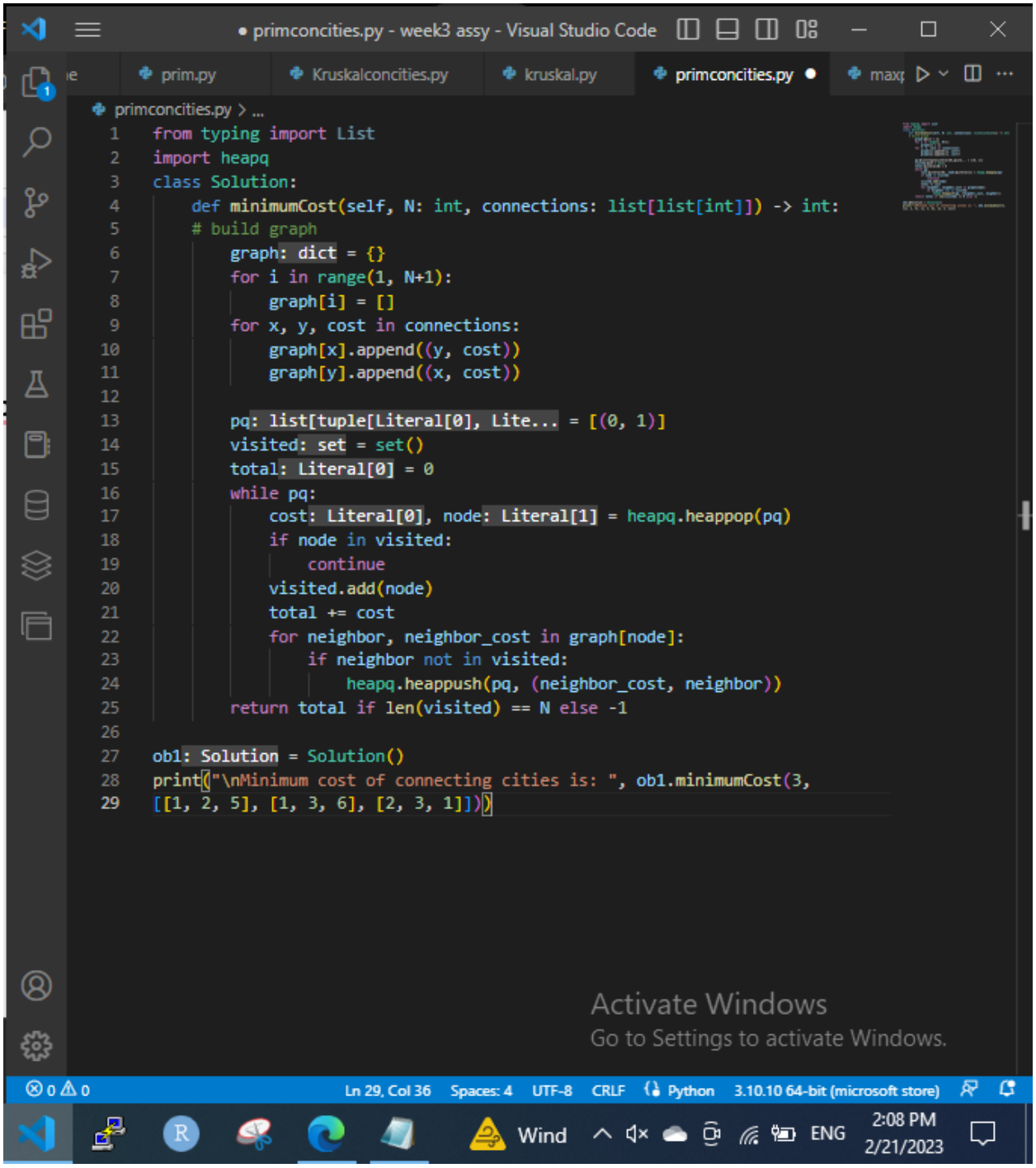
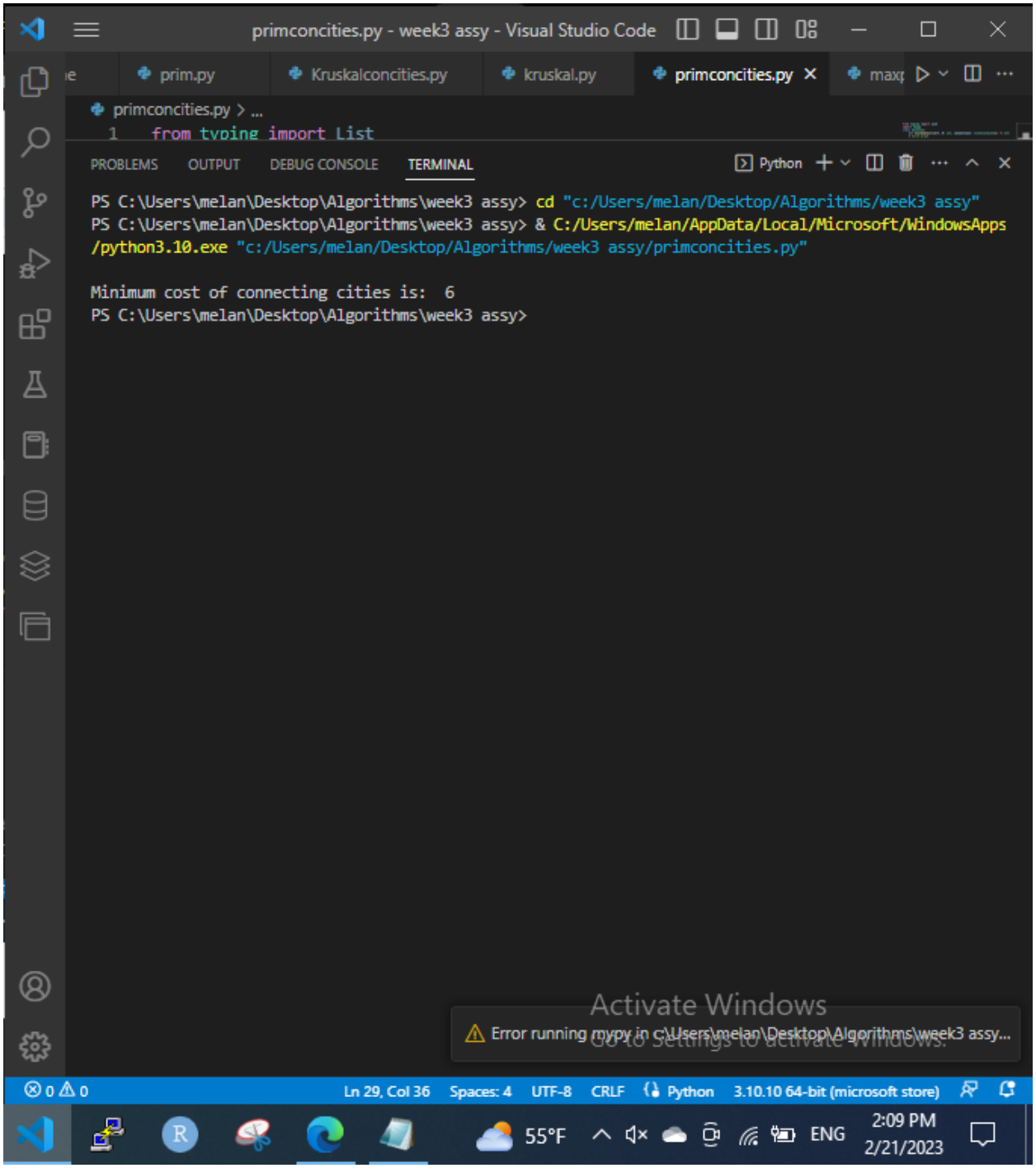
Week 5 Homework 1: Greedy Algorithm : Minimum Spanning Tree (Prim) - LC

