

JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, Noida

Department of CSE & IT



Project Report

Data Structures Lab

(15B17CI371)

Chocolate Distributor in City

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Problem Statement

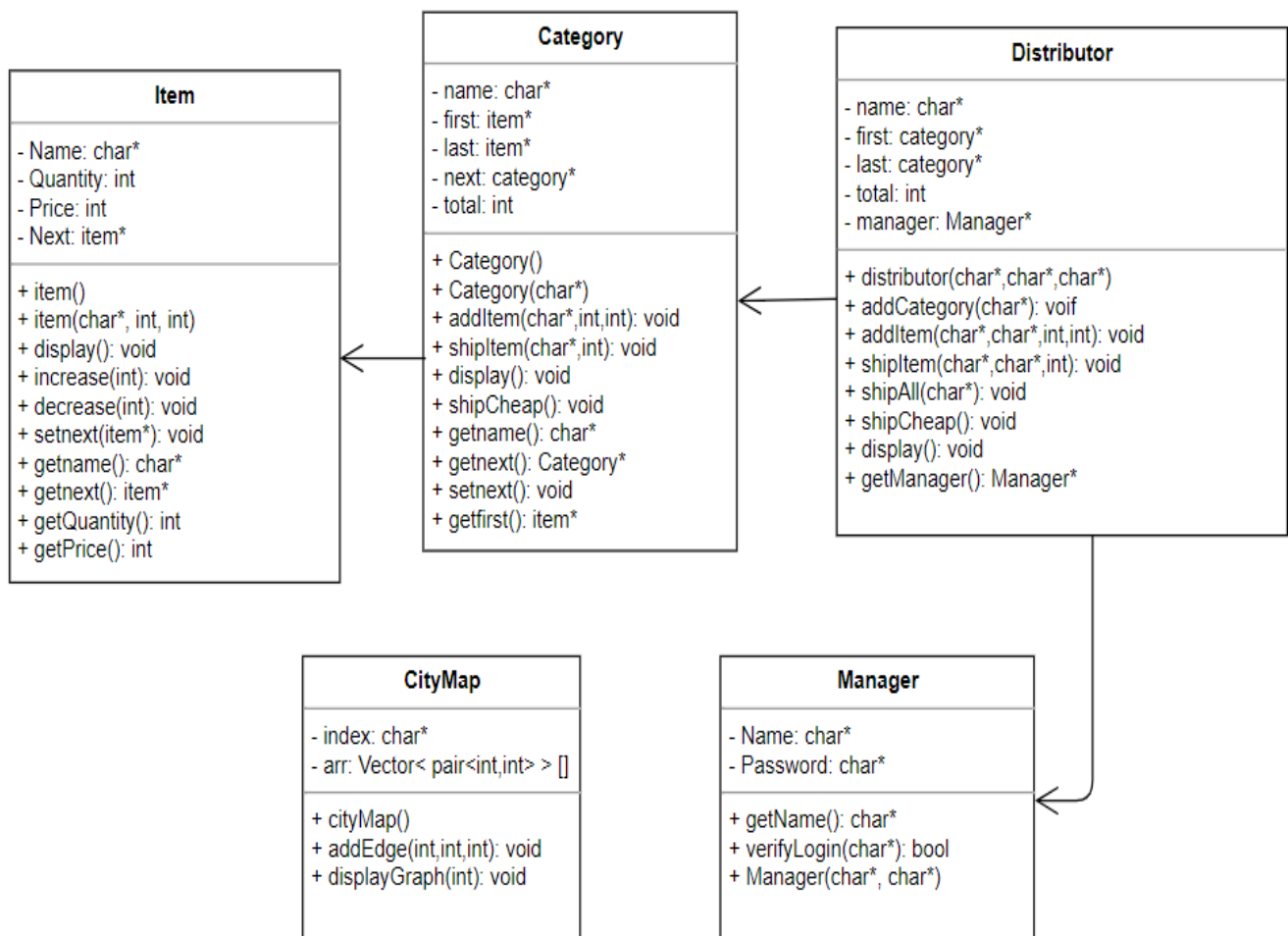
A Chocolate Wholesaler has 10 Shops under him in the City. Despite cutting all the cost he is unable to cut down the cost of Transportation. He wanted to cut down his transportation cost so that he delivers the chocolates at the intended shops taking the shortest route helping him in cutting down his cost.

He also faces the problem of managing the items in his store so he is also looking for a suitable data structure to help him out with the best way of storing the items.

Relevance:

Many real life problems can be simplified by using suitable data structures and algorithms and the problems related to networking and connections are most common. If someone thinks of city maps, computer networks, VLSI design etc., the first thing that comes to mind is connections and representing such connections efficiently is crucial.

