
```

```
    # The main function to construct MST using Kruskal's
    # algorithm
    def KruskalMST(self):

        result = []  # This will store the resultant MST

        # An index variable, used for sorted edges
        i = 0

        # An index variable, used for result[]
        e = 0

        # Step 1: Sort all the edges in
        # non-decreasing order of their
        # weight. If we are not allowed to change the
        # given graph, we can create a copy of graph
        self.graph = sorted(self.graph,
                            key=lambda item: item[2])

        parent = []
        rank = []

        # Create V subsets with single elements
        for node in range(self.V):
            parent.append(node)
            rank.append(0)

        # Number of edges to be taken is equal to V-1
        while e < self.V - 1:

            # Step 2: Pick the smallest edge and increment
            # the index for next iteration
            u, v, w = self.graph[i]
            i = i + 1
            x = self.find(parent, u)
            y = self.find(parent, v)

            # If including this edge does't
            # cause cycle, include it in result
            # and increment the indexof result
            # for next edge
            if x != y:
                e = e + 1
                result.append([u, v, w])
                self.union(parent, rank, x, y)
        # Else discard the edge

        minimumCost = 0
```

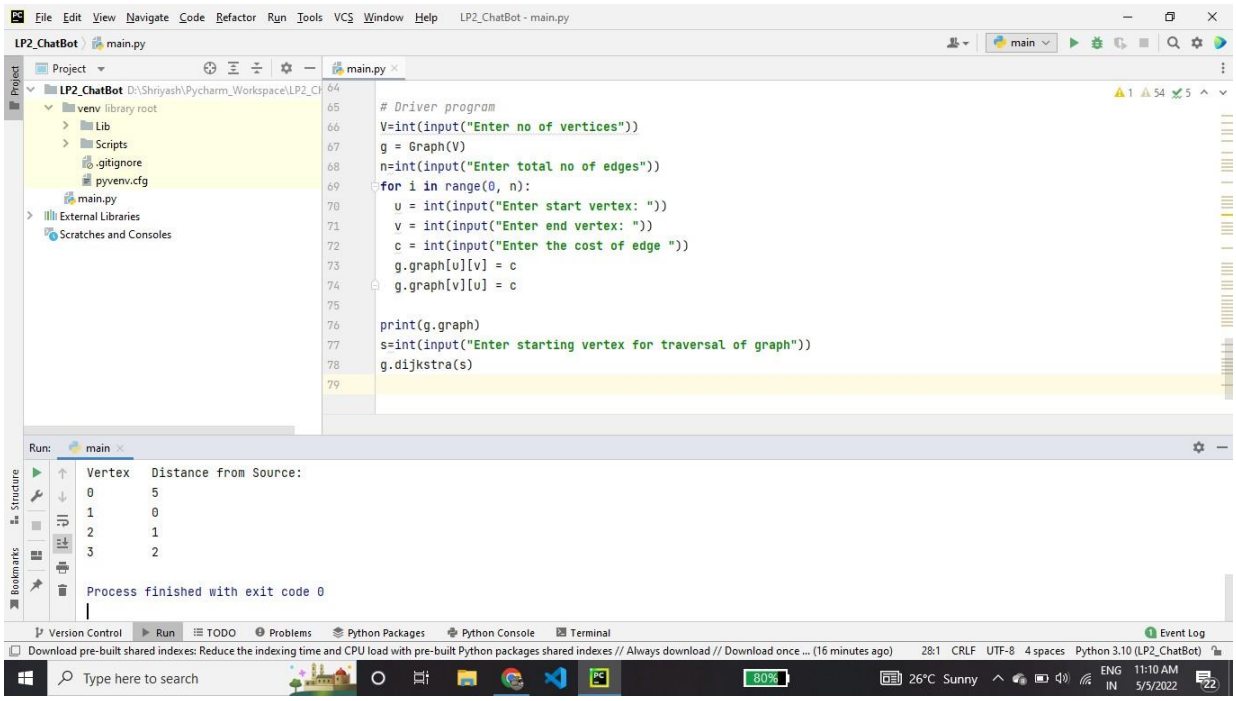
```
        print("Edges in the constructed MST")
        for u, v, weight in result:
            minimumCost += weight
            print("%d -- %d == %d" % (u, v, weight))
        print("Minimum Spanning Tree", minimumCost)