STEP 1




primconcities.py - week3 assy - Visual Studio Code
prim.py
Kruskalconcities.py
kruskal.py
primconcities.py
primconcities.py > ...
1 from typing import List
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
Python
PS C:\Users\melan\Desktop\Algorithms\week3 assy> cd "c:/Users/melan/Desktop/Algorithms/week3 assy"
PS C:\Users\melan\Desktop\Algorithms\week3 assy> & C:/Users/melan/AppData/Local/Microsoft/WindowsApps/python3.10.exe "c:/Users/melan/Desktop/Algorithms/week3 assy/primconcities.py"
Minimum cost of connecting cities is: 6
PS C:\Users\melan\Desktop\Algorithms\week3 assy>
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Error running mypy in c:\Users\melan\Desktop\Algorithms\week3 assy...
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Python
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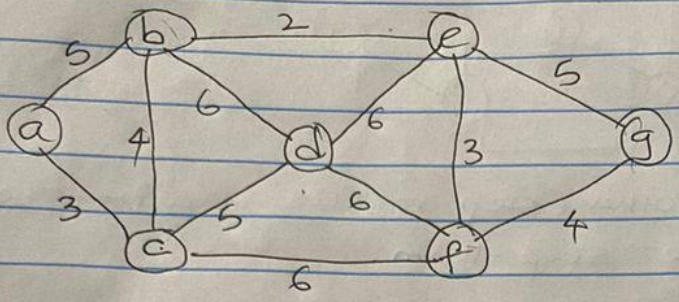
CODE

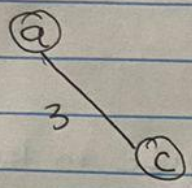
```
from typing import List
import heapq
class Solution:
    def minimumCost(self, N: int, connections: list[list[int]]) -> int:
    # build graph
        graph = {}
        for i in range(1, N+1):
            graph[i] = []
        for x, y, cost in connections:
            graph[x].append((y, cost))
            graph[y].append((x, cost))

        pq = [(0, 1)]
        visited = set()
        total = 0
        while pq:
            cost, node = heapq.heappop(pq)
            if node in visited:
                continue
            visited.add(node)
            total += cost
            for neighbor, neighbor_cost in graph[node]:
                if neighbor not in visited:
                    heapq.heappush(pq, (neighbor_cost, neighbor))
        return total if len(visited) == N else -1

ob1 = Solution()
print("\nMinimum cost of connecting cities is: ", ob1.minimumCost(3, [[1, 2, 5], [1, 3, 6],
[2, 3, 1]]))
```

STEP 2

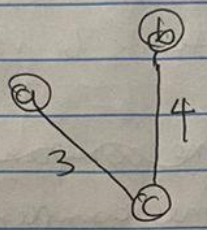
Prims



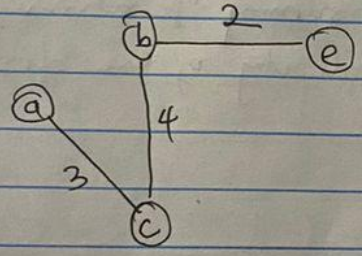
1.



2.



3.



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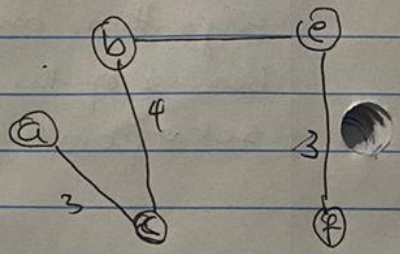
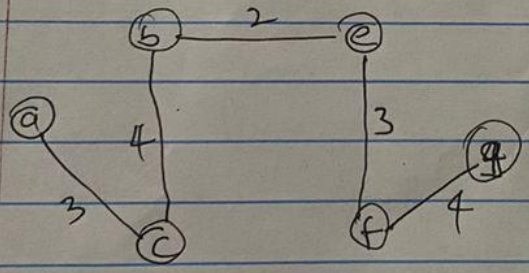
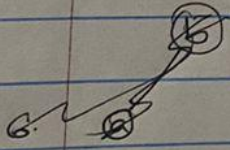


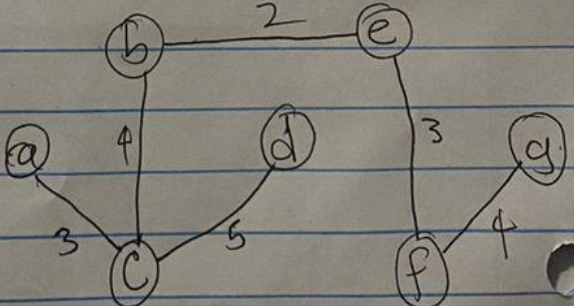
5.