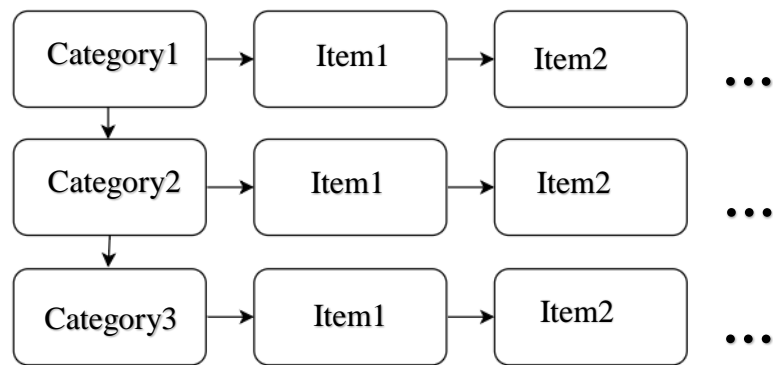
Class Diagram:



Data Structures Used

- **Multi List** – STL List is used in the form of multi list to store information about all the chocolates in the store. The chocolates are classified according to their manufacturer and further by their names.

The Multi list implementation makes it easier for one to search for an item.



- Graph** – A graph is maintained to store the details of all the retail shops in the locality. Appropriate algorithm is applied to search for the shortest path that covers all the retail shops as and when the wholesaler wants to supply them material.

The retail shops are the vertices in the graphs and an edge shows a direct two way road between the shops.

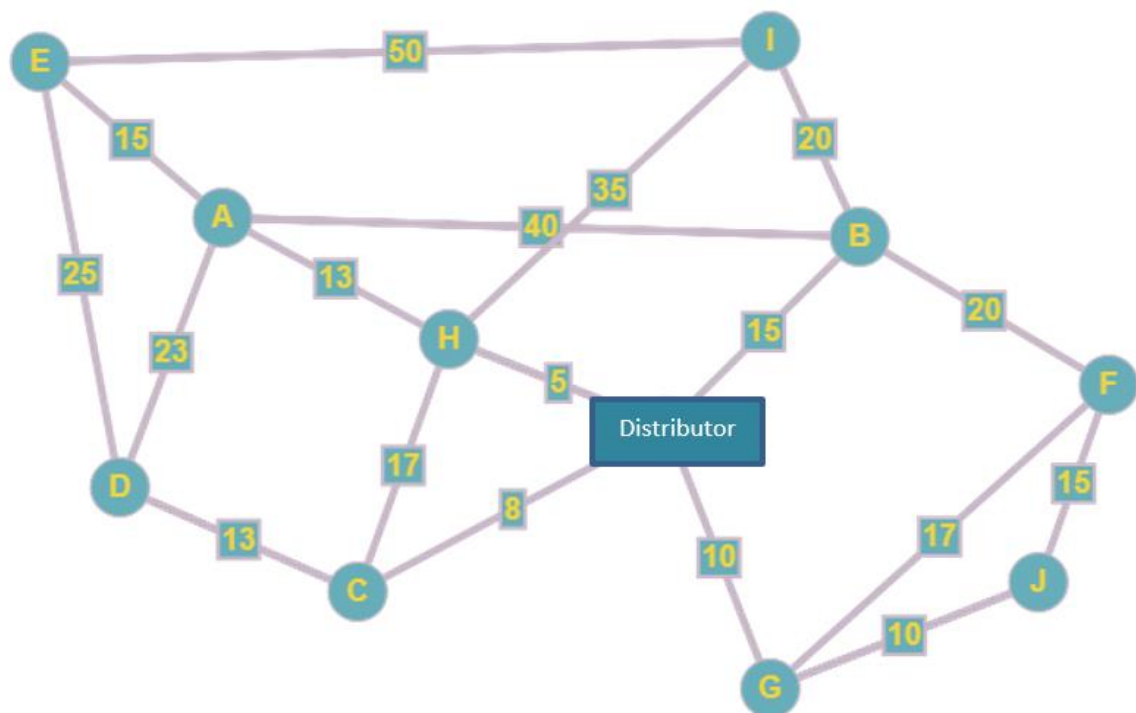
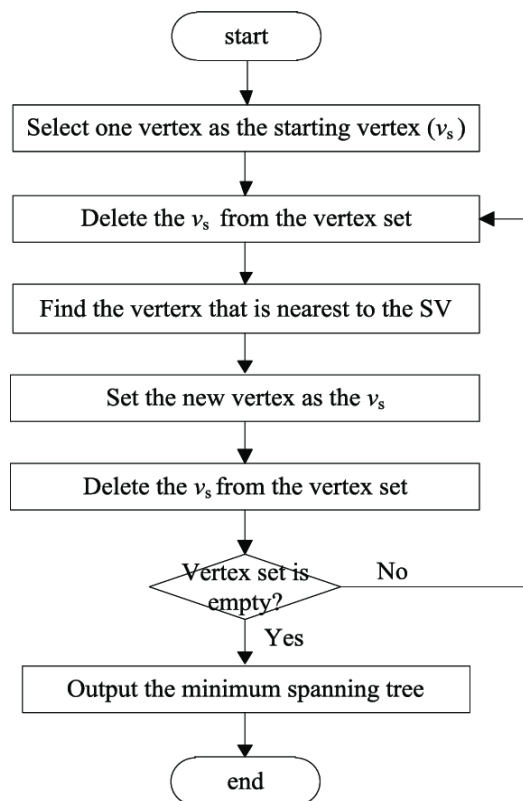


