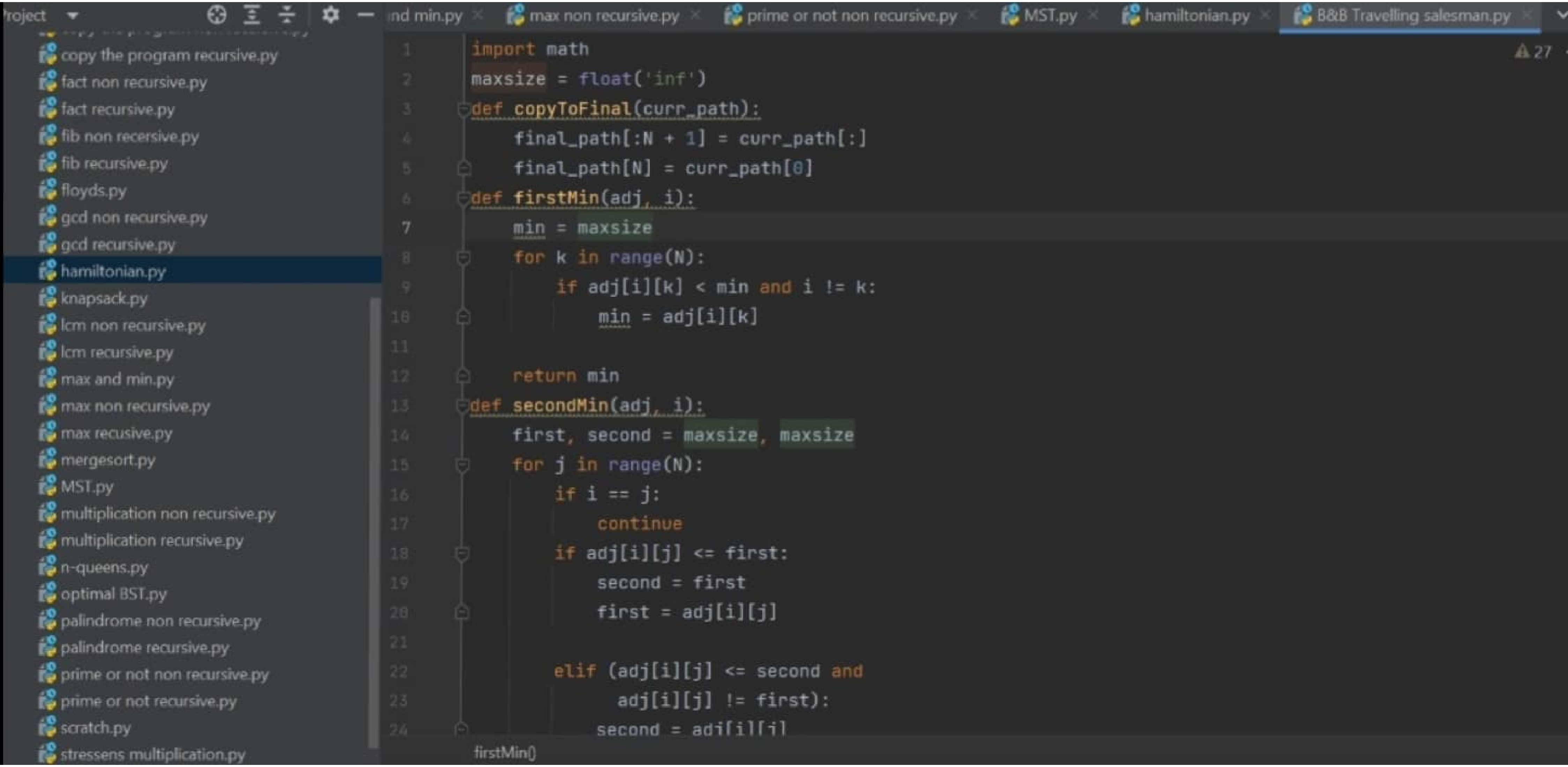
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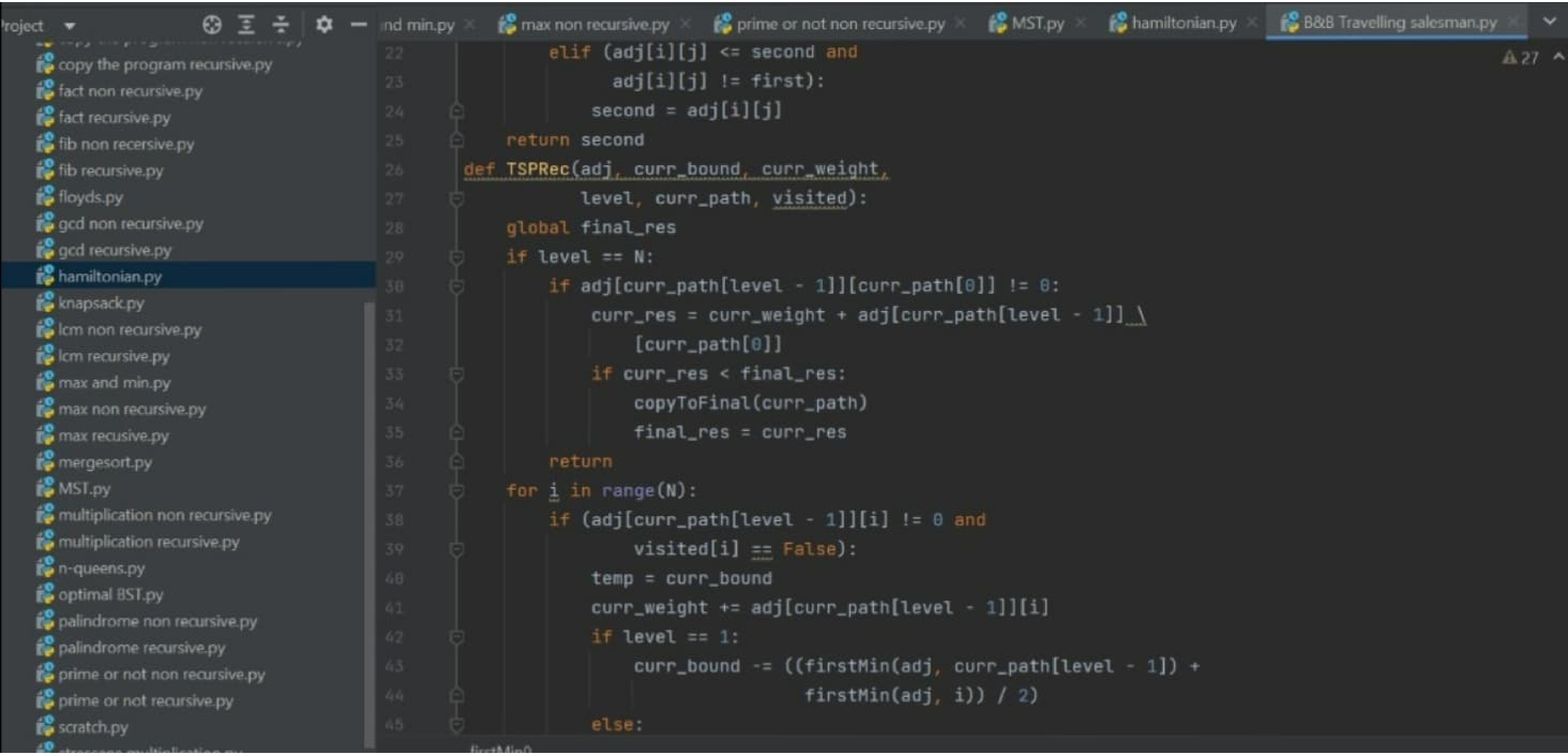
B&B Travelling salesman.py
27
firstMin()

```python
import math
maxsize = float('inf')
def copyToFinal(curr_path):
    final_path[:N + 1] = curr_path[:]
    final_path[N] = curr_path[0]
def firstMin(adj, i):
    min = maxsize
    for k in range(N):
        if adj[i][k] < min and i != k:
            min = adj[i][k]

    return min
def secondMin(adj, i):
    first, second = maxsize, maxsize
    for j in range(N):
        if i == j:
            continue
        if adj[i][j] <= first:
            second = first
            first = adj[i][j]

        elif (adj[i][j] <= second and
