Notebook

November 26, 2024

[3]:

```
try:
    import networkx as nx
    import matplotlib.pyplot as plt

except Exception as e:
    print(f"Error : {e}")
```

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```
# Step 1: Initialize the transport network graph
transport_network = nx.Graph()
```

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```
# Step 2: Add nodes (stations) to the graph
stations = {
    'Baker Street': {'lines': ['Bakerloo', 'Jubilee']},
    'Oxford Circus': {'lines': ['Bakerloo', 'Central', 'Victoria']},
    'Green Park': {'lines': ['Jubilee', 'Piccadilly', 'Victoria']},
    'Bond Street': {'lines': ['Jubilee', 'Central']},
    'Waterloo': {'lines': ['Bakerloo', 'Jubilee', 'Northern']},
    'Westminster': {'lines': ['Jubilee', 'District', 'Circle']},
}

# Adding nodes to the graph
for station, attributes in stations.items():
    transport_network.add_node(station, **attributes)
```

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```
# Step 3: Add edges (connections) to the graph
edges = [
    ('Baker Street', 'Oxford Circus', {'line': 'Bakerloo', 'distance': 1.0}),
    ('Oxford Circus', 'Green Park', {'line': 'Victoria', 'distance': 1.2}),
    ('Green Park', 'Bond Street', {'line': 'Jubilee', 'distance': 1.5}),
    ('Waterloo', 'Westminster', {'line': 'Jubilee', 'distance': 0.8}),
    ('Westminster', 'Bond Street', {'line': 'Jubilee', 'distance': 2.0}),
]

# Adding edges to the graph with attributes properly set
for edge in edges:
    transport_network.add_edge(edge[0], edge[1], **edge[2])
```

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```
# Step 4: Check if the graph is connected
if nx.is_connected(transport_network):
    print("The graph is connected.")
else:
    print("The graph is NOT connected.")
```

```
The graph is connected.
```

[10]:

```
# Step 3: Visualize the Transport Network

# Define colors for different lines
colors = {
    'Bakerloo': 'brown',
    'Jubilee': 'gray',
    'Victoria': 'blue',
    'Central': 'red',
    'Piccadilly': 'purple',
    'District': 'green',
    'Circle': 'yellow'
}

# Extract edge colors based on line names
edge_colors = [colors[transport_network[u][v]['line']] for u, v in␣
 ↪transport_network.edges()]

# Define the layout for visualization - using a spring layout for an organized␣
 ↪visual
pos = nx.spring_layout(transport_network, seed=42)  # Set seed for consistent␣
 ↪layout

# Draw the nodes (stations)
plt.figure(figsize=(12, 8))
nx.draw_networkx_nodes(transport_network, pos, node_size=700,␣
 ↪node_color='orange', edgecolors='black')

# Draw the edges with colors corresponding to transport lines
nx.draw_networkx_edges(transport_network, pos, edgelist=transport_network.
 ↪edges(), edge_color=edge_colors, width=3)

# Draw labels for nodes (stations)
nx.draw_networkx_labels(transport_network, pos, font_size=10,␣
 ↪font_family="sans-serif")

# Add line names as edge labels if needed
edge_labels = {(u, v): transport_network[u][v]['line'] for u, v in␣
 ↪transport_network.edges()}
```

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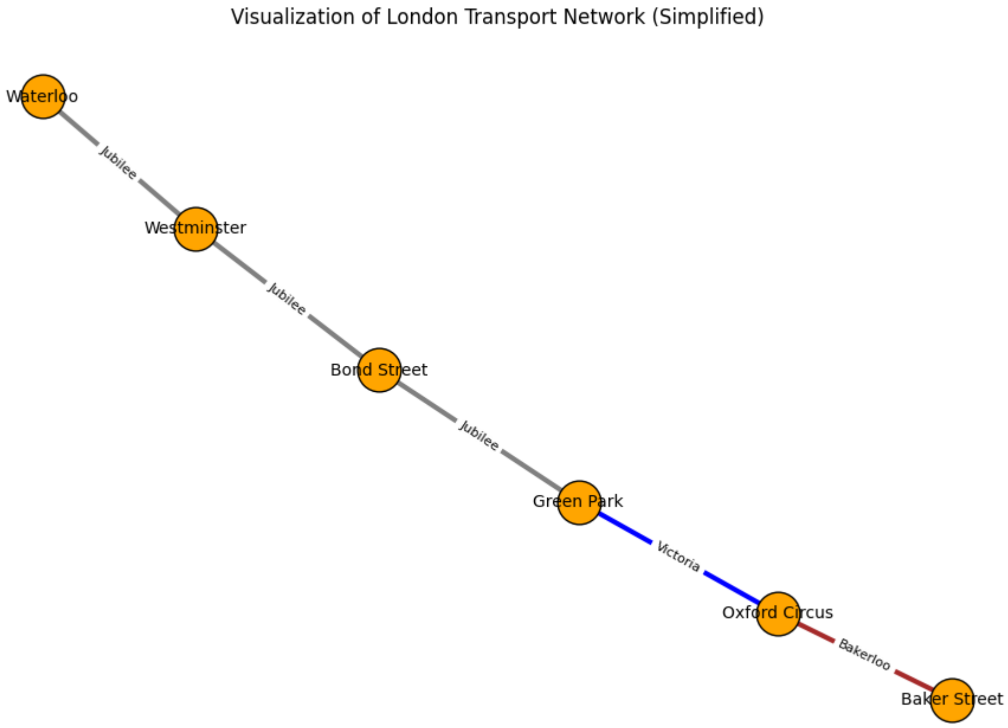
nx.draw_networkx_edge_labels(transport_network, pos, edge_labels=edge_labels,␣
 ↪font_color='black', font_size=8)