# Driver code

g = Graph(int(input("Enter no of vertex")))
t=int(input("Enter total no of edges: "))
for i in range (t):
    u=int(input("enter start vertex"))
    v = int(input("enter end vertex"))
    c = int(input("enter cost of edge"))
    g.addEdge(u,v,c)

# Function call
g.KruskalMST()
```



7. Dijkstra's Shortest Path Algorithm

```
# Python program for Dijkstra's single
# source shortest path algorithm. The program is
# for adjacency matrix representation of the graph
class Graph():

    def __init__(self, vertices):
        self.V = vertices
        self.graph = [[0 for column in range(vertices)]
                      for row in range(vertices)]

    def printSolution(self, dist):
        print("Vertex \t Distance from Source: ")
        for node in range(self.V):
            print(node, "\t\t", dist[node])

    # A utility function to find the vertex with
    # minimum distance value, from the set of vertices
    # not yet included in shortest path tree
    def minDistance(self, dist, sptSet):

        # Initialize minimum distance for next node
        min = 1e7

        # Search not nearest vertex not in the
        # shortest path tree
        for v in range(self.V):
            if dist[v] < min and sptSet[v] == False:
                min = dist[v]
                min_index = v

        return min_index

    # Function that implements Dijkstra's single source
    # shortest path algorithm for a graph represented
    # using adjacency matrix representation
    def dijkstra(self, src):

        dist = [1e7] * self.V
        dist[src] = 0
        sptSet = [False] * self.V

        for cout in range(self.V):

            # Pick the minimum distance vertex from
            # the set of vertices not yet processed.
            # u is always equal to src in first iteration
            u = self.minDistance(dist, sptSet)
```

```
        # Put the minimum distance vertex in the
        # shortest path tree
        sptSet[u] = True

        # Update dist value of the adjacent vertices
        # of the picked vertex only if the current
        # distance is greater than new distance and
        # the vertex in not in the shortest path tree
        for v in range(self.V):
            if (self.graph[u][v] > 0 and
            sptSet[v] == False and
            dist[v] > dist[u] + self.graph[u][v]):
                dist[v] = dist[u] + self.graph[u][v]

    self.printSolution(dist)

# Driver program
V=int(input("Enter no of vertices"))
g = Graph(V)
n=int(input("Enter total no of edges"))
for i in range(0, n):
  u = int(input("Enter start vertex: "))
  v = int(input("Enter end vertex: "))
  c = int(input("Enter the cost of edge "))
  g.graph[u][v] = c
  g.graph[v][u] = c

