Practical No. A1

Que :- Implement Depth First Search algorithm and Breadth First algorithm. Use an undirected graph and develop a recursive algorithm for searching all the vertices of the graph or tree data structure.

Solution :-

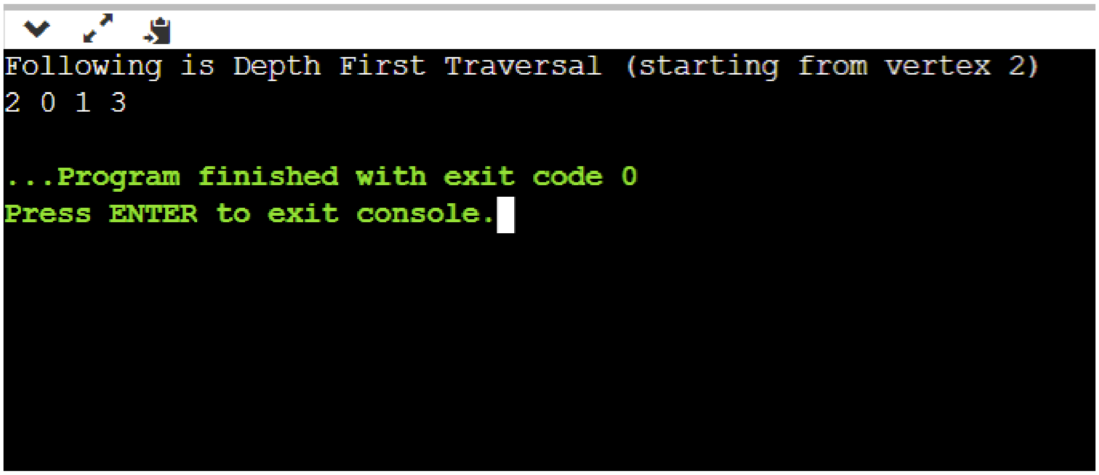
1. Depth First search :

Input =>

```
#include <iostream>
#include <map>
#include <list>

using namespace std;

class Graph {

        public:
                map<int, bool> visited;
                map<int, list<int> > adj;
                void addEdge(int v, int w);
                void DFS(int v);
};

void Graph::addEdge(int v, int w) {
        adj[v].push_back(w);
}

void Graph::DFS(int v) {
        visited[v] = true;
        cout << v << " ";
        list<int>::iterator i;
        for (i = adj[v].begin(); i != adj[v].end(); ++i)
                if (!visited[*i])
                        DFS(*i);
}
```

```
int main() {
	Graph g;
	g.addEdge(0, 1);
	g.addEdge(0, 2);
	g.addEdge(1, 2);
	g.addEdge(2, 0);
	g.addEdge(2, 3);
	g.addEdge(3, 3);
	cout << "Following is Depth First Traversal (starting from vertex 2) \n";
	g.DFS(2);
	return 0;
}
```

Output =>



```
Following is Depth First Traversal (starting from vertex 2)
2 0 1 3

...Program finished with exit code 0
Press ENTER to exit console.
```

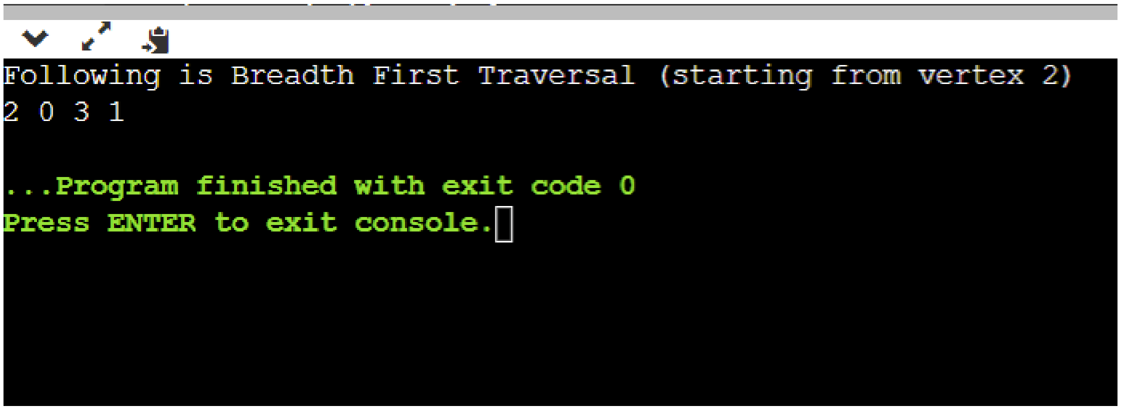
2. Breadth First Search :

Input =>

```
#include<iostream>
#include <list>
using namespace std;

class Graph {
   int V;
   list < int >*adj;

   public:
      Graph (int V);
      void addEdge (int v, int w);
      void BFS (int s);
};

Graph::Graph (int V) {
   this->V = V;
   adj = new list < int >[V];
}

void Graph::addEdge (int v, int w) {
   adj[v].push_back (w);
}
```

```
void Graph::BFS (int s) {
    bool * visited = new bool[V];
    for (int i = 0; i < V; i++)
        visited[i] = false;
    list < int >queue;
    visited[s] = true;
    queue.push_back (s);
    list < int >::iterator i;
    while (!queue.empty ()) {
        s = queue.front ();
        cout << s << " ";
        queue.pop_front ();
        for (i = adj[s].begin (); i != adj[s].end (); ++i) {
            if (!visited[*i]) {
                visited[*i] = true;
                queue.push_back (*i);
            }
        }
    }
}

int main () {
    Graph g (4);
    g.addEdge (0, 1);
    g.addEdge (0, 2);
    g.addEdge (1, 2);
    g.addEdge (2, 0);
    g.addEdge (2, 3);
    g.addEdge (3, 3);
    cout << "Following is Breadth First Traversal (starting from vertex 2) \n";
    g.BFS (2);
    return 0;
}
```

Output =>



```
Following is Breadth First Traversal (starting from vertex 2)
2 0 3 1

...Program finished with exit code 0
Press ENTER to exit console.
```

Practical No. A2

Que :- Implement A star Algorithm for any game search problem.