6.

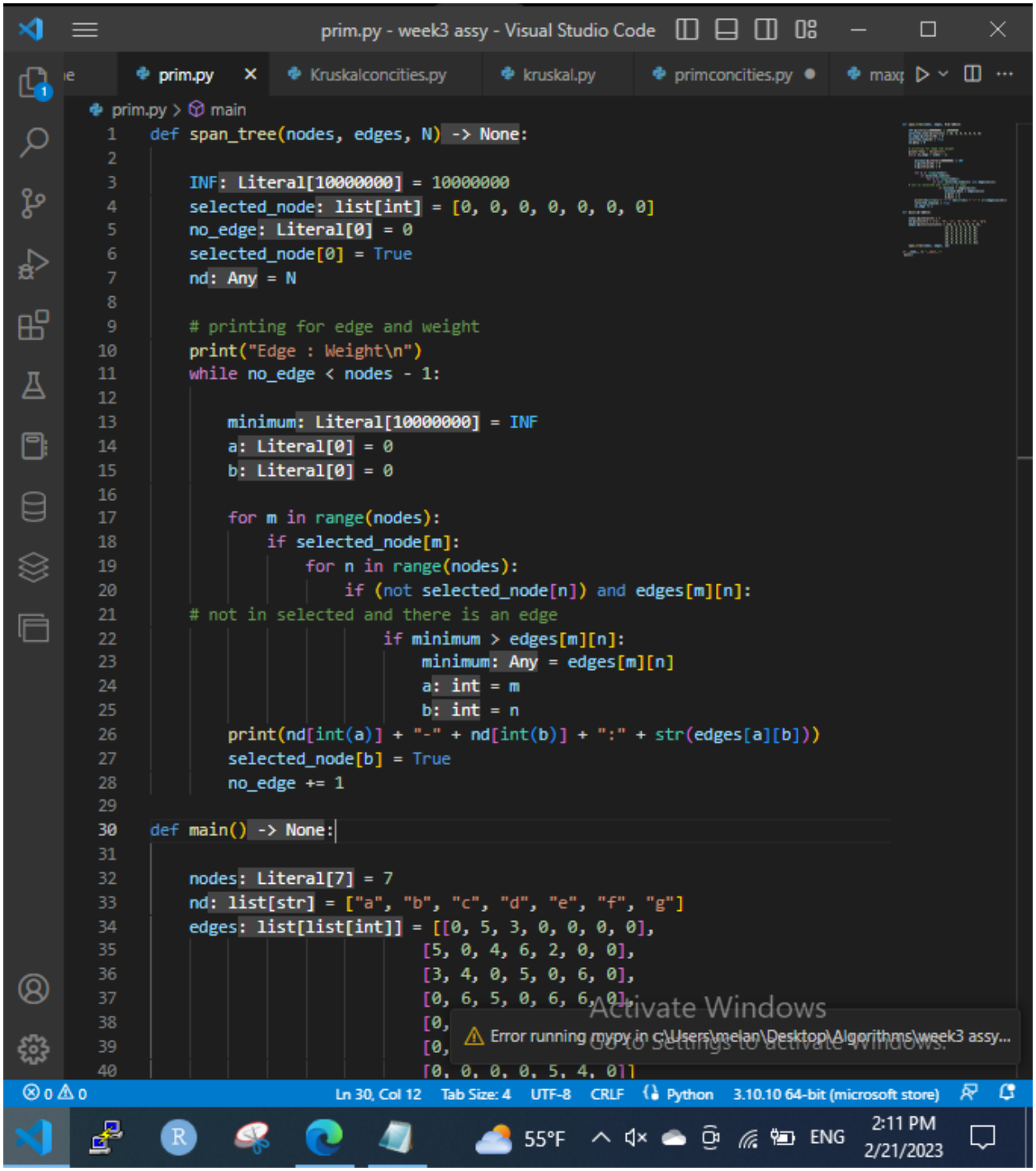


B.



