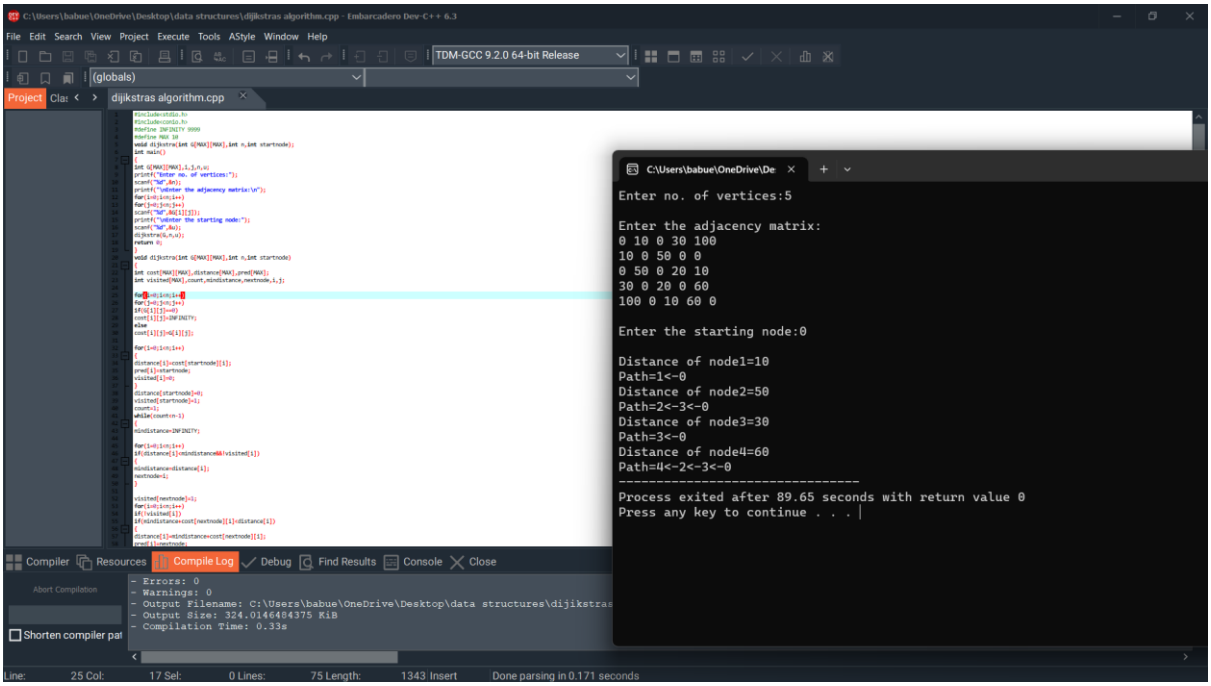
DATA STRUCTURES

1) Write a c program to implement single source shortest algorithm (Dijistra's)?

```
#include<stdio.h>
#include<conio.h>
#define INFINITY 9999
#define MAX 10
void dijkstra(int G[MAX][MAX],int n,int startnode);
int main()
{
int G[MAX][MAX],i,j,n,u;
printf("Enter no. of vertices:");
scanf("%d",&n);
printf("\nEnter the adjacency matrix:\n");
for(i=0;i<n;i++)
for(j=0;j<n;j++)
scanf("%d",&G[i][j]);
printf("\nEnter the starting node:");
scanf("%d",&u);
dijkstra(G,n,u);
return 0;
}
void dijkstra(int G[MAX][MAX],int n,int startnode)
{
int cost[MAX][MAX],distance[MAX],pred[MAX];
int visited[MAX],count,mindistance,nextnode,i,j;

for(i=0;i<n;i++)
for(j=0;j<n;j++)
if(G[i][j]==0)
cost[i][j]=INFINITY;
else
cost[i][j]=G[i][j];

for(i=0;i<n;i++)
{
distance[i]=cost[startnode][i];
pred[i]=startnode;
visited[i]=0;
}
distance[startnode]=0;
visited[startnode]=1;
count=1;
while(count<n-1)
{
```

```
mindistance=INFINITY;

for(i=0;i<n;i++)
if(distance[i]<mindistance&&!visited[i])
{
mindistance=distance[i];
nextnode=i;
}

visited[nextnode]=1;
for(i=0;i<n;i++)
if(!visited[i])
if(mindistance+cost[nextnode][i]<distance[i])
{
distance[i]=mindistance+cost[nextnode][i];
pred[i]=nextnode;
}
count++;
}

for(i=0;i<n;i++)
if(i!=startnode)
{
printf("\nDistance of node%d=%d",i,distance[i]);
printf("\nPath=%d",i);
j=i;
do
{
j=pred[j];
printf("<-%d",j);
}while(j!=startnode);
}
}
```