              adj[i][j] != first):
            second = adj[i][j]
```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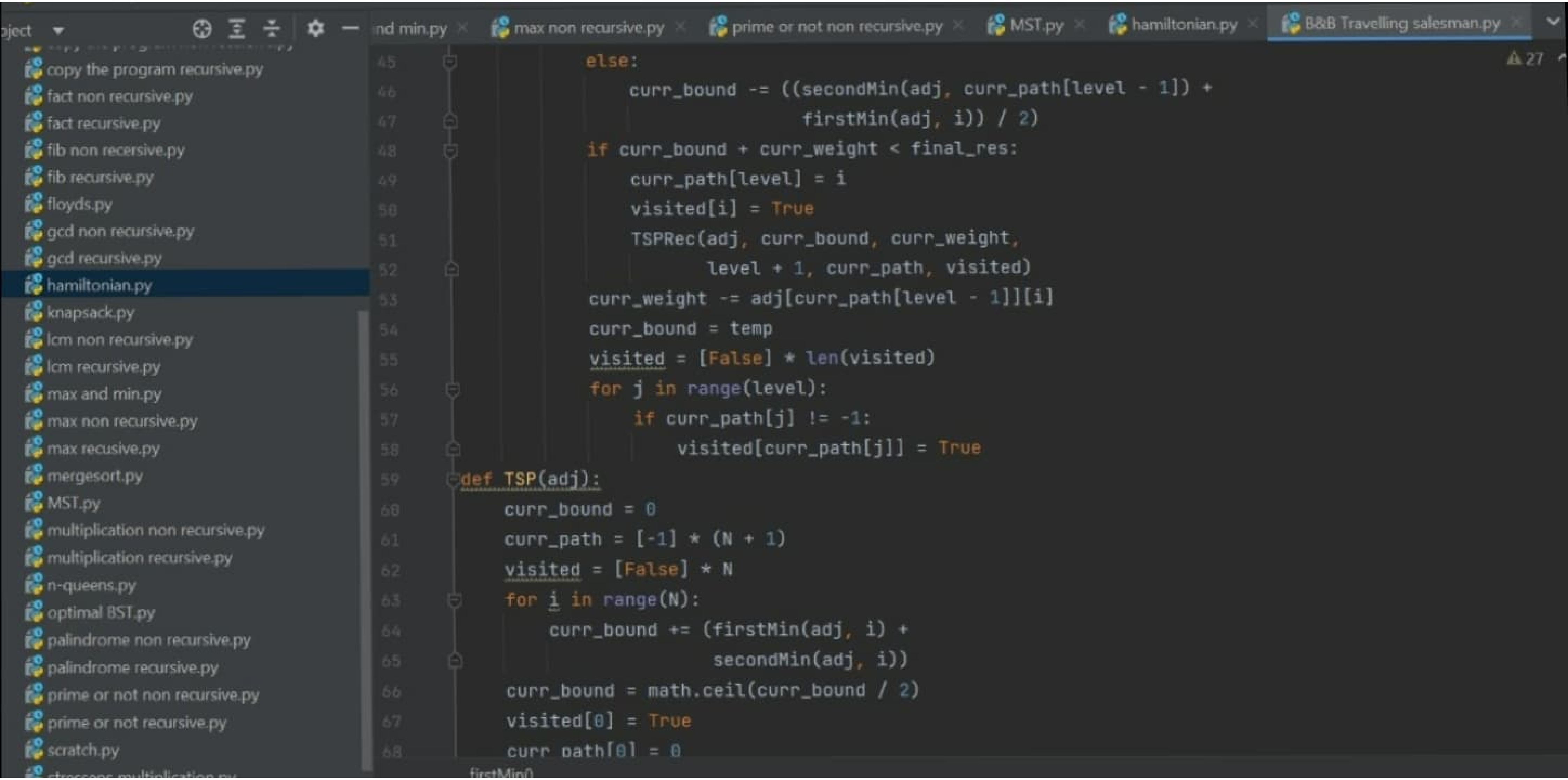
firstMin()

```
        elif (adj[i][j] <= second and
              adj[i][j] != first):
            second = adj[i][j]
    return second
def TSPRec(adj, curr_bound, curr_weight,
           level, curr_path, visited):
    global final_res
    if level == N:
        if adj[curr_path[level - 1]][curr_path[0]] != 0:
            curr_res = curr_weight + adj[curr_path[level - 1]] \
                [curr_path[0]]
            if curr_res < final_res:
                copyToFinal(curr_path)
                final_res = curr_res
        return