print(g.graph)
s=int(input("Enter starting vertex for traversal of graph"))
g.dijkstra(s)
```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LP2_ChatBot main.py
main
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venv library root
Lib
Scripts
.gitignore
pyvenv.cfg
main.py
External Libraries
Scratches and Consoles
main.py
64
65 # Driver program
66 V=int(input("Enter no of vertices"))
67 g = Graph(V)
68 n=int(input("Enter total no of edges"))
69 for i in range(0, n):
70 u = int(input("Enter start vertex: "))
71 v = int(input("Enter end vertex: "))
72 c = int(input("Enter the cost of edge "))
73 g.graph[u][v] = c
74 g.graph[v][u] = c
75
76 print(g.graph)
77 s=int(input("Enter starting vertex for traversal of graph"))
78 g.dijkstra(s)
79
Run: main
Vertex Distance from Source:
0 5
1 0
2 1
3 2
Process finished with exit code 0
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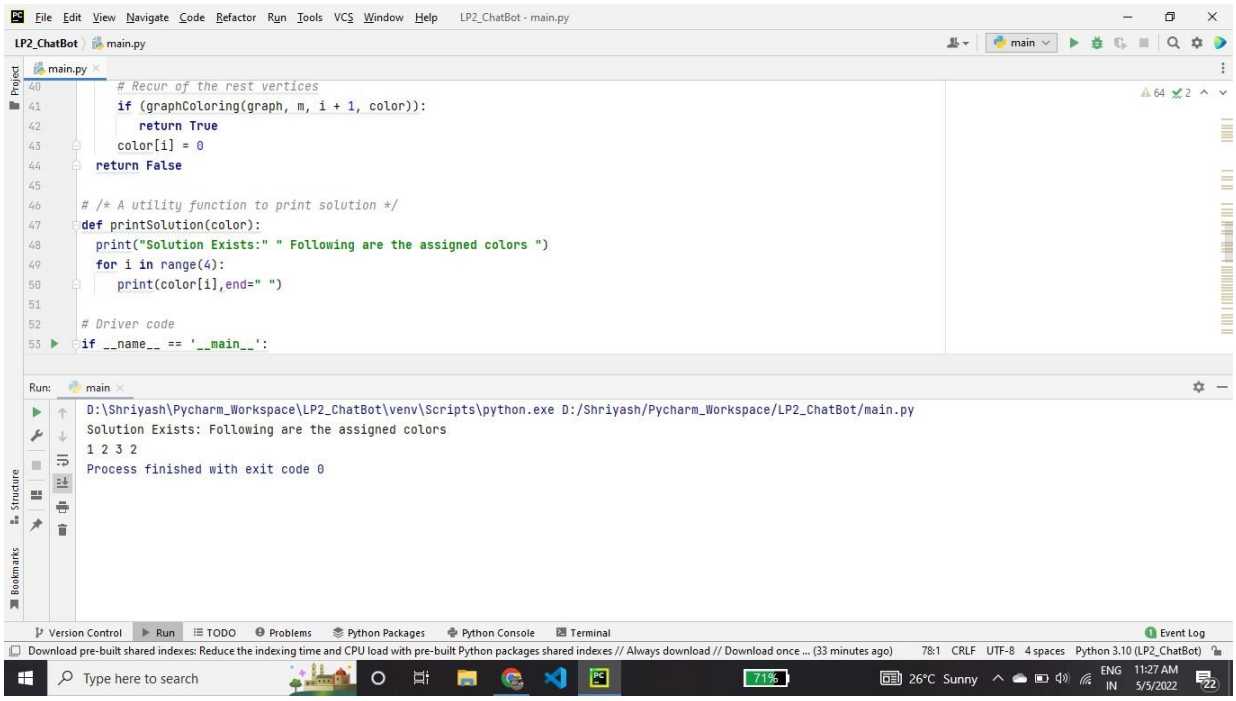
Practical No 4 Code

1. M Coloring Problem

```
# Number of vertices in the graph
# define 4 4

# check if the colored
# graph is safe or not
def isSafe(graph, color):

  # check for every edge
  for i in range(4):
     for j in range(i + 1, 4):
        if (graph[i][j] and color[j] == color[i]):
           return False
  return True

# /* This function solves the m Coloring
# problem using recursion. It returns
# false if the m colours cannot be assigned,
# otherwise, return true and prints
# assignments of colours to all vertices.
# Please note that there may be more than
# one solutions, this function prints one
# of the feasible solutions.*/
def graphColoring(graph, m, i, color):

  # if current index reached end
  if (i == 4):

     # if coloring is safe
     if (isSafe(graph, color)):

        # Print the solution
        printSolution(color)
        return True
     return False

  # Assign each color from 1 to m
  for j in range(1, m + 1):
     color[i] = j

     # Recur of the rest vertices
     if (graphColoring(graph, m, i + 1, color)):
        return True
```

```
            color[i] = 0
        return False

# /* A utility function to print solution */
def printSolution(color):
    print("Solution Exists:" " Following are the assigned colors ")
    for i in range(4):
        print(color[i],end=" ")

# Driver code
if __name__== '__main__':

    # /* Create following graph and
    # test whether it is 3 colorable
    # (3)---(2)
    # | / |
    # | / |
    # | / |
    # (0)---(1)
    # */
    graph = [
        [ 0, 1, 1, 1 ],
        [ 1, 0, 1, 0 ],
        [ 1, 1, 0, 1 ],
        [ 1, 0, 1, 0 ],
    ]
    m = 3 # Number of colors