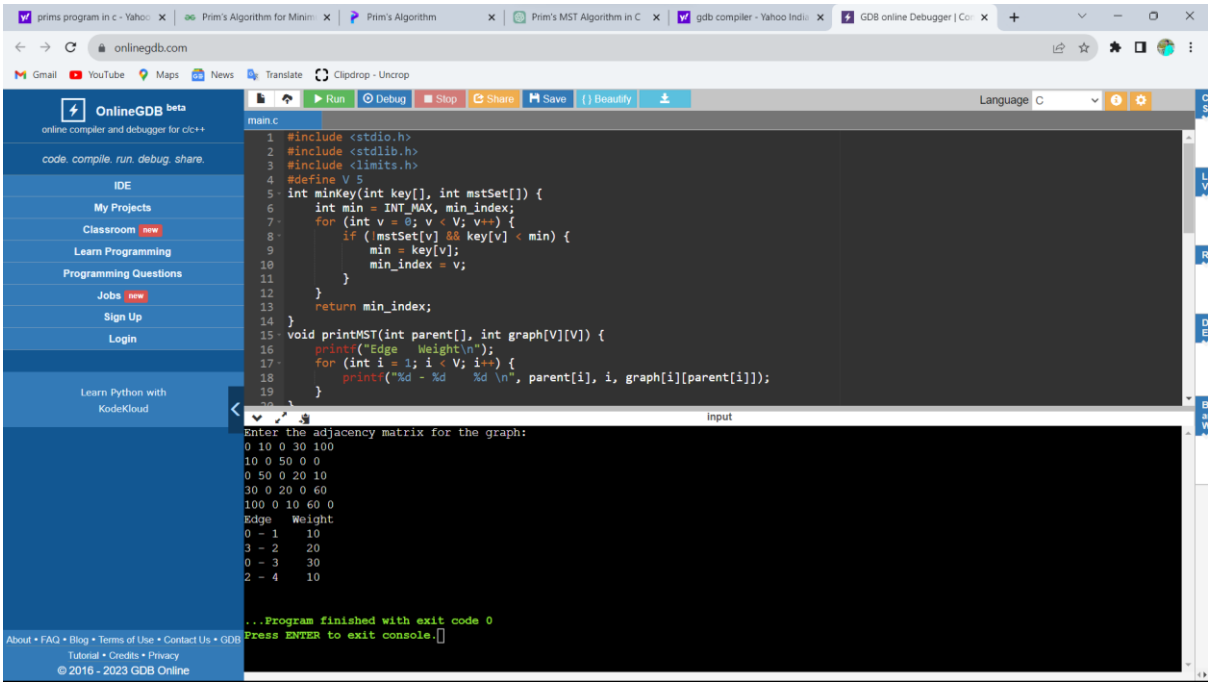

C:\Users\babue\OneDrive\Desktop\data structures\dijikstras algorithm.cpp - Embarcadero Dev-C++ 6.3
File Edit Search View Project Execute Tools AStyle Window Help
TDM-GCC 9.2.0 64-bit Release
(globals)
Project
dijikstras algorithm.cpp
C:\Users\babue\OneDrive\De
Enter no. of vertices:5
Enter the adjacency matrix:
0 10 0 30 100
10 0 50 0 0
0 50 0 20 10
30 0 20 0 60
100 0 10 60 0
Enter the starting node:0
Distance of node1=10
Path=1<-0
Distance of node2=50
Path=2<-3<-0
Distance of node3=30
Path=3<-0
Distance of node4=60
Path=4<-2<-3<-0
Process exited after 89.65 seconds with return value 0
Press any key to continue . . .
Compiler
Resources
Compile Log
Debug
Find Results
Console
Close
Abort Compilation
Shorten compiler pat
- Errors: 0
- Warnings: 0
- Output Filename: C:\Users\babue\OneDrive\Desktop\data structures\dijikstras
- Output Size: 324.0146484375 KiB
- Compilation Time: 0.33s
Line:
25 Col:
17 Sel:
0 Lines:
75 Length:
1343 Insert
Done parsing in 0.171 seconds

2) Write a c program to implement minimum spanning tree from prim's algorithm?