Time complexity = $O((V+E)\log V)$ because each edge is inserted in the priority queue only once and insertion in priority queue take logarithmic time.

STEP 3


prim.py - week3 assy - Visual Studio Code
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Kruskalconcities.py
kruskal.py
primconcities.py
prim.py > main
def span_tree(nodes, edges, N) -> None:
INF: Literal[10000000] = 10000000
selected_node: list[int] = [0, 0, 0, 0, 0, 0, 0]
no_edge: Literal[0] = 0
selected_node[0] = True
nd: Any = N
# printing for edge and weight
print("Edge : Weight\n")
while no_edge < nodes - 1:
minimum: Literal[10000000] = INF
a: Literal[0] = 0
b: Literal[0] = 0
for m in range(nodes):
if selected_node[m]:
for n in range(nodes):
if (not selected_node[n]) and edges[m][n]:
# not in selected and there is an edge
if minimum > edges[m][n]:
minimum: Any = edges[m][n]
a: int = m
b: int = n
print(nd[int(a)] + "-" + nd[int(b)] + ":" + str(edges[a][b]))
selected_node[b] = True
no_edge += 1
def main() -> None:
nodes: Literal[7] = 7
nd: list[str] = ["a", "b", "c", "d", "e", "f", "g"]
edges: list[list[int]] = [[0, 5, 3, 0, 0, 0, 0],
[5, 0, 4, 6, 2, 0, 0],
[3, 4, 0, 5, 0, 6, 0],
[0, 6, 5, 0, 6, 6, 0],
[0, 0, 0, 0, 5, 4, 0]]
Activate Windows
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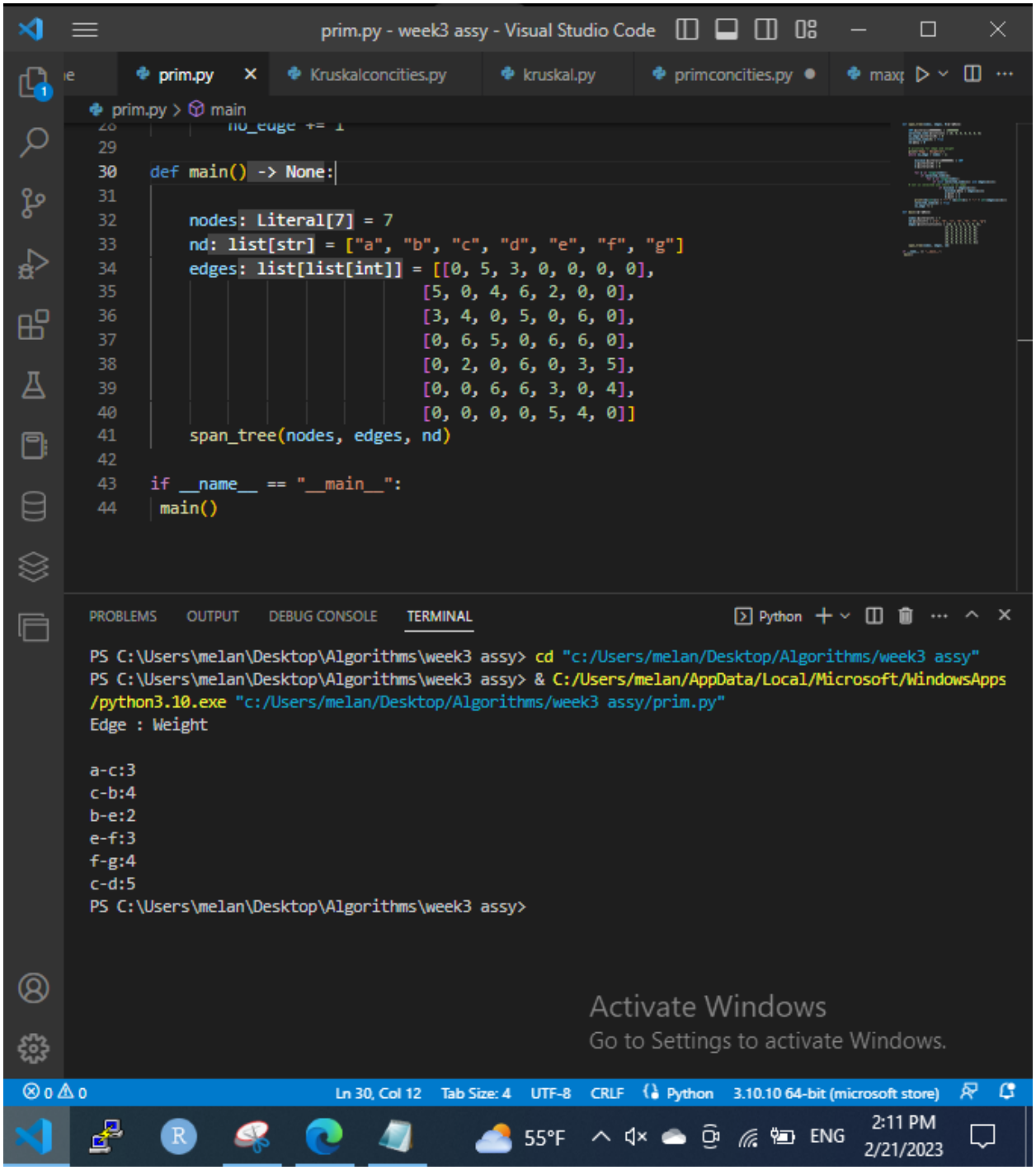
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prim.py > main
def main() -> None:
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nd: list[str] = ["a", "b", "c", "d", "e", "f", "g"]
edges: list[list[int]] = [[0, 5, 3, 0, 0, 0, 0],
[5, 0, 4, 6, 2, 0, 0],
[3, 4, 0, 5, 0, 6, 0],
[0, 6, 5, 0, 6, 6, 0],
[0, 2, 0, 6, 0, 3, 5],
[0, 0, 6, 6, 3, 0, 4],
[0, 0, 0, 0, 5, 4, 0]]
span_tree(nodes, edges, nd)
if __name__ == "__main__":
main()
PROBLEMS
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Python
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Edge : Weight
a-c:3
c-b:4
b-e:2
e-f:3
f-g:4
c-d:5
PS C:\Users\melan\Desktop\Algorithms\week3 assy>
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Go to Settings to activate Windows.
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Python
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ENG
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2/21/2023