    # Initialize all color values as 0.
    # This initialization is needed
    # correct functioning of isSafe()
    color = [0 for i in range(4)]

    if (not graphColoring(graph, m, 0, color)):
        print ("Solution does not exist")
```


File Edit View Navigate Code Refactor Run Tools VCS Window Help LP2_ChatBot - main.py
LP2_ChatBot main.py
main.py
# Recur of the rest vertices
if (graphColoring(graph, m, i + 1, color)):
return True
color[i] = 0
return False
# /* A utility function to print solution */
def printSolution(color):
print("Solution Exists:" " Following are the assigned colors ")
for i in range(4):
print(color[i],end=" ")
# Driver code
if __name__ == '__main__':
Run: main
D:\Shriyash\Pycharm_Workspace\LP2_ChatBot\venv\Scripts\python.exe D:/Shriyash/Pycharm_Workspace/LP2_ChatBot/main.py
Solution Exists: Following are the assigned colors
1 2 3 2
Process finished with exit code 0
Version Control Run TODO Problems Python Packages Python Console Terminal Event Log
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2. N Queen Problem

```
""" Python3 program to solve N Queen Problem
using Branch or Bound """

N = 8

""" A utility function to print solution """


def printSolution(board):
    for i in range(N):
        for j in range(N):
            print(board[i][j], end=" ")
        print()


""" A Optimized function to check if
a queen can be placed on board[row][col] """


def isSafe(row, col, slashCode, backslashCode,
           rowLookup, slashCodeLookup,
           backslashCodeLookup):
    if (slashCodeLookup[slashCode[row][col]] or
            backslashCodeLookup[backslashCode[row][col]] or
            rowLookup[row]):
        return False
    return True


""" A recursive utility function
to solve N Queen problem """


def solveNQueensUtil(board, col, slashCode, backslashCode,
                     rowLookup, slashCodeLookup,
                     backslashCodeLookup):
    """ base case: If all queens are
   placed then return True """
    if (col >= N):
        return True
    for i in range(N):
        if (isSafe(i, col, slashCode, backslashCode,
                   rowLookup, slashCodeLookup,
                   backslashCodeLookup)):

            """ Place this queen in board[i][col] """
            board[i][col] = 1
            rowLookup[i] = True
```

```
            slashCodeLookup[slashCode[i][col]] = True
            backslashCodeLookup[backslashCode[i][col]] = True

            """ recur to place rest of the queens """
            if (solveNQueensUtil(board, col + 1,
                                 slashCode, backslashCode,
                                 rowLookup, slashCodeLookup,
                                 backslashCodeLookup)):
                return True

            """ If placing queen in board[i][col]
        doesn't lead to a solution,then backtrack """

            """ Remove queen from board[i][col] """
            board[i][col] = 0
            rowLookup[i] = False
            slashCodeLookup[slashCode[i][col]] = False
            backslashCodeLookup[backslashCode[i][col]] = False

    """ If queen can not be place in any row in
   this column col then return False """
    return False


""" This function solves the N Queen problem using
Branch or Bound. It mainly uses solveNQueensUtil()to
solve the problem. It returns False if queens
cannot be placed,otherwise return True or
prints placement of queens in the form of 1s.
Please note that there may be more than one
solutions,this function prints one of the
feasible solutions."""


def solveNQueens():
    board = [[0 for i in range(N)]
             for j in range(N)]

    # helper matrices
    slashCode = [[0 for i in range(N)]
                 for j in range(N)]
    backslashCode = [[0 for i in range(N)]
                     for j in range(N)]

