THYNK UNLIMITED

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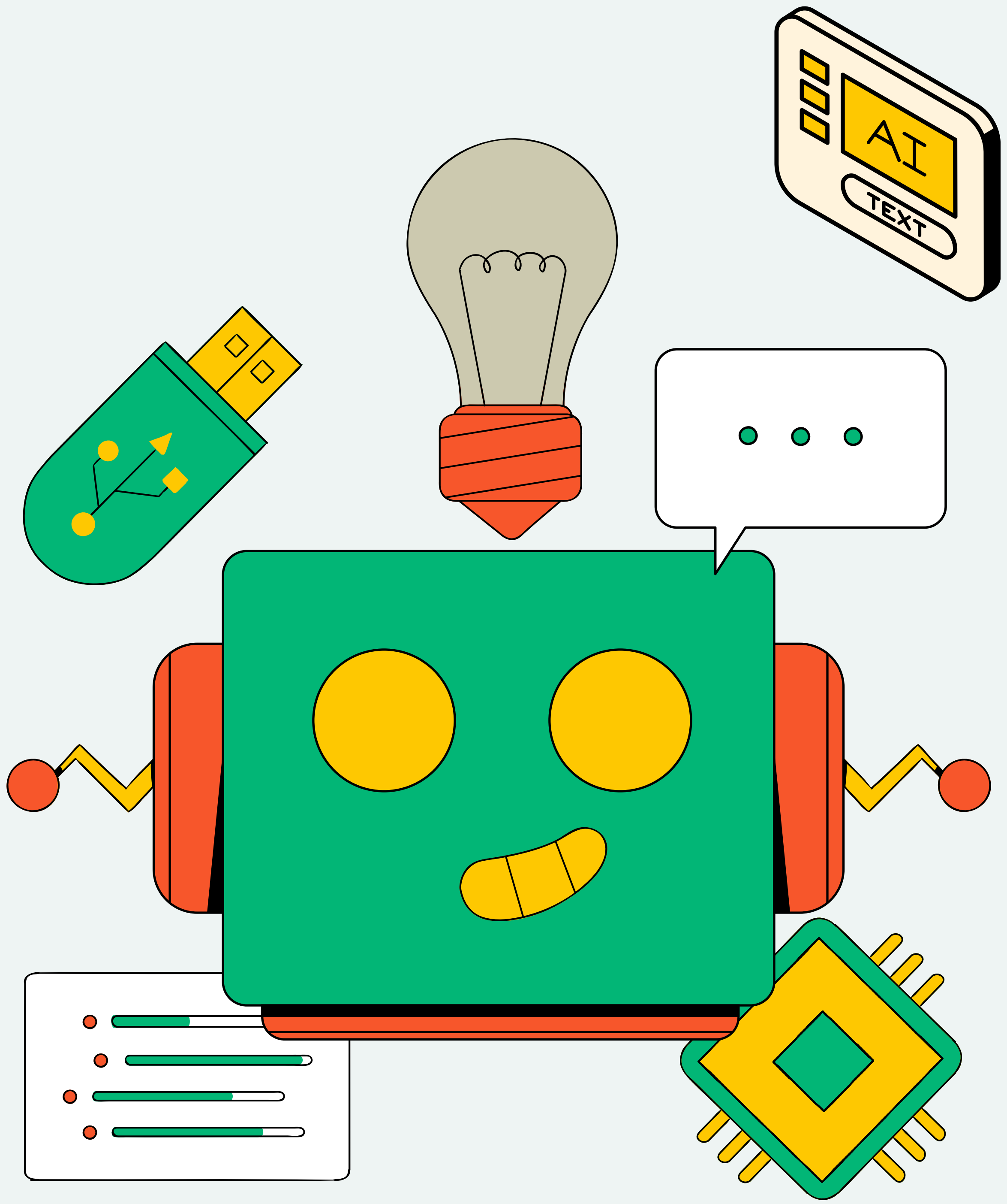