    for i in range(N):
        if (adj[curr_path[level - 1]][i] != 0 and
                visited[i] == False):
            temp = curr_bound
            curr_weight += adj[curr_path[level - 1]][i]
            if level == 1:
                curr_bound -= ((firstMin(adj, curr_path[level - 1]) +
                                firstMin(adj, i)) / 2)
            else:
```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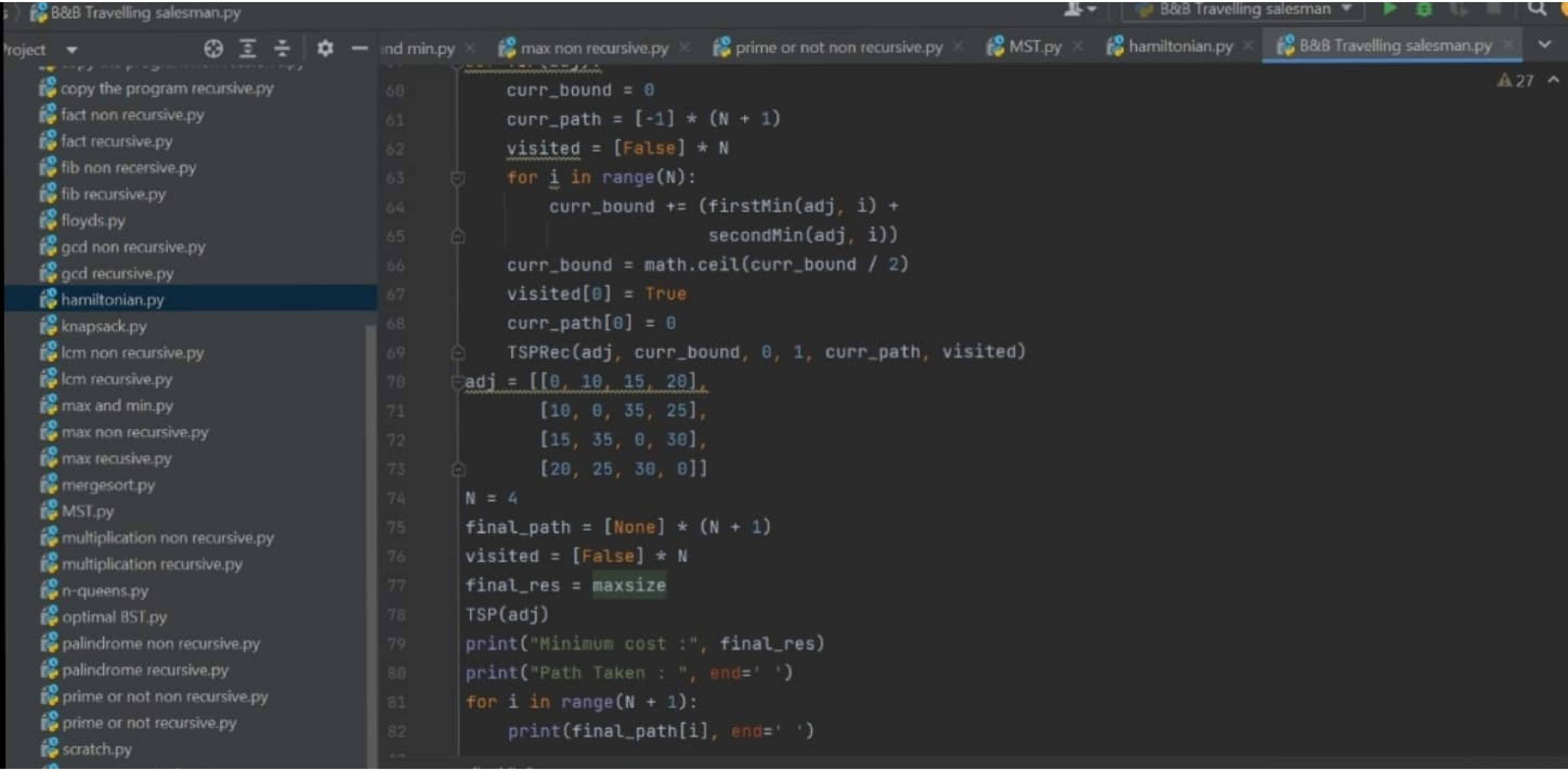
⚠27
firstMin()

```python
            else:
                curr_bound -= ((secondMin(adj, curr_path[level - 1]) +
                               firstMin(adj, i)) / 2)
            if curr_bound + curr_weight < final_res:
                curr_path[level] = i
                visited[i] = True
                TSPRec(adj, curr_bound, curr_weight,
                       level + 1, curr_path, visited)
            curr_weight -= adj[curr_path[level - 1]][i]
            curr_bound = temp
            visited = [False] * len(visited)
            for j in range(level):
                if curr_path[j] != -1:
                    visited[curr_path[j]] = True
def TSP(adj):
    curr_bound = 0
    curr_path = [-1] * (N + 1)
    visited = [False] * N
    for i in range(N):
        curr_bound += (firstMin(adj, i) +
                       secondMin(adj, i))
    curr_bound = math.ceil(curr_bound / 2)
    visited[0] = True
    curr_path[0] = 0
```



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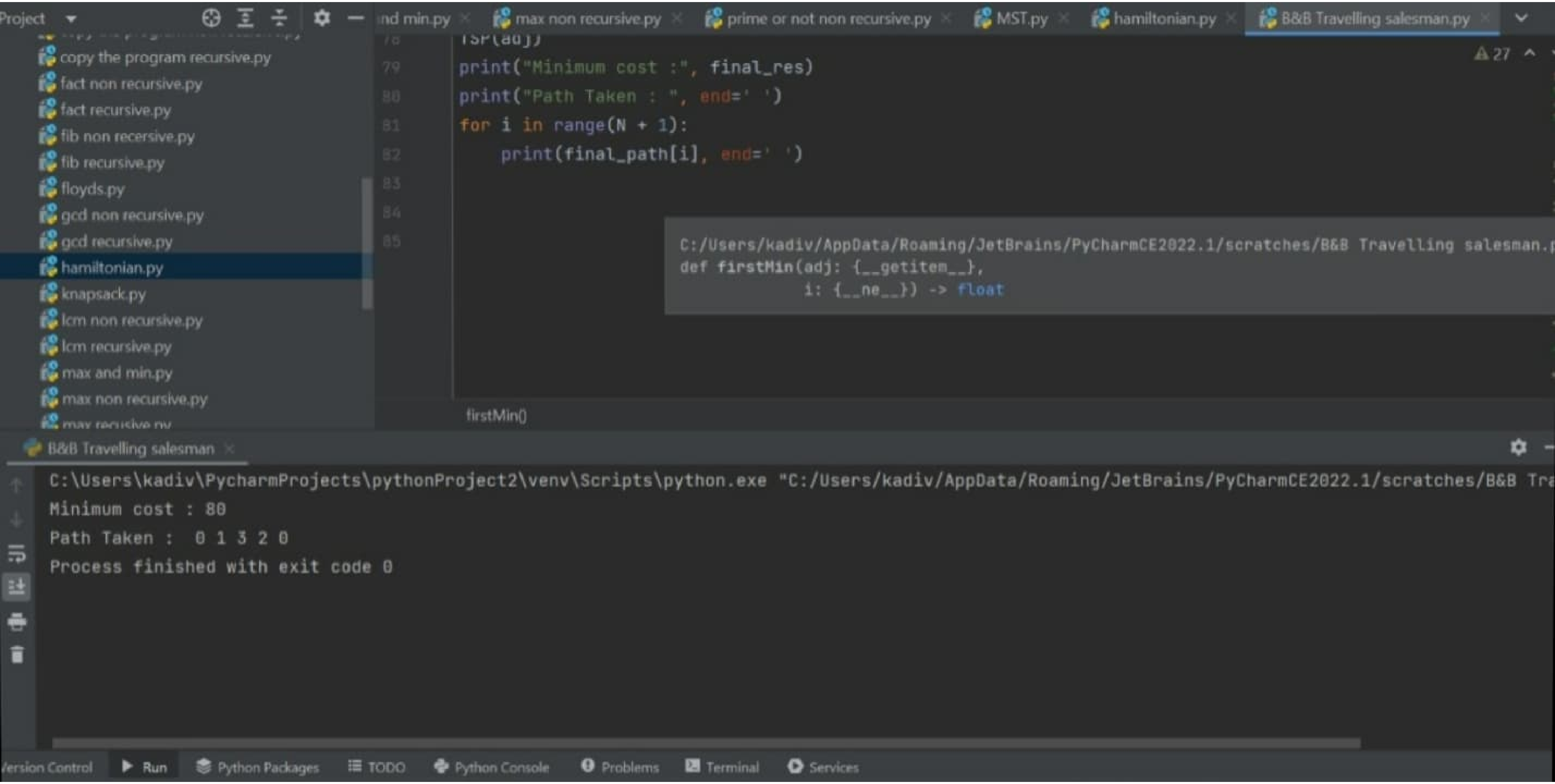
prime or not recursive.py
scratch.py

```python
    curr_bound = 0
    curr_path = [-1] * (N + 1)
    visited = [False] * N
    for i in range(N):
        curr_bound += (firstMin(adj, i) +
                       secondMin(adj, i))
    curr_bound = math.ceil(curr_bound / 2)
    visited[0] = True
    curr_path[0] = 0
    TSPRec(adj, curr_bound, 0, 1, curr_path, visited)
adj = [[0, 10, 15, 20],
       [10, 0, 35, 25],
       [15, 35, 0, 30],
       [20, 25, 30, 0]]
N = 4
final_path = [None] * (N + 1)
visited = [False] * N
final_res = maxsize
TSP(adj)
print("Minimum cost :", final_res)
print("Path Taken : ", end=' ')
for i in range(N + 1):
    print(final_path[i], end=' ')
```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Python Console
Problems
Terminal
Services

```python
TSP(adj)
print("Minimum cost :", final_res)
print("Path Taken : ", end=' ')
for i in range(N + 1):
    print(final_path[i], end=' ')
```

```
C:/Users/kadiv/AppData/Roaming/JetBrains/PyCharmCE2022.1/scratches/B&B Travelling salesman.p
def firstMin(adj: {__getitem__},
             i: {__ne__}) -> float
```

```
C:\Users\kadiv\PycharmProjects\pythonProject2\venv\Scripts\python.exe "C:/Users/kadiv/AppData/Roaming/JetBrains/PyCharmCE2022.1/scratches/B&B Tra
Minimum cost : 80
Path Taken :  0 1 3 2 0
Process finished with exit code 0
```