Fig. A, B...E represent Retail shops, and edges represent the distance between them

Prim's Algorithm for Minimum Spanning Tree



1) Create a Min Heap of size V where V is the number of vertices in the given graph. Every node of min heap contains vertex number and key value of the vertex.

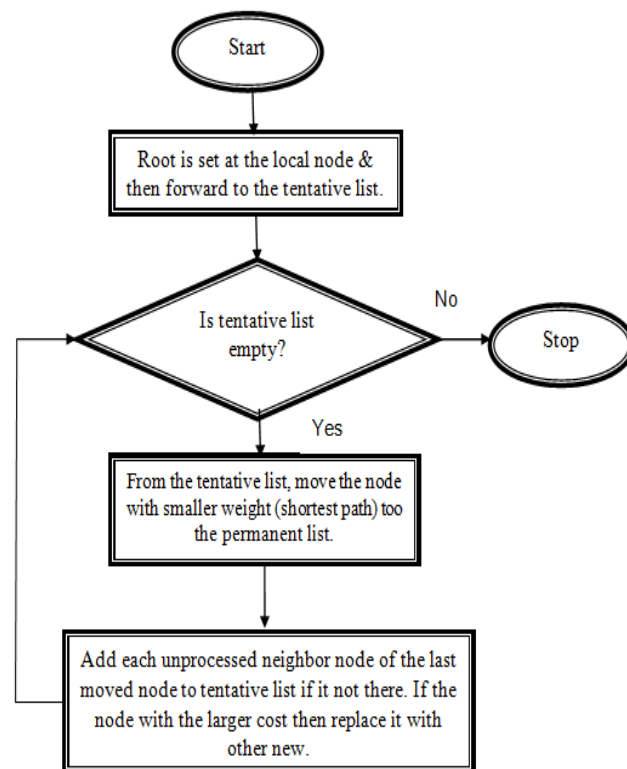
2) Initialize Min Heap with first vertex as root (the key value assigned to first vertex is 0). The key value assigned to all other vertices is INF (infinite).

3) While Min Heap is not empty, do following

.....a) Extract the min value node from Min Heap. Let the extracted vertex be u .

.....b) For every adjacent vertex v of u , check if v is in Min Heap (not yet included in MST). If v is in Min Heap and its key value is more than weight of $u-v$, then update the key value of v as weight of $u-v$

Dijkstra's Algorithm for Shortest Distance between two nodes



```

function Dijkstra(Graph, source):
  for each vertex v in Graph;
    dist[v] := infinity
    previous[v] := undefined
  dist[source] := 0
  Q := the set of all nodes in Graph
  while Q is not empty:
    u = node with smallest dist[]
    remove u from Q
    for each neighbor v of u:
      alt := dist[u] + dist
      between(u, v)
      if alt < dist[v]    13:
        dist[v] := alt
        previous[v] := u
  return previous[]
  
```

Functions Related to Multi list:

Sequential Searching: To search for an item in the multi list, first look for its parent category and then search for that item itself.

Deleting An Item: Deleting the item can be directly done by simply decreasing the quantity attribute of that particular item class. The Complexity is the same as that of sequential Searching.