Code:

```
#include <stdio.h>
#include <stdlib.h>
#include <limits.h>
#define V 5
int minKey(int key[], int mstSet[]) {
   int min = INT_MAX, min_index;
   for (int v = 0; v < V; v++) {
      if (!mstSet[v] && key[v] < min) {
         min = key[v];
         min_index = v;
      }
   }
   return min_index;
}
void printMST(int parent[], int graph[V][V]) {
   printf("Edge   Weight\n");
   for (int i = 1; i < V; i++) {
      printf("%d - %d    %d \n", parent[i], i, graph[i][parent[i]]);
   }
}
void primMST(int graph[V][V]) {
   int parent[V];
   int key[V];
   int mstSet[V];
   for (int i = 0; i < V; i++) {
      key[i] = INT_MAX;
      mstSet[i] = 0;
   }
   key[0] = 0;
   parent[0] = -1;
   for (int count = 0; count < V - 1; count++) {
      int u = minKey(key, mstSet);
      mstSet[u] = 1;
      for (int v = 0; v < V; v++) {
         if (graph[u][v] && !mstSet[v] && graph[u][v] < key[v]) {
            parent[v] = u;
            key[v] = graph[u][v];
         }
      }
   }
   printMST(parent, graph);
}
int main() {
   int graph[V][V];
   printf("Enter the adjacency matrix for the graph:\n");
   for (int i = 0; i < V; i++) {
```

```
        for (int j = 0; j < V; j++) {
            scanf("%d", &graph[i][j]);
        }
    }
    primMST(graph);
    return 0;
}
```

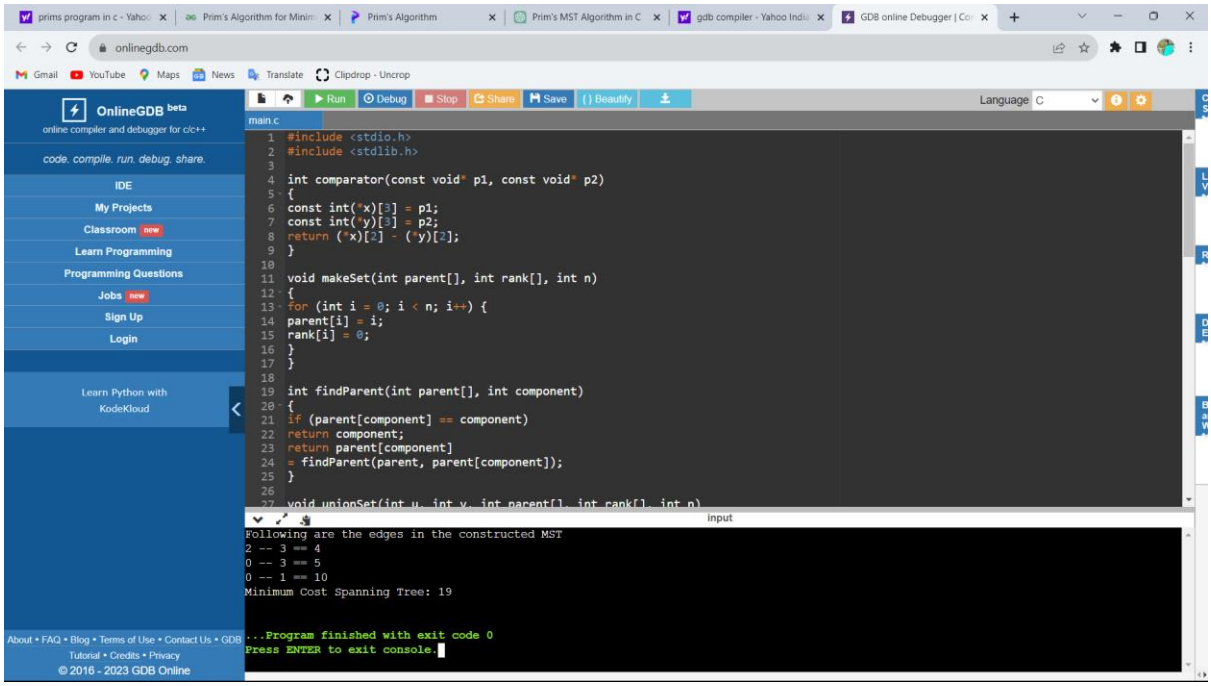


3) Write a c program to implement Kruskal's algorithm?