    # arrays to tell us which rows are occupied
    rowLookup = [False] * N

    # keep two arrays to tell us
    # which diagonals are occupied
```

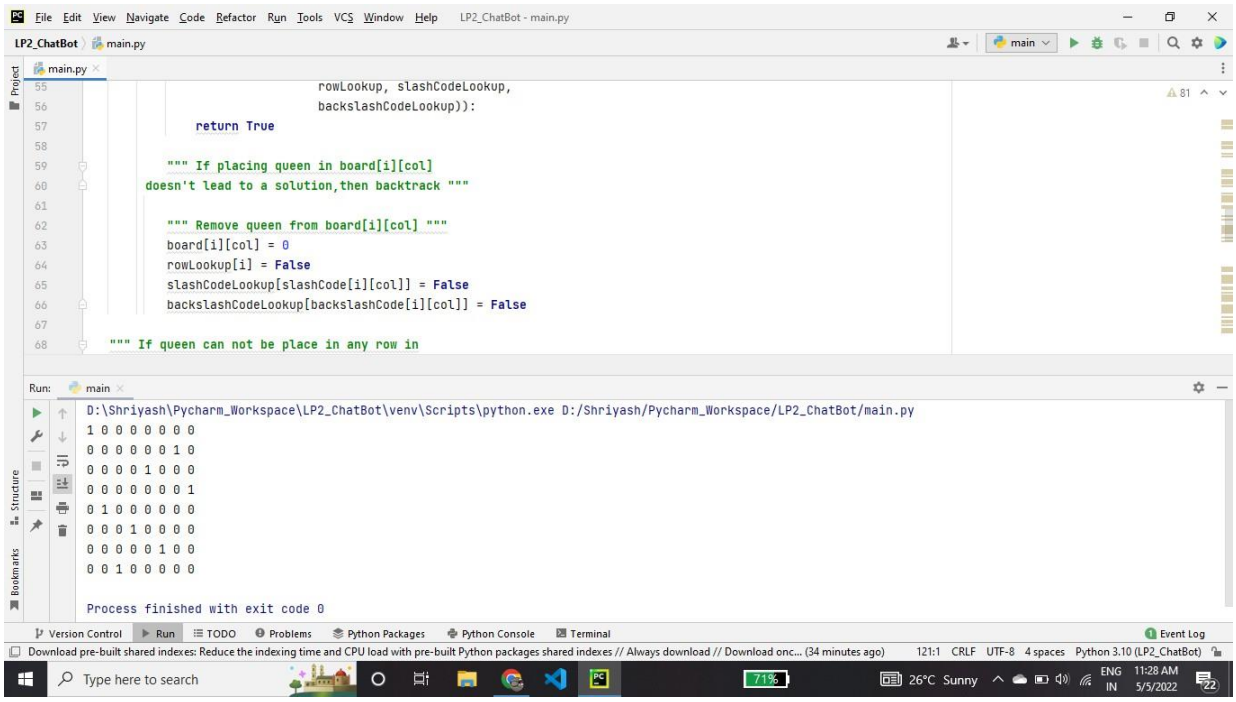
```
    x = 2 * N - 1
    slashCodeLookup = [False] * x
    backslashCodeLookup = [False] * x

    # initialize helper matrices
    for rr  in  range(N):
        for cc in range(N):
            slashCode[rr][cc] = rr + cc
            backslashCode[rr][cc] = rr - cc + 7

    if (solveNQueensUtil(board, 0, slashCode, backslashCode,
                         rowLookup, slashCodeLookup,
                         backslashCodeLookup) == False):
        print("Solution does not exist")
        return False

    # solution found
    printSolution(board)
    return True


# Driver Cde
solveNQueens()
```



Practical no 5 Code

ChatBot

Simple Python chatbot

```
import random


name = "Bot_6282"

resp = {
   "name":["My name is {0}".format(name)],

"deliver": [
"Currently due to covid-19 we only provide parcel delivery services through zomato/swiggy.",
"Yeah we are soon looking to open an outlet nearest to you, but for now we only have parcel service. ",
"Sorry only parcel service is available.",
"Our kitchen is situated near aissms college,pune ,only parcel service available."],

"safety": [
"Don't worry our food is 100% safe.",
"We are currently ranked A+ in food safety.",
"Don't worry,Your food is prepared with all safety measures.", ],

"menu":[
"poha --------- 30rs\n "
"upma ---------- 35rs\n"
"vada sambhar ----------40rs\n"
"veg pulav----------50rs\n"
"panner masala ---------- 100rs\n"
"mushroom ----------90rs\n"
"roti ----------10rs\n"
"coco-cola----------20rs\n",
 ],

"":[
"I'm Sorry i didn't understand can u please enter valid keywords.",
"What do you mean by these?, please enter valid keywords.",
"OOps!! can u please enter valid keywords."],