Solution :-

Input =>

```
#include <bits/stdc++.h>
using namespace std;

#define ROW 9
#define COL 10

typedef pair < int, int > Pair;
typedef pair < double, pair < int, int >> pPair;

struct cell {
   int parent_i, parent_j;
   double f, g, h;
};

bool isValid (int row, int col) {
   return (row >= 0) && (row < ROW) && (col >= 0) && (col < COL);
}

bool isUnBlocked (int grid[][COL], int row, int col) {
   if (grid[row][col] == 1)
```

```
        return (true);
    else
        return (false);
}



bool isDestination (int row, int col, Pair dest) {
    if (row == dest.first && col == dest.second)
        return (true);
    else
        return (false);
}



double calculateHValue (int row, int col, Pair dest) {
    return ((double) sqrt ((row - dest.first) * (row - dest.first)+(col - dest.second) * (col - dest.second)));
}


void tracePath (cell cellDetails[][COL], Pair dest) {
    printf ("\nThe Path is ");
    int row = dest.first;
    int col = dest.second;
    stack < Pair > Path;
    while (!(cellDetails[row][col].parent_i == row && cellDetails[row][col].parent_j == col)) {
        Path.push (make_pair (row, col));
        int temp_row = cellDetails[row][col].parent_i;
        int temp_col = cellDetails[row][col].parent_j;
        row = temp_row;
        col = temp_col;
    }
    Path.push (make_pair (row, col));
    while (!Path.empty ()) {
        pair < int, int >p = Path.top ();
        Path.pop ();
        printf ("-> (%d,%d) ", p.first, p.second);
    }
    return;
}



void aStarSearch (int grid[][COL], Pair src, Pair dest) {
    if (isValid (src.first, src.second) == false) {
        printf ("Source is invalid\n");
        return;
    }
    if (isValid (dest.first, dest.second) == false) {
        printf ("Destination is invalid\n");
        return;
    }
    if (isUnBlocked (grid, src.first, src.second) == false || isUnBlocked (grid, dest.first, dest.second) == false) {
        printf ("Source or the destination is blocked\n");
        return;
    }
    if (isDestination (src.first, src.second, dest) == true) {
        printf ("We are already at the destination\n");
        return;
```

```
}
bool closedList[ROW][COL];
memset (closedList, false, sizeof (closedList));
cell cellDetails[ROW][COL];
int i, j;
for (i = 0; i < ROW; i++) {
    for (j = 0; j < COL; j++) {
    cellDetails[i][j].f = FLT_MAX;
    cellDetails[i][j].g = FLT_MAX;
    cellDetails[i][j].h = FLT_MAX;
    cellDetails[i][j].parent_i = -1;
    cellDetails[i][j].parent_j = -1;
    }
}
i = src.first, j = src.second;
cellDetails[i][j].f = 0.0;
cellDetails[i][j].g = 0.0;
cellDetails[i][j].h = 0.0;
cellDetails[i][j].parent_i = i;
cellDetails[i][j].parent_j = j;
set < pPair > openList;
openList.insert (make_pair (0.0, make_pair (i, j)));
bool foundDest = false;
while (!openList.empty ()) {
    pPair p = *openList.begin ();
    openList.erase (openList.begin ());
    i = p.second.first;
    j = p.second.second;
```