Code:

```
#include <stdio.h>
#include <stdlib.h>

int comparator(const void* p1, const void* p2)
{
const int(*x)[3] = p1;
const int(*y)[3] = p2;
return (*x)[2] - (*y)[2];
}

void makeSet(int parent[], int rank[], int n)
{
for (int i = 0; i < n; i++) {
parent[i] = i;
rank[i] = 0;
}
}

int findParent(int parent[], int component)
{
if (parent[component] == component)
return component;
return parent[component]
= findParent(parent, parent[component]);
}

void unionSet(int u, int v, int parent[], int rank[], int n)
{

u = findParent(parent, u);
v = findParent(parent, v);
if (rank[u] < rank[v]) {
parent[u] = v;
}
else if (rank[u] > rank[v]) {
parent[v] = u;
}
else {
parent[v] = u;

rank[u]++;
}
}

void kruskalAlgo(int n, int edge[n][3])
{
```

```
qsort(edge, n, sizeof(edge[0]), comparator);
int parent[n];
int rank[n];

makeSet(parent, rank, n);

int minCost = 0;
printf(
"Following are the edges in the constructed MST\n");
for (int i = 0; i < n; i++) {
int v1 = findParent(parent, edge[i][0]);
int v2 = findParent(parent, edge[i][1]);
int wt = edge[i][2];

if (v1 != v2) {
unionSet(v1, v2, parent, rank, n);
minCost += wt;
printf("%d -- %d == %d\n", edge[i][0],
edge[i][1], wt);
}
}
printf("Minimum Cost Spanning Tree: %d\n", minCost);
}

int main()
{
int edge[5][3] = { { 0, 1, 10 },
{ 0, 2, 6 },
{ 0, 3, 5 },
{ 1, 3, 15 },
{ 2, 3, 4 } };
kruskalAlgo(5, edge);
return 0;
}
```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Language C
main.c
#include <stdio.h>
#include <stdlib.h>
int comparator(const void* p1, const void* p2)
{
const int(*x)[3] = p1;
const int(*y)[3] = p2;
return (*x)[2] - (*y)[2];
}
void makeSet(int parent[], int rank[], int n)
{
for (int i = 0; i < n; i++) {
parent[i] = i;
rank[i] = 0;
}
}
int findParent(int parent[], int component)
{
if (parent[component] == component)
return component;
return parent[component]
= findParent(parent, parent[component]);
}
void unionSet(int u, int v, int parent[], int rank[], int n)
input
Following are the edges in the constructed MST
2 -- 3 == 4
0 -- 3 == 5
0 -- 1 == 10
Minimum Cost Spanning Tree: 19
...Program finished with exit code 0
Press ENTER to exit console.

4) Write a c program to implement the graph traversals?