"default": ["This is a default message"] }
```

```
def res(message):
    if message in resp:
            bot286_message = random.choice(resp[message])
    else:
            bot286_message = random.choice(resp["default"])
    return bot286_message

def real(xtext):
     if "safety"  in xtext:
         ytext = "safety"
     elif  "secure"  in xtext:
         ytext ="safety"
     elif  "kitchen"  in xtext:
         ytext ="safety"
     elif "deliver" in xtext:
           ytext = "deliver"
     elif "address" in xtext:
           ytext = "deliver"
     elif "name" in xtext:
           ytext = "name"
     elif "menu" in xtext:
           ytext ="menu"
     else:
           ytext = ""
     return ytext


def calculatebill():
    n="start"
    bill=0
    while(n!="stop"):
        dish= input("Enter name of dish: ").lower()
        if "poha" in dish:
            bill+=30
        elif "upma" in dish:
            bill+=35
        elif "vada" in dish:
            bill+=40
        elif "veg" in dish:
            bill+=50
        elif "panner" in dish:
            bill+=100
        elif "mushroom" in dish:
            bill+=90
        elif "roti" in dish:
            bill+=10
        elif "coco" in dish:
            bill+=20
```

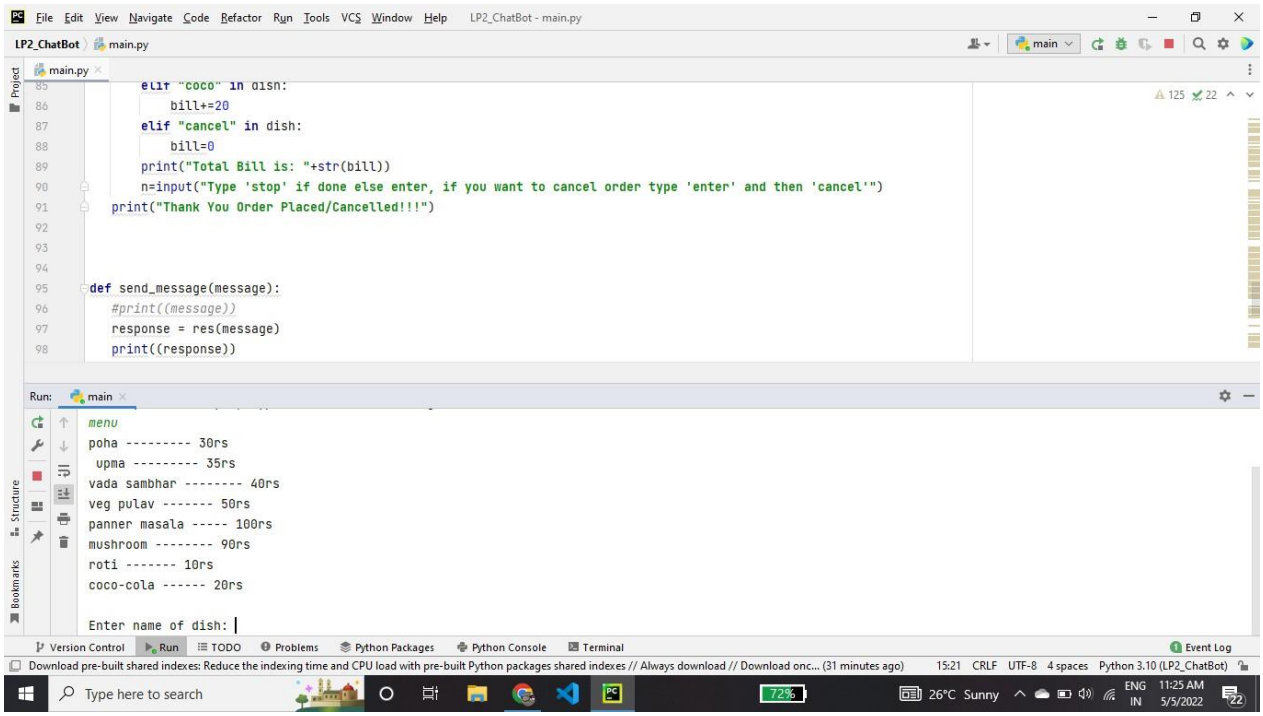
```
        elif "cancel" in dish:
            bill=0
        print("Total Bill is: "+str(bill))
        n=input("Type 'stop' if done else enter, if you want to cancel
order type 'enter' and then 'cancel'")
    print("Thank You Order Placed/Cancelled!!!")