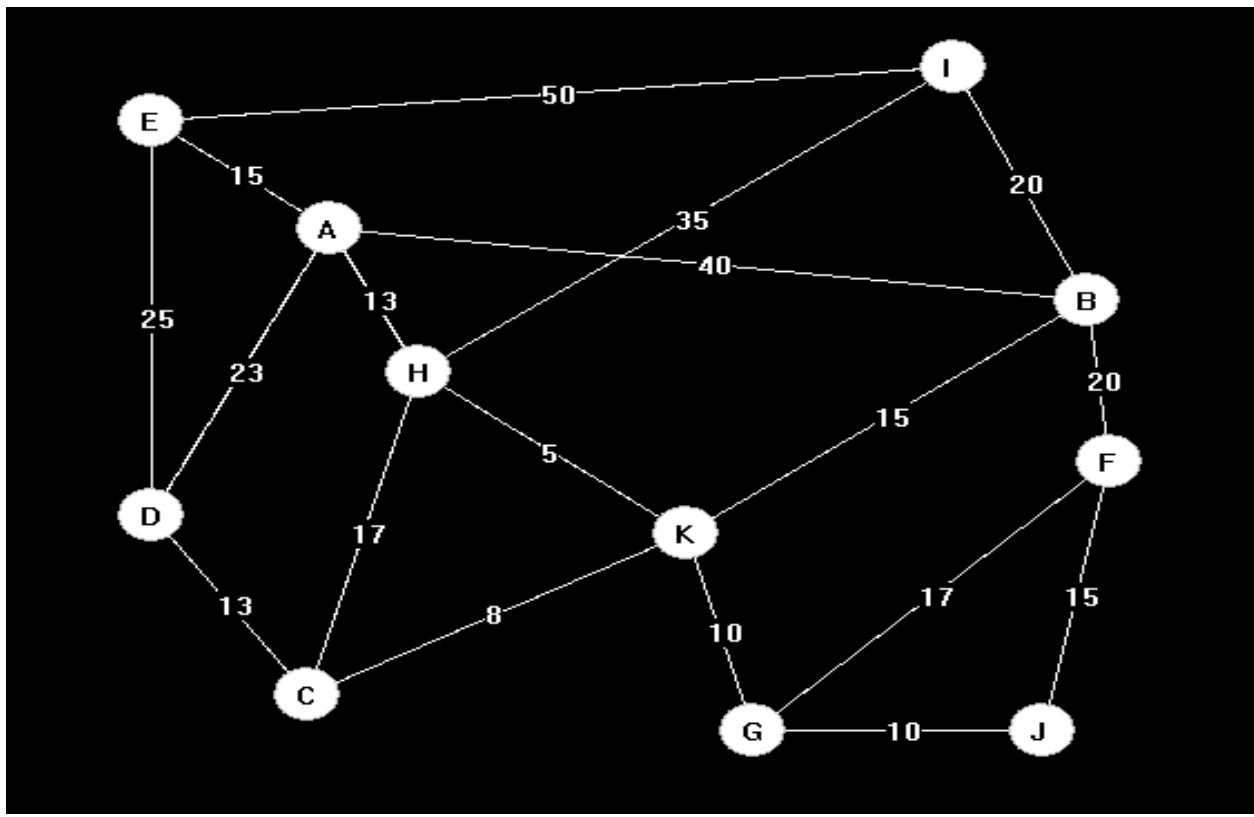
Adding An Item: Adding an Item in the stock is directly done by creating a new item node in the corresponding category or by simply increasing the count of the already existing item.

Make Shipment: The wholesaler needs to send the shipment to the intended nodes. With the help of the multi list, he chooses the item from the multi list and then searches for path with the help of dijkstra algorithm.