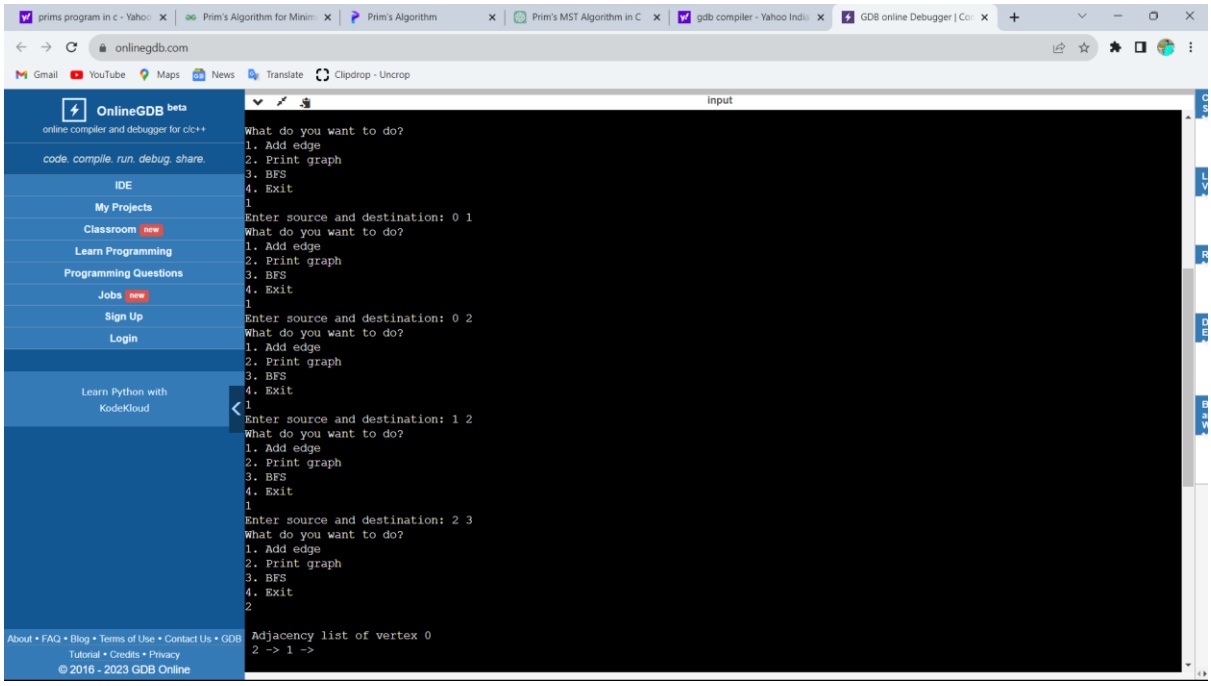
Code:

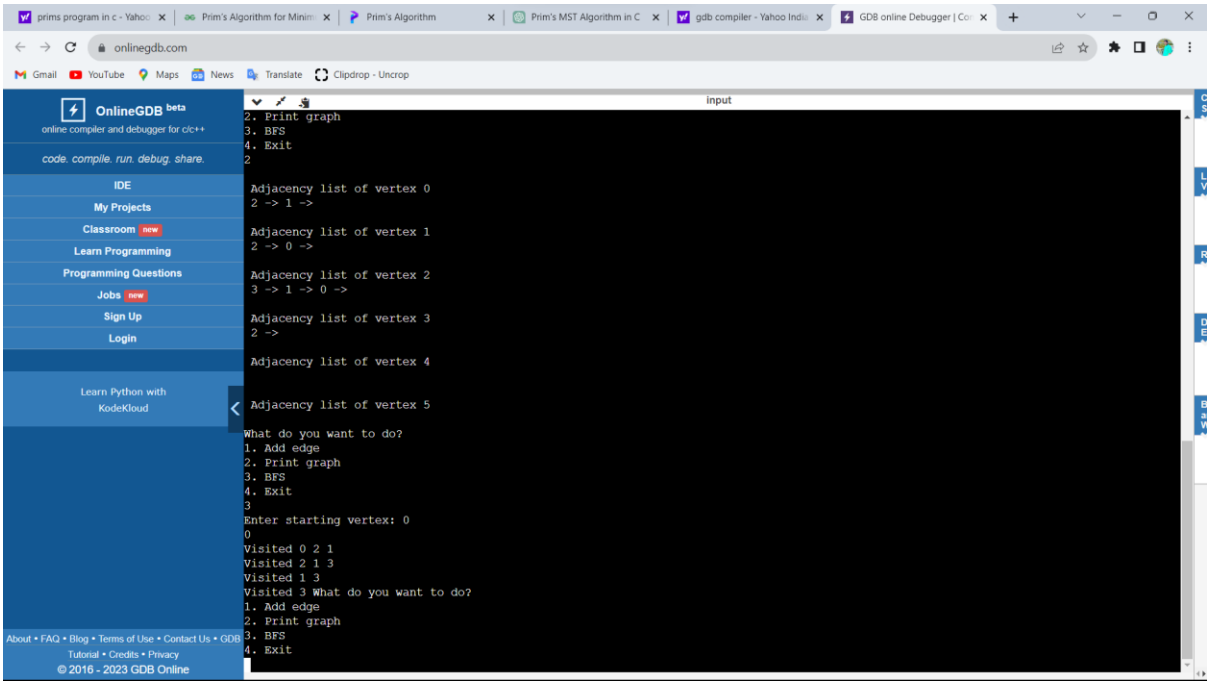
```
#include <stdio.h>
#include <stdlib.h>
struct node
{
int vertex;
struct node *next;
};
struct node *createNode(int);
struct Graph
{
int numVertices;
struct node **adjLists;
int *visited;
};
struct Graph *createGraph(int vertices)
{
struct Graph *graph = malloc(sizeof(struct Graph));
graph->numVertices = vertices;
graph->adjLists = malloc(vertices * sizeof(struct node *));
graph->visited = malloc(vertices * sizeof(int));
int i;
for (i = 0; i < vertices; i++)
{
graph->adjLists[i] = NULL;
graph->visited[i] = 0;
}
return graph;
}
void addEdge(struct Graph *graph, int src, int dest)
{
struct node *newNode = createNode(dest);
newNode->next = graph->adjLists[src];
graph->adjLists[src] = newNode;
newNode = createNode(src);
newNode->next = graph->adjLists[dest];
graph->adjLists[dest] = newNode;
}
struct node *createNode(int v)
{
struct node *newNode = malloc(sizeof(struct node));
newNode->vertex = v;
newNode->next = NULL;
return newNode;
}
void printGraph(struct Graph *graph)
{
```

```
int v;
for (v = 0; v < graph->numVertices; v++)
{
struct node *temp = graph->adjLists[v];
printf("\n Adjacency list of vertex %d\n ", v);
while (temp)
{
printf("%d -> ", temp->vertex);
temp = temp->next;
}
printf("\n");
}
}
void bfs(struct Graph *graph, int startVertex)
{
struct node *queue = NULL;
graph->visited[startVertex] = 1;
enqueue(&queue, startVertex);
while (!isEmpty(queue))
{
printQueue(queue);
int currentVertex = dequeue(&queue);
printf("Visited %d ", currentVertex);
struct node *temp = graph->adjLists[currentVertex];
while (temp)
{
int adjVertex = temp->vertex;
if (graph->visited[adjVertex] == 0)
{
graph->visited[adjVertex] = 1;
enqueue(&queue, adjVertex);
}
temp = temp->next;
}
}
}
int isEmpty(struct node *queue)
{
return queue == NULL;
}
void enqueue(struct node **queue, int value)
{
struct node *newNode = createNode(value);
if (isEmpty(*queue))
{
*queue = newNode;
}
else
```

```
{
struct node *temp = *queue;
while (temp->next)
{
temp = temp->next;
}
temp->next = newNode;
}
}
int dequeue(struct node **queue)
{
int nodeData = (*queue)->vertex;
struct node *temp = *queue;
*queue = (*queue)->next;
free(temp);
return nodeData;
}
void printQueue(struct node *queue)
{
while (queue)
{
printf("%d ", queue->vertex);
queue = queue->next;
}
printf("\n");
}
int main(void)
{
struct Graph *graph = createGraph(6);
printf("\nWhat do you want to do?\n");
printf("1. Add edge\n");
printf("2. Print graph\n");
printf("3. BFS\n");
printf("4. Exit\n");
int choice;
scanf("%d", &choice);
while (choice != 4)
{
if (choice == 1)
{
int src, dest;
printf("Enter source and destination: ");
scanf("%d %d", &src, &dest);
addEdge(graph, src, dest);
}
else if (choice == 2)
{
printGraph(graph);
```

```
}
else if (choice == 3)
{
int startVertex;
printf("Enter starting vertex: ");
scanf("%d", &startVertex);
bfs(graph, startVertex);
}
else
{
printf("Invalid choice\n");
}
printf("What do you want to do?\n");
printf("1. Add edge\n");
printf("2. Print graph\n");
printf("3. BFS\n");
printf("4. Exit\n");
scanf("%d", &choice);
}
return 0;
}
```

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input
2. Print graph
3. BFS
4. Exit
2
Adjacency list of vertex 0
2 -> 1 ->
Adjacency list of vertex 1
2 -> 0 ->
Adjacency list of vertex 2
3 -> 1 -> 0 ->
Adjacency list of vertex 3
2 ->
Adjacency list of vertex 4
Adjacency list of vertex 5
What do you want to do?
1. Add edge
2. Print graph
3. BFS
4. Exit
3
Enter starting vertex: 0
0
Visited 0 2 1
Visited 2 1 3
Visited 1 3
Visited 3 What do you want to do?
1. Add edge
2. Print graph
3. BFS
4. Exit