def send_message(message):
    #print((message))
    response = res(message)
    print((response))
    if(message=="menu"):
        calculatebill()


print("Hi there, My name is {0} \n "
          "Welcome to Dhawalikar Pure Veg Restaurant \n"
          "How may i assist you, type 'menu' for referring our Menu-Card
".format(name))

while 1:
    my_input = input()
    my_input = my_input.lower()
    related_text = real(my_input)
    send_message(related_text)
    if my_input == "exit" or my_input == "stop":
        print("BOT: GoodBye!!!")
        break
```


File Edit View Navigate Code Refactor Run Tools VCS Window Help LP2_ChatBot - main.py
LP2_ChatBot main.py
main.py
elif "coco" in dish:
bill+=20
elif "cancel" in dish:
bill=0
print("Total Bill is: "+str(bill))
n=input("Type 'stop' if done else enter, if you want to cancel order type 'enter' and then 'cancel'")
print("Thank You Order Placed/Cancelled!!!")
def send_message(message):
#print((message))
response = res(message)
print((response))
Run: main
menu
poha --------- 30rs
upma --------- 35rs
vada sambhar -------- 40rs
veg pulav ------- 50rs
panner masala ----- 100rs
mushroom -------- 90rs
roti ------- 10rs
coco-cola ------ 20rs
Enter name of dish:
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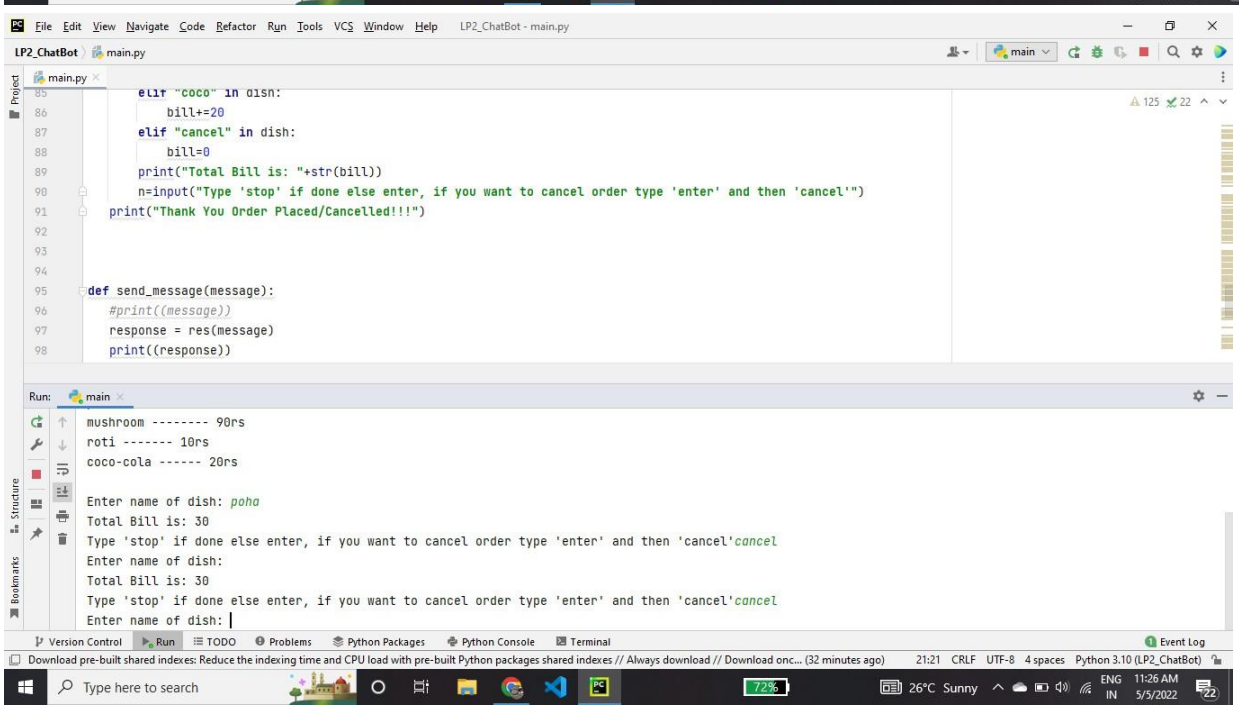
File Edit View Navigate Code Refactor Run Tools VCS Window Help LP2_ChatBot - main.py
LP2_ChatBot main.py
main.py
elif "coco" in dish:
bill+=20
elif "cancel" in dish:
bill=0
print("Total Bill is: "+str(bill))
n=input("Type 'stop' if done else enter, if you want to cancel order type 'enter' and then 'cancel'")
print("Thank You Order Placed/Cancelled!!!")
def send_message(message):
#print((message))
response = res(message)
print((response))
Run: main
mushroom -------- 90rs
roti ------- 10rs
coco-cola ------ 20rs
Enter name of dish: poha
Total Bill is: 30
Type 'stop' if done else enter, if you want to cancel order type 'enter' and then 'cancel'cancel
Enter name of dish:
Total Bill is: 30
Type 'stop' if done else enter, if you want to cancel order type 'enter' and then 'cancel'cancel
Enter name of dish:
Version Control Run TODO Problems Python Packages Python Console Terminal
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Practical No 6 Code