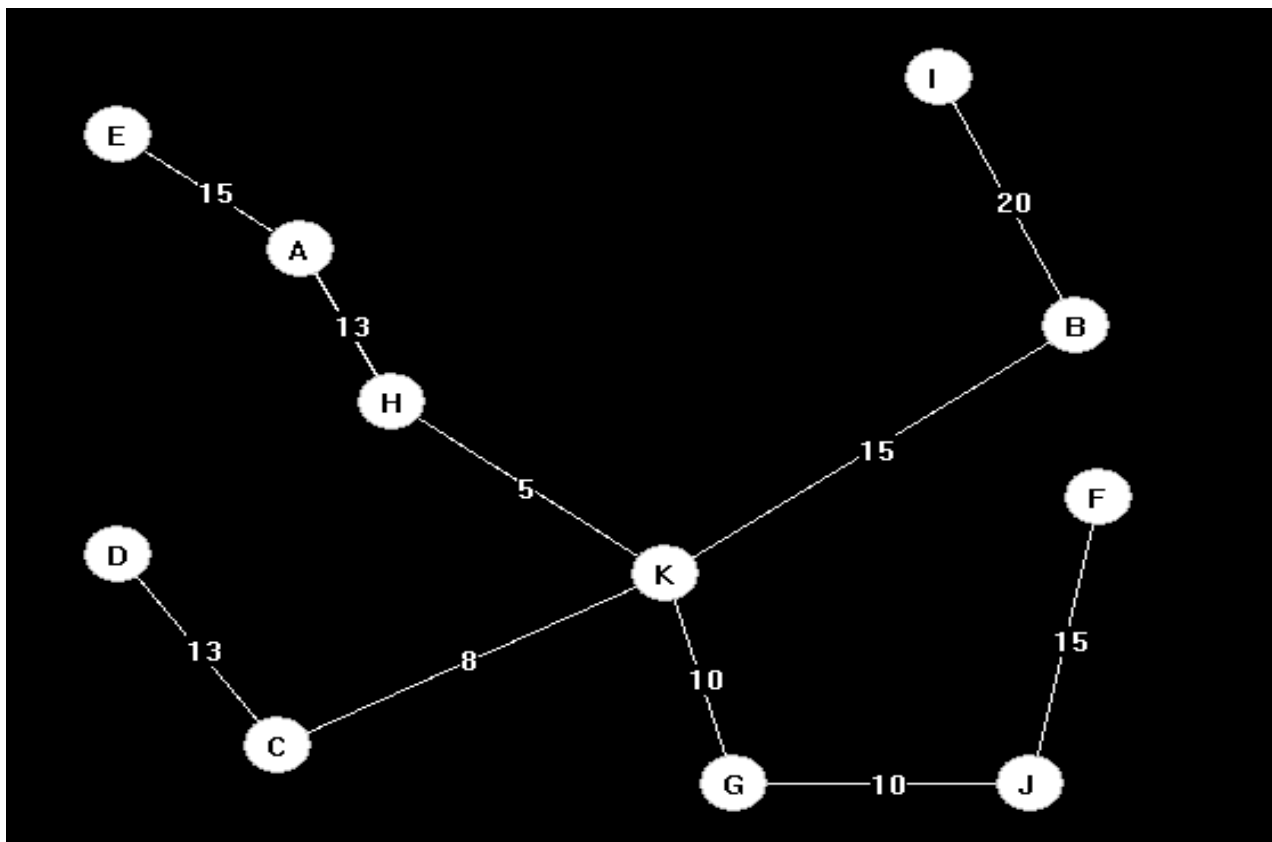
Screenshots

```
*****
*          ---<  MANAGER ACCESS OF THE SHOP  >---          *
*                                                                *
*                  DESCRIPTION                                *
*                                                                *
*      The access program includes many features and          *
*      the manager has access to many functions              *
*          Choose the functionality                            *
*                                                                *
*      (1) See City Map                                       *
*                                                                *
*      (2) Check Stock                                        *
*                                                                *
*      (3) Add Items to the Stock                             *
*                                                                *
*      (4) Make a Shipment                                    *
*                                                                *
*      Please Enter Your Choice Here                          *
*                                                                *
*****
```

1 Main Screen



2 City Map of Retail Shops



3 The Minimum Spanning Tree

Cadbury	FerreroRocher	Nestle	Lindt	Hershey
Item : Bournville Quantity : 1500 Price : 150	Item : GiftPack Quantity : 800 Price : 475	Item : Kitkat Quantity : 1000 Price : 10	Item : ExcellenceBar Quantity : 1400 Price : 270	Item : GiftPack Quantity : 500 Price : 350
Item : DairyMilk Quantity : 1200 Price : 10		Item : MilkyBar Quantity : 1500 Price : 10	Item : Lindor Quantity : 800 Price : 150	
Item : DairyMilkSilk Quantity : 1000 Price : 200		Item : BarOne Quantity : 1000 Price : 20		
Item : DairyMilkCrackle Quantity : 900 Price : 40				
Press any key to continue . . .				

4 Multi List Display

```

Total Distance= 33
Path:-
  Distributor
  |
  \ \ /
  Balaji_General_Store
  |
  \ \ /
  Gupta_Confectionery
  |
  \ \ /
  All_in_One_General_Store _

```

5 Path for the Required Shop

Group Member Wise Task Distribution

Utsav Gupta and Rajat Kumar Garg: Implementation and Algorithms related to Graph

Rohan Jain and Hardik Bhardwaj: Implementations and Algorithms related to Multi list

Learning Outcomes

The Implementation of this project led to:

1. Better Understanding of Graphs and related Algorithms
2. Better Understanding of Multi list Implementation
3. Variations In Dijkstra's Algorithm
4. Variations In Prim's Minimum Spanning Tree Algorithm