Practical No: 3 Roll No:

Subject: Artificial Intelligence

Title: Implement Greedy search algorithm for Kruskal's Minimal Spanning Tree Algorithm

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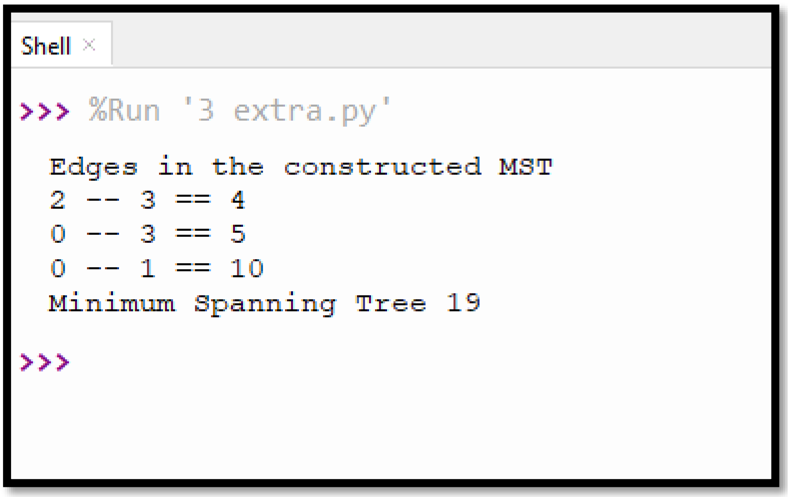
Program Code: extra.py

```
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(4)
g.addEdge(0, 1, 10)
g.addEdge(0, 2, 6)
g.addEdge(0, 3, 5)
g.addEdge(1, 3, 15)
g.addEdge(2, 3, 4)
# Function call
g.KruskalMST()
```

Output :

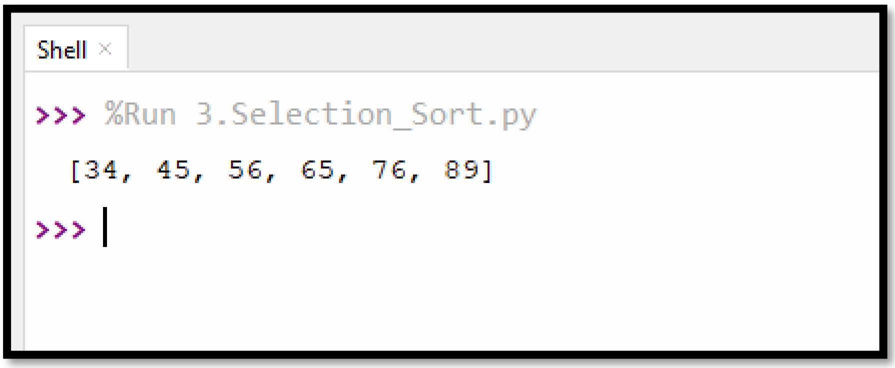


```
>>> %Run '3 extra.py'

  Edges in the constructed MST
  2 -- 3 == 4
  0 -- 3 == 5
  0 -- 1 == 10
  Minimum Spanning Tree 19

>>>
```

Program Code: selection_sort.py

```
def selectionSort(arr):
   for i in range(len(arr)):
      min = float('-inf')
      for j in range(i + 1, len(arr)):
         if arr[i] > arr[j]:
            arr[i],arr[j] = arr[j], arr[i]
   return arr

print(selectionSort([89,56,45,34,65,76]))
```

Output :

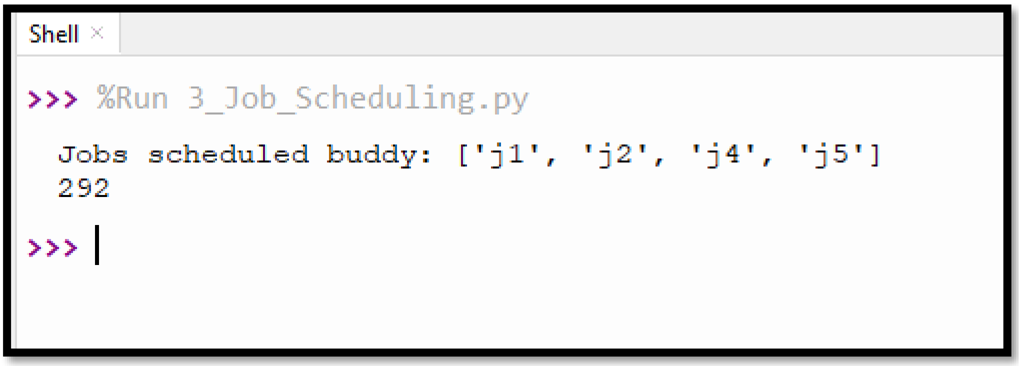


```
>>> %Run 3.Selection_Sort.py

  [34, 45, 56, 65, 76, 89]

>>>
```

Program Code : Job_scheduling.py

```
# Jobs, Profit, Slot
profit = [15,27,10,100, 150]
jobs = ["j1", "j2", "j3", "j4", "j5"]
deadline = [2,3,3,3,4]
profitNJobs = list(zip(profit,jobs,deadline))
profitNJobs = sorted(profitNJobs, key = lambda x: x[0], reverse = True)
slot = []
for _ in range(len(jobs)):
   slot.append(0)

profit = 0
ans = []

for i in range(len(jobs)):
   ans.append('null')

for i in range(len(jobs)):
      job = profitNJobs[i]
      #check if slot is occupied
      for j in range(job[2], 0, -1):
         if slot[j] == 0:
            ans[j] = job[1]
            profit += job[0]
            slot[j] = 1
            break

print("Jobs scheduled buddy:",ans[1:])
print(profit)
```

Output :



```
>>> %Run 3_Job_Scheduling.py

 Jobs scheduled buddy: ['j1', 'j2', 'j4', 'j5']
 292

>>> 
```