```
go:-
hypothesis(Disease),
write('I believe that the patient have'),
write(Disease),
nl,
write('TAKE CARE '),
undo.
/*Hypothesis that should be tested*/
hypothesis(cold) :- cold, !.
hypothesis(flu) :- flu, !.
hypothesis(typhoid) :- typhoid, !.
hypothesis(measles) :- measles, !.
hypothesis(malaria) :- malaria, !.
hypothesis(unknown). /* no diagnosis*/
/*Hypothesis Identification Rules*/
cold :-
verify(headache),
verify(runny_nose),
verify(sneezing),
verify(sore_throat),
write('Advices and Sugestions:'),
nl,
write('1: Tylenol/tab'),
nl,
write('2: panadol/tab'),
nl,
write('3: Nasal spray'),
nl,
write('Please weare warm cloths Because'),
nl.
flu :-
verify(fever),
verify(headache),
verify(chills),
verify(body_ache),
write('Advices and Sugestions:'),
nl,
write('1: Tamiflu/tab'),
nl,
write('2: panadol/tab'),
nl,
write('3: Zanamivir/tab'),
nl,
write('Please take a warm bath and do salt gargling Because'),
nl.
typhoid :-
verify(headache),
verify(abdominal_pain),
verify(poor_appetite),
verify(fever),
write('Advices and Sugestions:'),
```

```
nl,
write('1: Chloramphenicol/tab'),
nl,
write('2: Amoxicillin/tab'),
nl,
write('3: Ciprofloxacin/tab'),
nl,
write('4: Azithromycin/tab'),
nl,
write('Please do complete bed rest and take soft Diet Because'),
nl.
measles :-
verify(fever),
verify(runny_nose),
verify(rash),
verify(conjunctivitis),
write('Advices and Sugestions:'),
nl,
write('1: Tylenol/tab'),
nl,
write('2: Aleve/tab'),
nl,
write('3: Advil/tab'),
nl,
write('4: Vitamin A'),
nl,
write('Please Get rest and use more liquid Because'),
nl.
malaria :-
verify(fever),
verify(sweating),
verify(headache),
verify(nausea),
verify(vomiting),
verify(diarrhea),
write('Advices and Sugestions:'),
nl,
write('1: Aralen/tab'),
nl,
write('2: Qualaquin/tab'),
nl,
write('3: Plaquenil/tab'),
nl,
write('4: Mefloquine'),
nl,
write('Please do not sleep in open air and cover your full skin Because'),
nl.
/* how to ask questions */
ask(Question) :-
write('Does the patient have following symptom:'),
write(Question),
write('? '),
```

```
read(Response),
nl,
( (Response == yes ; Response == y)
->
assert(yes(Question)) ;
assert(no(Question)), fail).
:- dynamic yes/1,no/1.
/*How to verify something */
verify(S) :-
(yes(S)
->
true ;
(no(S)
->
fail ;
ask(S))).
/* undo all yes/no assertions*/
undo :- retract(yes(_)),fail.
undo :- retract(no(_)),fail.
undo.
```

/*Output*/