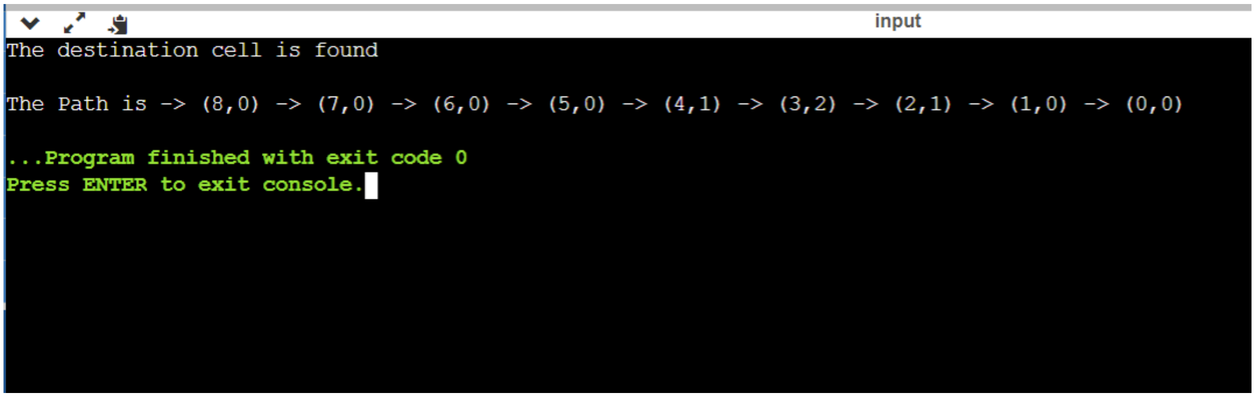
```
closedList[i][j] = true;
double gNew, hNew, fNew;
if (isValid (i - 1, j) == true) {
    if (isDestination (i - 1, j, dest) == true) {
        cellDetails[i - 1][j].parent_i = i;
        cellDetails[i - 1][j].parent_j = j;
        printf ("The destination cell is found\n");
        tracePath (cellDetails, dest);
        foundDest = true;
        return;
    }
        else if (closedList[i - 1][j] == false && isUnBlocked (grid, i - 1, j) == true) {
        gNew = cellDetails[i][j].g + 1.0;
        hNew = calculateHValue (i - 1, j, dest);
        fNew = gNew + hNew;
        if (cellDetails[i - 1][j].f == FLT_MAX || cellDetails[i - 1][j].f > fNew) {
            openList.insert (make_pair (
            fNew, make_pair (i - 1, j)));
            cellDetails[i - 1][j].f = fNew;
            cellDetails[i - 1][j].g = gNew;
            cellDetails[i - 1][j].h = hNew;
            cellDetails[i - 1][j].parent_i = i;
            cellDetails[i - 1][j].parent_j = j;
        }
    }
}
if (isValid (i + 1, j) == true) {
    if (isDestination (i + 1, j, dest) == true) {
        cellDetails[i + 1][j].parent_i = i;
        cellDetails[i + 1][j].parent_j = j;
        printf ("The destination cell is found\n");
        tracePath (cellDetails, dest);
        foundDest = true;
        return;
    }
    else if (closedList[i + 1][j] == false && isUnBlocked (grid, i + 1, j) == true) {
        gNew = cellDetails[i][j].g + 1.0;
        hNew = calculateHValue (i + 1, j, dest);
        fNew = gNew + hNew;
        if (cellDetails[i + 1][j].f == FLT_MAX || cellDetails[i + 1][j].f > fNew) {
            openList.insert (make_pair(fNew, make_pair (i + 1, j)));
            cellDetails[i + 1][j].f = fNew;
            cellDetails[i + 1][j].g = gNew;
            cellDetails[i + 1][j].h = hNew;
            cellDetails[i + 1][j].parent_i = i;
            cellDetails[i + 1][j].parent_j = j;
        }
    }

}
if (isValid (i, j + 1) == true) {
    if (isDestination (i, j + 1, dest) == true) {
        cellDetails[i][j + 1].parent_i = i;
        cellDetails[i][j + 1].parent_j = j;
        printf ("The destination cell is found\n");
        tracePath (cellDetails, dest);
        foundDest = true;
        return;
    }
    else if (closedList[i][j + 1] == false && isUnBlocked (grid, i, j + 1) == true) {
        gNew = cellDetails[i][j].g + 1.0;
        hNew = calculateHValue (i, j + 1, dest);
        fNew = gNew + hNew;
        if (cellDetails[i][j + 1].f == FLT_MAX || cellDetails[i][j + 1].f > fNew) {
            openList.insert (make_pair(fNew, make_pair (i, j + 1)));
            cellDetails[i][j + 1].f = fNew;
            cellDetails[i][j + 1].g = gNew;
            cellDetails[i][j + 1].h = hNew;
            cellDetails[i][j + 1].parent_i = i;
            cellDetails[i][j + 1].parent_j = j;
        }
    }
}
if (isValid(i, j - 1) == true)
{
    if (isDestination(i, j - 1, dest) == true)
    {
                cellDetails[i][j - 1].parent_i = i;
                cellDetails[i][j - 1].parent_j = j;
                printf("The destination cell is found\n");
                tracePath(cellDetails, dest);
                foundDest = true;
                return;
    }
    else if (closedList[i][j - 1] == false && isUnBlocked(grid, i, j - 1) == true)
    {
                gNew = cellDetails[i][j].g + 1.0;
                hNew = calculateHValue(i, j - 1, dest);
                fNew = gNew + hNew;
                if (cellDetails[i][j - 1].f == FLT_MAX || cellDetails[i][j - 1].f > fNew)
                {
                        openList.insert(make_pair(fNew, make_pair(i, j - 1)));
                        cellDetails[i][j - 1].f = fNew;
                        cellDetails[i][j - 1].g = gNew;
                        cellDetails[i][j - 1].h = hNew;
                        cellDetails[i][j - 1].parent_i = i;
                        cellDetails[i][j - 1].parent_j = j;
                }
    }
}
if (isValid(i - 1, j + 1) == true)
{
    if (isDestination(i - 1, j + 1, dest) == true)
    {
                cellDetails[i - 1][j + 1].parent_i = i;
                cellDetails[i - 1][j + 1].parent_j = j;
                printf("The destination cell is found\n");
                tracePath(cellDetails, dest);
                foundDest = true;
                return;
    }
    else if (closedList[i - 1][j + 1] == false && isUnBlocked(grid, i - 1, j + 1) == true)
```

```
   {
            gNew = cellDetails[i][j].g + 1.414;
            hNew = calculateHValue(i - 1, j + 1, dest);
            fNew = gNew + hNew;
            if (cellDetails[i - 1][j + 1].f == FLT_MAX || cellDetails[i - 1][j + 1].f > fNew)
            {
                     openList.insert(make_pair(fNew, make_pair(i - 1, j + 1)));
                     cellDetails[i - 1][j + 1].f = fNew;
                     cellDetails[i - 1][j + 1].g = gNew;
                     cellDetails[i - 1][j + 1].h = hNew;
                     cellDetails[i - 1][j + 1].parent_i = i;
                     cellDetails[i - 1][j + 1].parent_j = j;
            }
   }
}
if (isValid(i - 1, j - 1) == true)
{
   if (isDestination(i - 1, j - 1, dest) == true)
   {
            cellDetails[i - 1][j - 1].parent_i = i;
            cellDetails[i - 1][j - 1].parent_j = j;
            printf("The destination cell is found\n");
            tracePath(cellDetails, dest);
            foundDest = true;
            return;
   }
   else if (closedList[i - 1][j - 1] == false && isUnBlocked(grid, i - 1, j - 1) == true)
   {
```

```
            gNew = cellDetails[i][j].g + 1.414;
            hNew = calculateHValue(i - 1, j - 1, dest);
            fNew = gNew + hNew;
            if (cellDetails[i - 1][j - 1].f == FLT_MAX || cellDetails[i - 1][j - 1].f > fNew)
            {
                    openList.insert(make_pair(fNew, make_pair(i - 1, j - 1)));
                    cellDetails[i - 1][j - 1].f = fNew;
                    cellDetails[i - 1][j - 1].g = gNew;
                    cellDetails[i - 1][j - 1].h = hNew;
                    cellDetails[i - 1][j - 1].parent_i = i;
                    cellDetails[i - 1][j - 1].parent_j = j;
            }
    }
}
if (isValid(i + 1, j + 1) == true)
{
    if (isDestination(i + 1, j + 1, dest) == true)
    {
            cellDetails[i + 1][j + 1].parent_i = i;
            cellDetails[i + 1][j + 1].parent_j = j;
            printf("The destination cell is found\n");
            tracePath(cellDetails, dest);
            foundDest = true;
            return;
    }
    else if (closedList[i + 1][j + 1] == false && isUnBlocked(grid, i + 1, j + 1) == true)
    {
            gNew = cellDetails[i][j].g + 1.414;
            hNew = calculateHValue(i + 1, j + 1, dest);
            fNew = gNew + hNew;
            if (cellDetails[i + 1][j + 1].f == FLT_MAX || cellDetails[i + 1][j + 1].f > fNew)
            {
                    openList.insert(make_pair(fNew, make_pair(i + 1, j + 1)));
                    cellDetails[i + 1][j + 1].f = fNew;
                    cellDetails[i + 1][j + 1].g = gNew;
                    cellDetails[i + 1][j + 1].h = hNew;
                    cellDetails[i + 1][j + 1].parent_i = i;
                    cellDetails[i + 1][j + 1].parent_j = j;
            }
    }
}
if (isValid(i + 1, j - 1) == true)
{
    if (isDestination(i + 1, j - 1, dest) == true)
    {
            cellDetails[i + 1][j - 1].parent_i = i;
            cellDetails[i + 1][j - 1].parent_j = j;
            printf("The destination cell is found\n");
            tracePath(cellDetails, dest);
            foundDest = true;
            return;
    }
    else if (closedList[i + 1][j - 1] == false && isUnBlocked(grid, i + 1, j - 1) == true)
    {
            gNew = cellDetails[i][j].g + 1.414;
```

```
                        hNew = calculateHValue(i + 1, j - 1, dest);
                        fNew = gNew + hNew;
                        if (cellDetails[i + 1][j - 1].f == FLT_MAX || cellDetails[i + 1][j - 1].f > fNew)
                        {
                                    openList.insert(make_pair(fNew, make_pair(i + 1, j - 1)));
                                    cellDetails[i + 1][j - 1].f = fNew;
                                    cellDetails[i + 1][j - 1].g = gNew;
                                    cellDetails[i + 1][j - 1].h = hNew;
                                    cellDetails[i + 1][j - 1].parent_i = i;
                                    cellDetails[i + 1][j - 1].parent_j = j;
                        }
            }
        }
    }
    if (foundDest == false)
            printf("Failed to find the Destination Cell\n");
    return;
}

int main()
{
            int grid[ROW][COL] = {
                        { 1, 0, 1, 1, 1, 1, 0, 1, 1, 1 },
                        { 1, 1, 1, 0, 1, 1, 1, 0, 1, 1 },
                        { 1, 1, 1, 0, 1, 1, 0, 1, 0, 1 },
                        { 0, 0, 1, 0, 1, 0, 0, 0, 0, 1 },
                        { 1, 1, 1, 0, 1, 1, 1, 0, 1, 0 },
                        { 1, 0, 1, 1, 1, 1, 0, 1, 0, 0 },
                { 1, 0, 0, 0, 0, 1, 0, 0, 0, 1 },
                { 1, 0, 1, 1, 1, 1, 0, 1, 1, 1 },
                { 1, 1, 1, 0, 0, 0, 1, 0, 0, 1 }
        };
        Pair src = make_pair(8, 0);
        Pair dest = make_pair(0, 0);
        aStarSearch(grid, src, dest);
        return (0);
}
```