CASE STUDY 1: SOLVING REAL WORLD PROBLEM

PRELIM EXAM

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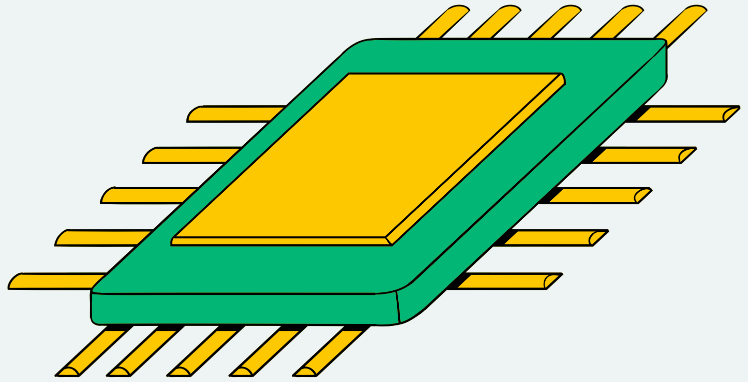


PROBLEM

the chosen real world problem is the optimising delivery routes for logistics company by finding the fastest and shortest route possible

ALGORITHMS USED

- Graph Theory
- Dijkstra Algorithm

1ST ITERATION

problem identification

how can we optimize the delivery routes for logistics company in order to save travel time?

decomposition

sub problems:

- graphing the routes
- finding the shortest path

pattern recognition

using gps apps like waze and google maps

abstraction

relevant: routes, stopovers, distance
irrelevant: package, transportation

2ND ITERATION

problem identification

how can we find the fastest route in optimizing delivery routes?

decomposition

sub problems:

- finding shortest route
- calculating traffic

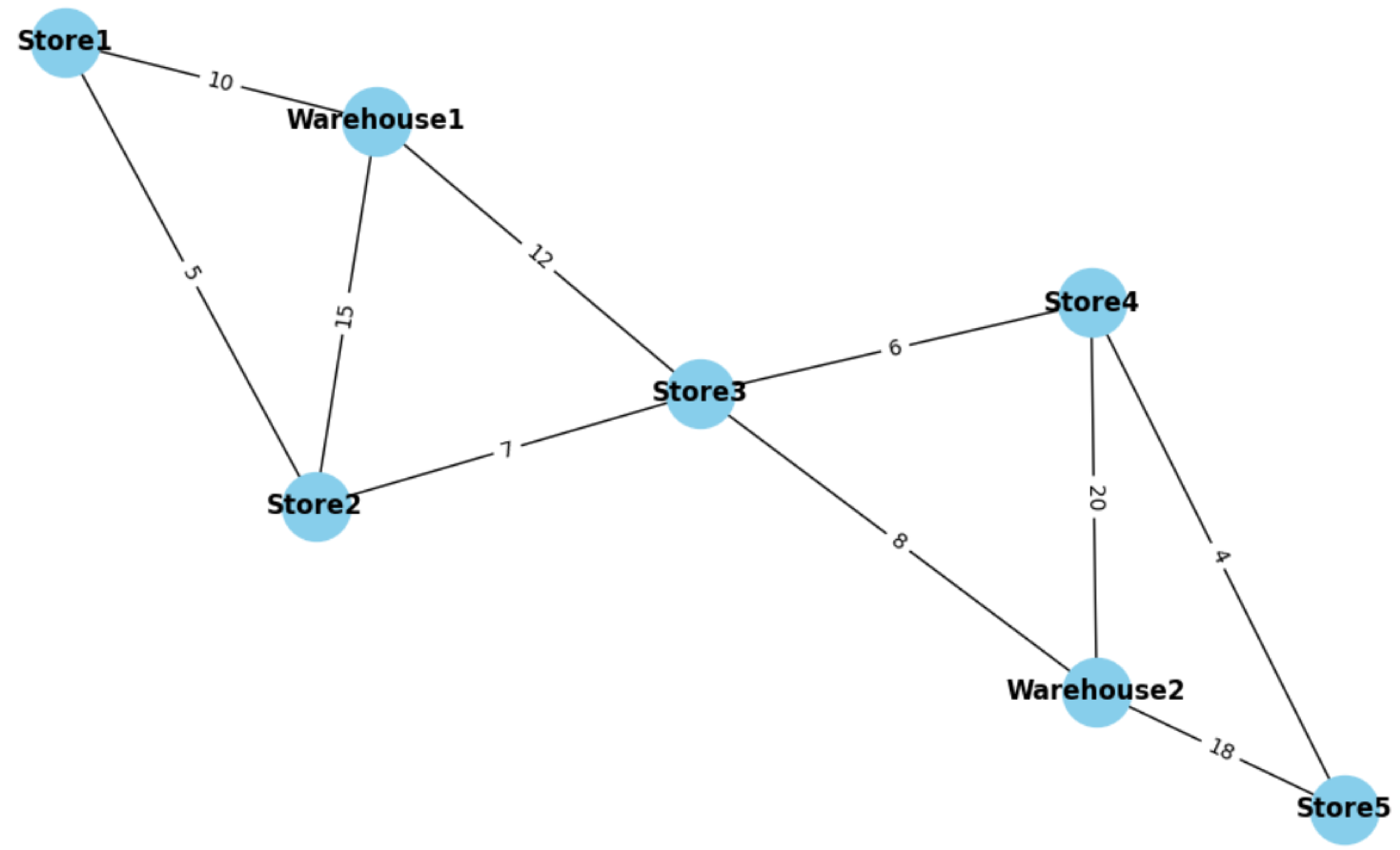
pattern recognition

using gps apps like waze and google maps

abstraction

relevant: routes, stopovers, traffic
irrelevant: transportation, road

GRAPH


Store1
10
Warehouse1
5
15
12
Store4
6
Store3
7
Store2
20
8
4
Warehouse2
18
Store5

CODES:

```
def shortestPath(self, src, dest):
    # Initialize distances and previous nodes
    distances = {node: float('inf') for node in self.adj}
    distances[src] = 0
    previous = {node: None for node in self.adj}

    # Priority queue implemented using a list
    pq = [(0, src)]

    while pq:
        # Pop node with the smallest distance from the priority queue
        current_distance, current_node = min(pq)
        pq.remove((current_distance, current_node))

        # Check if the current node is the destination
        if current_node == dest:
            break

        # Explore neighbors of the current node
        for neighbor, weight in self.adj[current_node]:
            distance = current_distance + weight
            # Update distance and previous node if a shorter path is found
            if distance < distances[neighbor]:
                distances[neighbor] = distance
                previous[neighbor] = current_node
                pq.append((distance, neighbor))

    # Reconstruct the shortest path from src to dest
    shortest_path = []
    current = dest
    while current is not None:
        shortest_path.insert(0, current.getName())  # Append node name instead of node object
        current = previous[current]

    return shortest_path, distances[dest]
```

TESTING:

```
Warehouse1 ---->
    Store1 (Weight: 10)
    Store2 (Weight: 15)
    Store3 (Weight: 12)
Warehouse2 ---->
    Store3 (Weight: 8)
    Store4 (Weight: 20)
    Store5 (Weight: 18)
Store1 ---->
    Store2 (Weight: 5)
Store2 ---->
    Store3 (Weight: 7)
Store3 ---->
    Store4 (Weight: 6)
Store4 ---->
    Store5 (Weight: 4)
Store5 ---->
Enter source (Warehouse1/Warehouse2): Warehouse1
Enter destination (Store1/Store2/Store3/Store4/Store5): Store5

Shortest path from Warehouse1 to Store5 is ['Warehouse1', 'Store3', 'Store4', 'Store5']
Shortest distance from Warehouse1 to Store5 is 22
```