CODE

```
def span_tree(nodes, edges, N):

        INF = 10000000
        selected_node = [0, 0, 0, 0, 0, 0, 0]
        no_edge = 0
        selected_node[0] = True
        nd = N

        # printing for edge and weight
        print("Edge : Weight\n")
        while no_edge < nodes - 1:

                minimum = INF
                a = 0
                b = 0

                for m in range(nodes):
                        if selected_node[m]:
                                for n in range(nodes):
                                        if (not selected_node[n]) and edges[m][n]:
        # not in selected and there is an edge
                                                if minimum > edges[m][n]:
                                                        minimum = edges[m][n]
                                                        a = m
                                                        b = n
                print(nd[int(a)] + "-" + nd[int(b)] + ":" + str(edges[a][b]))
                selected_node[b] = True
                no_edge += 1

def main():

        nodes = 7
        nd = ["a", "b", "c", "d", "e", "f", "g"]
        edges = [[0, 5, 3, 0, 0, 0, 0],
                                                        [5, 0, 4, 6, 2, 0, 0],
                                                        [3, 4, 0, 5, 0, 6, 0],
                                                        [0, 6, 5, 0, 6, 6, 0],
                                                        [0, 2, 0, 6, 0, 3, 5],
                                                        [0, 0, 6, 6, 3, 0, 4],
                                                        [0, 0, 0, 0, 5, 4, 0]]
        span_tree(nodes, edges, nd)
```

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