Output =>



```
The destination cell is found

The Path is -> (8,0) -> (7,0) -> (6,0) -> (5,0) -> (4,1) -> (3,2) -> (2,1) -> (1,0) -> (0,0)

...Program finished with exit code 0
Press ENTER to exit console.
```

Practical No. A3

Que :- Implement Greedy search algorithm for any of the following application:

Prim's Minimal Spanning Tree Algorithm

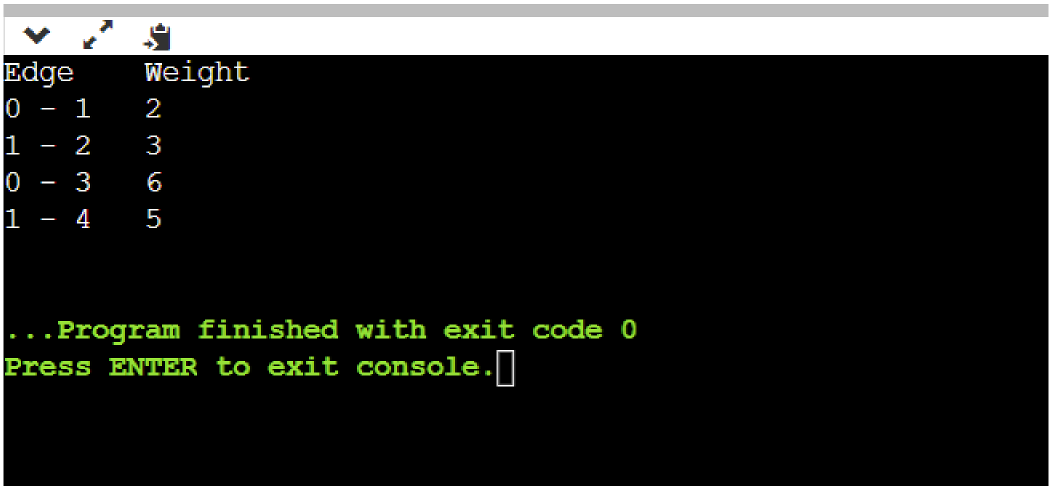
Solution :-

Input =>

```
#include <bits/stdc++.h>

using namespace std;

#define V 5

int minKey(int key[], bool mstSet[]) {
    int min = INT_MAX, min_index;
    for (int v = 0; v < V; v++)
        if (mstSet[v] == false && key[v] < min)
            min = key[v], min_index = v;
    return min_index;
}

void printMST(int parent[], int graph[V][V]) {
    cout<<"Edge \tWeight\n";
    for (int i = 1; i < V; i++)
        cout<<parent[i]<<" - "<<i<<" \t"<<graph[i][parent[i]]<<" \n";
}
```

```
void primMST(int graph[V][V]) {
    int parent[V];
    int key[V];
    bool mstSet[V];
    for (int i = 0; i < V; i++)
        key[i] = INT_MAX, mstSet[i] = false;
    key[0] = 0;
    parent[0] = -1;
    for (int count = 0; count < V - 1; count++){
        int u = minKey(key, mstSet);
        mstSet[u] = true;
        for (int v = 0; v < V; v++)
        if (graph[u][v] && mstSet[v] == false && graph[u][v] < key[v])
        parent[v] = u, key[v] = graph[u][v];
    }
    printMST(parent, graph);
}

int main() {
    int graph[V][V] = { { 0, 2, 0, 6, 0 },
                        { 2, 0, 3, 8, 5 },
                        { 0, 3, 0, 0, 7 },
                        { 6, 8, 0, 0, 9 },
                        { 0, 5, 7, 9, 0 } };
    primMST(graph);
    return 0;
}
```

Output =>



```
Edge     Weight
0 - 1    2
1 - 2    3
0 - 3    6
1 - 4    5


...Program finished with exit code 0
Press ENTER to exit console.
```

Practical No. 1

Sr. No.	**Website URL**	**Purpose of Website**	**Things liked in the website**	**Things disliked in the website**	**Overall evaluation of the website (Good/Bad)**
1	https://www.wikipedia.org/	Online Encyclopedia	Simple UI design, User Friendly	N/A	Good
2	https://www.ebay.com/	Ecommerce	Interactive, Simple design, Easy Navigation	N/A	Good
3	https://www.apple.com/in/	Ecommerce	Interactive, User Friendly	N/A	Good
4	https://arngren.net/	Ecommerce	N/A	Cluttered	Bad
5	https://www.art.yale.edu/	Educational	User Friendly	Poor Presentation, Cluttered, Unattractive	Bad