plt.title("Visualization of London Transport Network (Simplified)")
plt.axis('off')  # Hide axis
plt.show()
```



[11]:

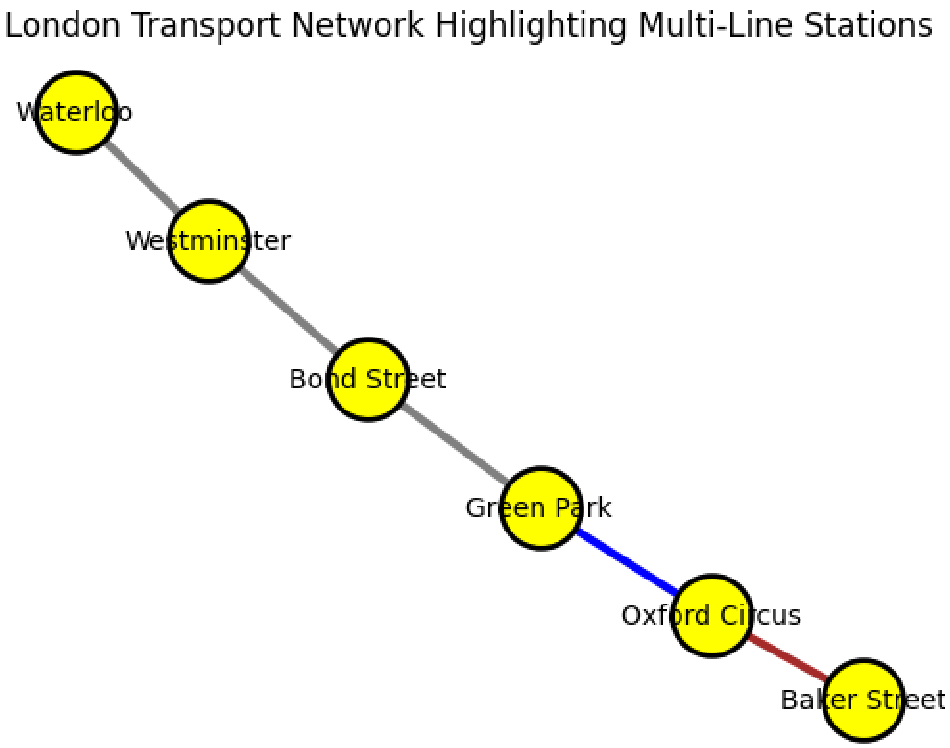
```
# Highlight nodes that belong to multiple lines
multi_line_stations = [node for node, attr in transport_network.
 ↪nodes(data=True) if len(attr['lines']) > 1]

# Draw the nodes again, with special styling for multi-line stations
nx.draw_networkx_nodes(transport_network, pos, nodelist=multi_line_stations,␣
 ↪node_size=900, node_color='yellow', edgecolors='black', linewidths=2)

# Rest of the visualization stays the same as above
nx.draw_networkx_nodes(transport_network, pos, nodelist=[n for n in␣
 ↪transport_network if n not in multi_line_stations], node_size=700,␣
 ↪node_color='orange')
nx.draw_networkx_edges(transport_network, pos, edgelist=transport_network.
 ↪edges(), edge_color=edge_colors, width=3)
```

```
nx.draw_networkx_labels(transport_network, pos, font_size=10,␣
 ↪font_family="sans-serif")

plt.title("London Transport Network Highlighting Multi-Line Stations")
plt.axis('off')
plt.show()
```


London Transport Network Highlighting Multi-Line Stations
Waterloo
Westminster
Bond Street
Green Park
Oxford Circus
Baker Street