Practical No. 2

Input :-

page1.html :

```
<!DOCTYPE html>
<html>
        <head>
                <title> WT Lab 2 </title>

                <meta name="description" content="Page Description Here"/>
                <meta http-equiv="Content-Type" content="text/html"; charset="utf-8"/>
                <meta name="viewport" content="width=device-width, initial-scale=1"/>

                <style>

                body {
                        margin:0;
                        padding:0;
                        line-height: 1.5em;
                }

                /* ##### Navigation Bar ##### */

                ul {
                        list-style-type: none;
                        margin: 500;
        padding: 500;
        background-color: #000;
}

li {
        float: left;
        border-right:1px solid #bbb;
}

li:last-child {
        border-right: none;
}

li a {
        display: block;
        color: white;
        text-align: left;
        padding: 14px 120px;
        text-decoration: none;
}

li a:hover:not(.active) {
        background-color:      #808080;
}

.active {
        background-color: #0099ff;
}
```

```
   </style>

    </head>

    <body>
        <a id="home"></a>
        <table width="100%" height="60" border="0" cellspacing="5" cellpadding="5" bgcolor="#000000">
            <tr>
                <td align="left">
                    <ul style="display: inline;font face="Verdana; text-align="center";">
                        <li><a class="active" href="#home">Home</a></li>
                        <li><a href="C:\Users\OJUS\OneDrive\Desktop\   \WT\Lab\Practical 2\about Us.html" target="blank_">About Us</a></li>
                        <li><a href="#services">Services</a></li>
                        <li><a href="#clients">Clients</a></li>
                        <li><a href="#contact">Contact</a></li>
                    </ul>
                </td>
            </tr>
        </table>
        <a id="mail"></a>
        <table width="100%" height="150" border="0" cellspacing="5" cellpadding="5" bgcolor="#F0F0F0">
            <tr>
                <td align="center">
```

```
                    <table width="708" border="0" cellspacing="1"
cellpadding="1">
                        <tr>
                            <td width="400" align="left"><font
face="Verdana, Geneva, sans-serif" color="black" size="5"><strong>My
Business</strong><br>Web Page</font></td>
                            <td width="291" align="right"><font
face="Verdana, Geneva, sans-serif" color="black" size="5"><strong>Contact Us
Today!</strong><br>webdev@webdev.com</font></td>
                        </tr>
                    </table>
                </td>
            </tr>
        </table>
        <table width="100%" height="150" border="0" cellspacing="5" cellpadding="5"
bgcolor="#F0F0F0">
            <tr>
                <td align="center">
                    <table width="600" border="0" cellspacing="1"
cellpadding="1">
                        <tr>
                            <td align="center"><img
src="D:\Projects\Web Development\Downloads\Section 10 - HTML Development\Lecture 98 -
HTML Project l Image\website2.jpg" width="1000" height="500"></td>
                        </tr>
                    </table>
                </td>
            </tr>
        </table>
        <table width="100%" height="80" border="0" cellspacing="5" cellpadding="5"
bgcolor="white">
            <tr>
```

```
                <td height="70" align="center" valign="top">
                    <table width="730" border="0" cellspacing="1"
cellpadding="1" bgcolor="#FF9900">
                        <tr>
                            <td width="800" align="center"
nowrap><font face="Verdana, Geneva, sans-serif" color="white" size="6"><a
href="C:\Users\OJUS\OneDrive\Desktop\   \WT\Lab\Practical 2\page2.html"
target="blank_"><strong>Demo Web Page</strong></a></font></td>
                        </tr>
                    </table>
                </td>
            </tr>
        </table>
        <table width="100%" height="80" border="0" cellspacing="5" cellpadding="5"
bgcolor="white">
            <tr>
                <td height="70" align="center" valign="top">
                    <table width="730" border="0" cellspacing="1"
cellpadding="1">
                        <tr>
                            <td width="800" align="center"><font
face="Verdana, Geneva, sans-serif" color="black" size="6">My Company Web
Page<strong><br>Dream. Plan. Create.</strong></font></td>
                        </tr>
                    </table>
                </td>
            </tr>
        </table>
        <a id="contact"></a>
        <table width="100%" height="80" border="0" cellspacing="5" cellpadding="5"
bgcolor="white">
```

```
            <tr>
                <td height="70" align="center" valign="top">
                    <table width="730" border="0" cellspacing="1"
cellpadding="1" bgcolor="#FF9900">
                        <tr>
                            <td width="800" align="center"
nowrap><font face="Verdana, Geneva, sans-serif" color="white" size="6"><a
href="#mail"><strong>Contact Us Today!</strong></a></font></td>
                        </tr>
                    </table>
                </td>
            </tr>
        </table>
        <table width="100%" height="80" border="0" cellspacing="5" cellpadding="5"
bgcolor="white">
            <tr>
                <td width="800" align="center" nowrap valign="top"><font
face="Verdana, Geneva, sans-serif" color="black" size="5"><strong>Register for our
Newsletter:</strong></font><br>
                    <form name="contact" method="post" action="send.php">
                        <input type="text" name="email" />
                        <input type="submit" name="button"
value="Submit" />
                    </form>
                </td>
            </tr>
        </table>
        <a id="services"></a>
        <table width="100%" height="236" border="0" cellspacing="5" cellpadding="5"
bgcolor="white">
            <tr>
```

```
                <td height="70" align="center">
                    <table width="900" border="1" bordercolor="#CCCCCC"
cellspacing="1" cellpadding="1" align="center">
                        <tr>
                            <td width="300"><font face="Verdana,
Geneva, sans-serif" color="black"><strong><u>ABOUT US</u></strong></font></td>
                            <td width="300"><font face="Verdana,
Geneva, sans-serif" color="black"><strong><u>OUR VISION</u></strong></font></td>
                            <td width="300"><font face="Verdana,
Geneva, sans-serif" color="black"><strong><u>SERVICES</u></strong></font></td>
                        </tr>
                        <tr>
                            <td width="300"><font face="Verdana,
Geneva, sans-serif" color="black" size="2" >Web development company</font></td>
                            <td width="300"><font face="Verdana,
Geneva, sans-serif" color="black" size="2" >Web development for profit</font></td>
                            <td width="300">
                                <font face="Verdana, Geneva, sans-
serif" color="black" size="2" >
                                    <ul>
                                        <li>IT Management
<br> Globalization</li>
                                    </ul>
                                </font>
                            </td>
                        </tr>
                    </table>
                </td>
            </tr>
        </table>
        <table width="100%" height="60" border="0" cellspacing="5" cellpadding="5" bgcolor="#000000">

            <tr>

                <td align="center"><font face="Verdana, Geneva, sans-serif" color="white">Home - About - Services - Clients - Contact<br><br>Made By :-<br>MyBusinessWebDev</font></td>

            </tr>

        </table>

    </body>

</html>
```

page2.html :

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8" />
<meta name="viewport" content="width=device-width, initial-scale=1">
<title>Demo Web Page</title>

<style>

        body {
                background: #222;
                margin-top: 20px;
                font-family: arial;
                color: white;
        }

        .thumbnails img {
        height: 80px;
        border: 4px solid #555;
        padding: 1px;
        margin: 0 10px 10px 0;
        }

        .thumbnails img:hover {
        border: 4px solid #00ccff;
        }
        .preview img {
        border: 4px solid #444;
        padding: 1px;
        width: 800px;
        }

</style>

</head>
<body>

<div id="container" align="center">

        <h1>My Web Page Gallery</h1>

        <br />

        <div class="thumbnails">
                <img onmouseover="preview.src=img1.src" name="img1"
src="images/img1.jpg" />
                <img onmouseover="preview.src=img2.src" name="img2"
src="images/img2.jpg" />
                <img onmouseover="preview.src=img3.src" name="img3"
src="images/img3.jpg" />
                <img onmouseover="preview.src=img4.src" name="img4"
src="images/img4.jpg" />
                <img onmouseover="preview.src=img5.src" name="img5"
src="images/img5.jpg" />
        </div>
```

```
    <br/>

    <div class="preview" align="center">
        <img name="preview" src="images/img1.jpg" />
    </div>

</div>

</body>
</html>
```

About Us.html :

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8" />
<meta name="viewport" content="width=device-width, initial-scale=1">
<title>About Us</title>

<style>

        body {
            margin:0;
            padding:0;
            line-height: 1.5em;
        }

        #header {
            background: black;
            font-family: Arial;
            height: 50px;
        }

        #contentwrapper {
            float: left;
            width: 100%;
        }
```

```
#contentcolumn {
        margin: 0 230px 0 230px;
}

#leftcolumn {
        float: left;
        width: 230px;
        margin-left: -100%;
        background: #24C8FF;
}

#rightcolumn {
        float: left;
        width: 230px;
        margin-left: -230px;
        background: #FFFB00;
}

.innertext {
        margin: 20px;
        font-family: Arial;
        color: #5E5E5E;
}

#footer {
        clear: left; /* Cannot float on Left */
        width: 100%;
        background: black;
```

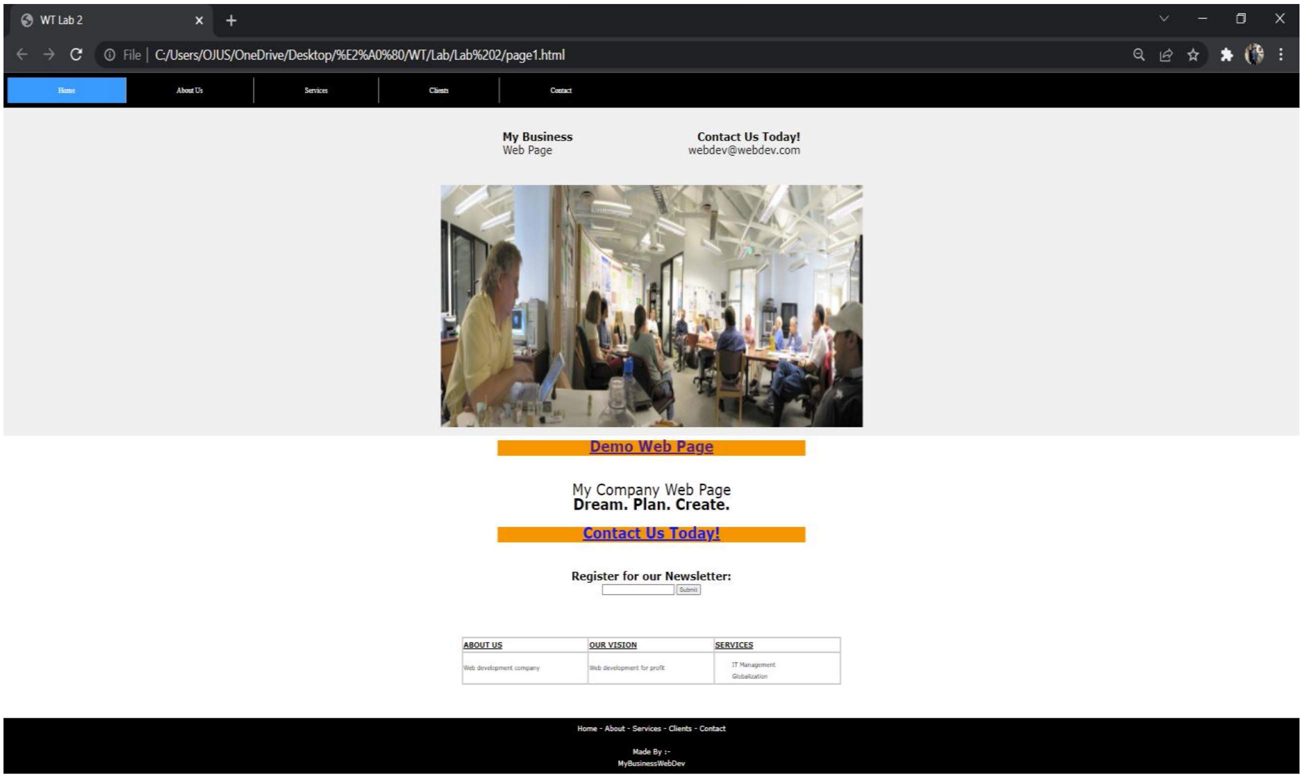
```
    color: #FFF;
    font-family: Arial;
    text-align: center;
    padding: 4px;
}

/* ###### Responsive layout CSS ###### */

@media (max-width: 840px){ /* Drop Right Column Down */

#leftcolumn {
        margin-left: -100%;
    }

#rightcolumn {
        float: none;
        width: 100%;
        margin-left: 0;
        clear: both;
    }

#contentcolumn {
        margin-right: 0; /*Set margin to LeftColumnWidth*/
    }

}

@media (max-width: 600px){ /* Drop Left Column Down */
```

```
                #leftcolumn {
                        float: none;
                        width: 100%;
                        clear: both;
                        margin-left: 0;
                }

                #contentcolumn {
                        margin-left: 0;
                }

        }


</style>

</head>
<body>

<div id="container">

        <div id="header">

                <p style="color:white;text-align:center;font-size:40px;padding:10px">About
Us</p>

        </div>
```

```
    <div id="contentwrapper">

        <div id="contentcolumn">

            <div class="innertext">

                <b>Welcome!</b> <br /> Contrary to popular belief, Lorem Ipsum is not simply random text. It has roots in a piece of classical Latin literature from 45 BC, making it over 2000 years old. Richard McClintock, a Latin professor at Hampden-Sydney College in Virginia, looked up one of the more obscure Latin words, consectetur, from a Lorem Ipsum passage, and going through the cites of the word in classical literature, discovered the undoubtable source. Lorem Ipsum comes from sections 1.10.32 and 1.10.33 of "de Finibus Bonorum et Malorum" (The Extremes of Good and Evil) by Cicero, written in 45 BC. This book is a treatise on the theory of ethics, very popular during the Renaissance. The first line of Lorem Ipsum, "Lorem ipsum dolor sit amet..", comes from a line in section 1.10.32.

                The standard chunk of Lorem Ipsum used since the 1500s is reproduced below for those interested. Sections 1.10.32 and 1.10.33 from "de Finibus Bonorum et Malorum" by Cicero are also reproduced in their exact original form, accompanied by English versions from the 1914 translation by H. Rackham.

            </div>
        </div>
    </div>

    <div id="leftcolumn">
        <div class="innertext">
            <b>Left Column: <em>230px</em></b><br /> It is a long established fact that a reader will be distracted by the readable content of a page when looking at its layout. The point of using Lorem Ipsum is that it has a more-or-less normal distribution of letters, as opposed to using 'Content here, content here', making it look like readable English. Many desktop publishing packages and web page editors now use Lorem Ipsum as their default model text, and a search for 'lorem ipsum' will uncover many web sites still in their infancy. Various
```

```
versions have evolved over the years, sometimes by accident, sometimes on purpose (injected humour and the like).
        </div>
    </div>

    <div id="rightcolumn">
        <div class="innertext">
            <b>Right Column: <em>230px</em></b><br /> Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsum.
        </div>
    </div>

    <div id="footer">Contact Now for Web Development</div>

</div>

</body>
</html>
```

Output :-



WT Lab 2
File | C:/Users/OJUS/OneDrive/Desktop/%E2%A0%80/WT/Lab/Lab%202/page1.html
Home
About Us
Services
Clients
Contact

My Business
Web Page

Contact Us Today!
webdev@webdev.com

Demo Web Page

My Company Web Page
Dream. Plan. Create.

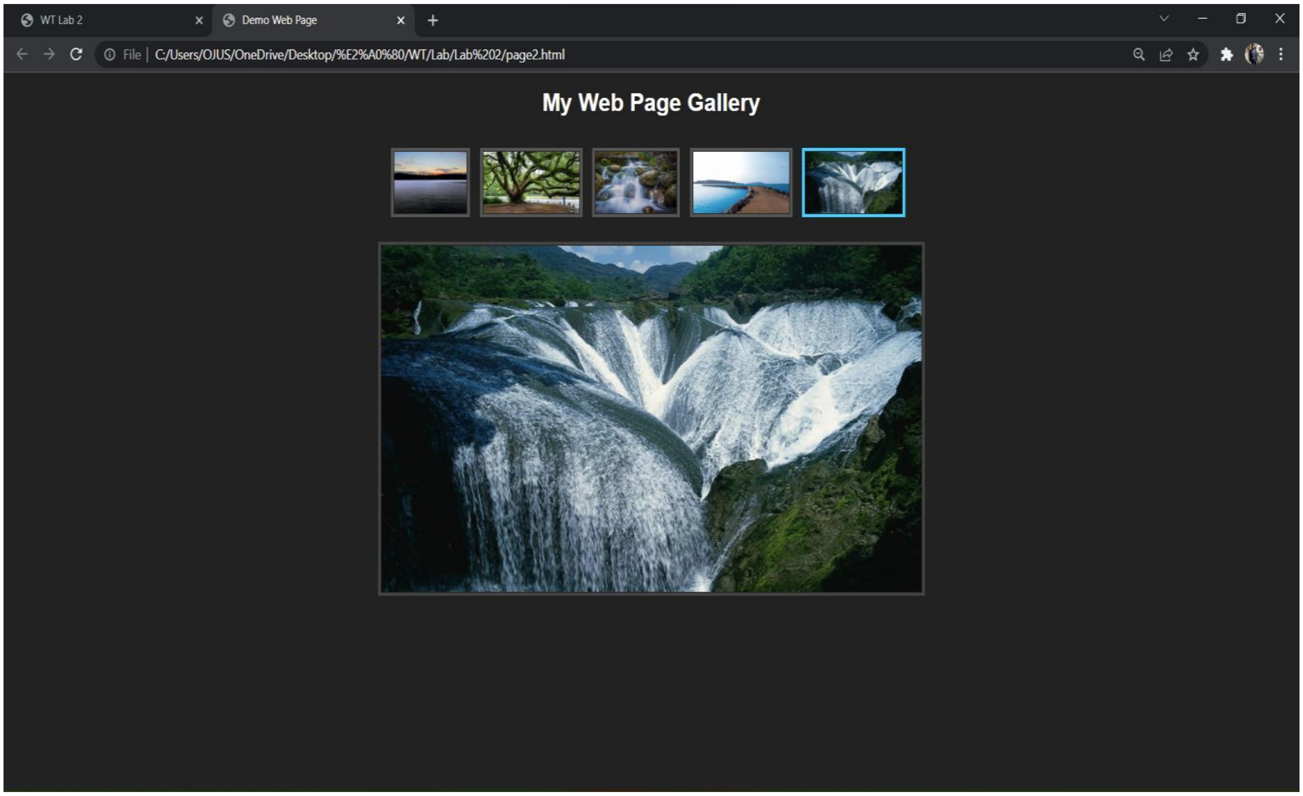
Contact Us Today!

Register for our Newsletter:
Submit

ABOUT US	OUR VISION	SERVICES
Web development company	Web development for profit	IT Management Globalization

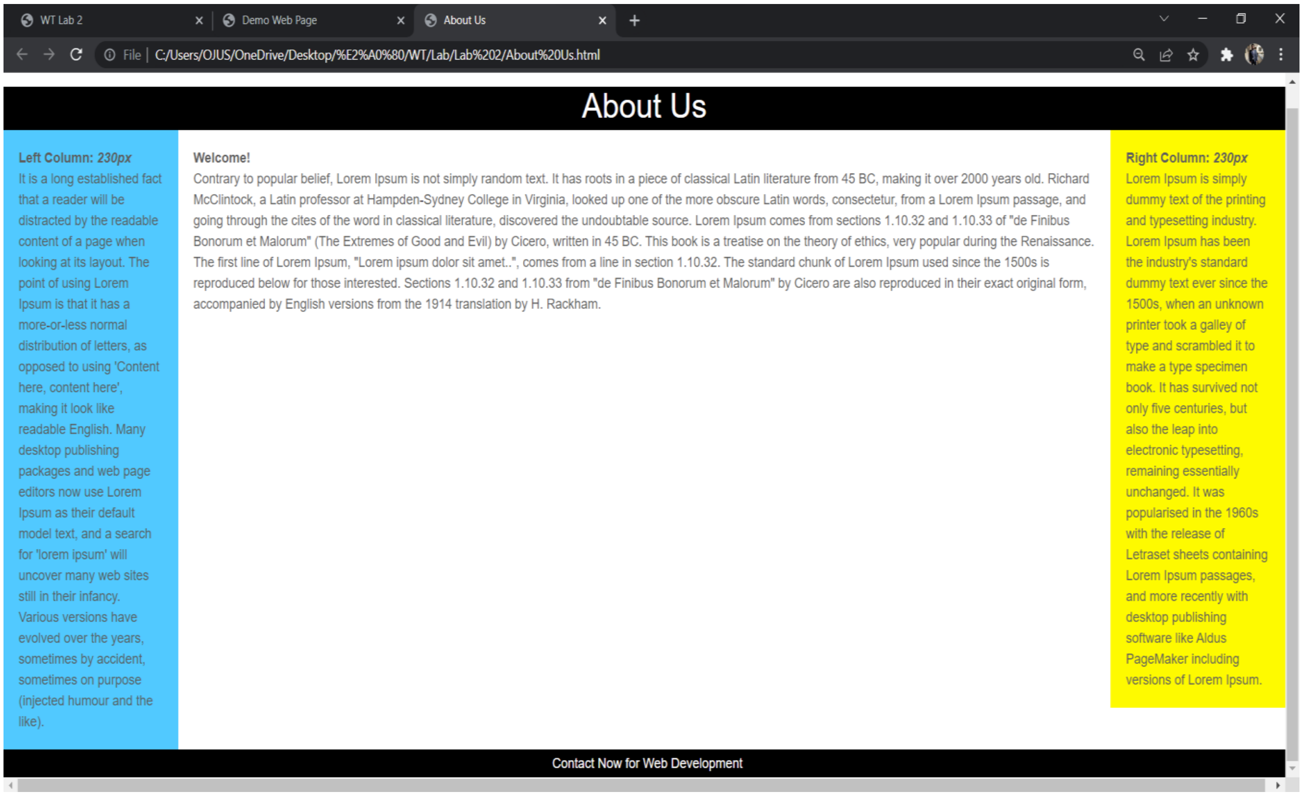
Home - About - Services - Clients - Contact

Made By :-
MyBusinessWebDev



WT Lab 2
Demo Web Page
File | C:/Users/OJUS/OneDrive/Desktop/%E2%A0%80/WT/Lab/Lab%202/page2.html

My Web Page Gallery


WT Lab 2
Demo Web Page
About Us
File
C:/Users/OJUS/OneDrive/Desktop/%E2%A0%80/WT/Lab/Lab%202/About%20Us.html

About Us

Left Column: *230px*
It is a long established fact that a reader will be distracted by the readable content of a page when looking at its layout. The point of using Lorem Ipsum is that it has a more-or-less normal distribution of letters, as opposed to using 'Content here, content here', making it look like readable English. Many desktop publishing packages and web page editors now use Lorem Ipsum as their default model text, and a search for 'lorem ipsum' will uncover many web sites still in their infancy. Various versions have evolved over the years, sometimes by accident, sometimes on purpose (injected humour and the like).

Welcome!
Contrary to popular belief, Lorem Ipsum is not simply random text. It has roots in a piece of classical Latin literature from 45 BC, making it over 2000 years old. Richard McClintock, a Latin professor at Hampden-Sydney College in Virginia, looked up one of the more obscure Latin words, consectetur, from a Lorem Ipsum passage, and going through the cites of the word in classical literature, discovered the undoubtable source. Lorem Ipsum comes from sections 1.10.32 and 1.10.33 of "de Finibus Bonorum et Malorum" (The Extremes of Good and Evil) by Cicero, written in 45 BC. This book is a treatise on the theory of ethics, very popular during the Renaissance. The first line of Lorem Ipsum, "Lorem ipsum dolor sit amet..", comes from a line in section 1.10.32. The standard chunk of Lorem Ipsum used since the 1500s is reproduced below for those interested. Sections 1.10.32 and 1.10.33 from "de Finibus Bonorum et Malorum" by Cicero are also reproduced in their exact original form, accompanied by English versions from the 1914 translation by H. Rackham.

Right Column: *230px*
Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like Aldus PageMaker including versions of Lorem Ipsum.

Contact Now for Web Development

Practical No. 3

Input :-

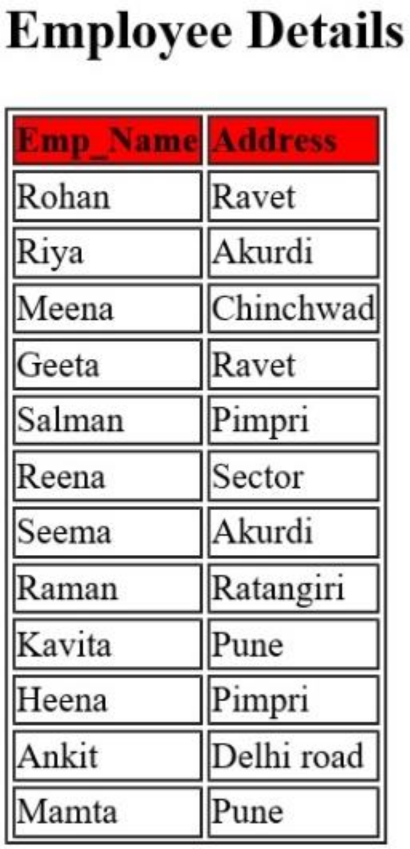
Employee.xml :

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="C:\Users\Acer\Downloads\style.xsl"?>
<!DOCTYPE catalog [
<!ELEMENT catalog (cd)>
<!ELEMENT cd (Emp_Name,Address,Age,company,Experience)>
<!ELEMENT Emp_Name (#PCDATA)>
<!ELEMENT Address (#PCDATA)>
<!ELEMENT Age (#PCDATA)>
<!ELEMENT company (#PCDATA)>
<!ELEMENT Experience (#PCDATA)>
]>
<catalog>
  <cd>
    <Emp_Name>Rohan</Emp_Name>
    <Address>Ravet</Address>
    <Age>26</Age>
    <company>Infosys</company>
    <Experience>10 years</Experience>
  </cd>
  <cd>
    <Emp_Name>Riya</Emp_Name>
    <Address>Akurdi</Address>
    <Age>25</Age>
    <company>TCS</company>
    <Experience>9 year</Experience>

  </cd>
  <cd>
    <Emp_Name>Meena</Emp_Name>
    <Address>Chinchwad</Address>
    <Age>30</Age>
    <company>RCA</company>
    <Experience>11 year</Experience>

  </cd>
  <cd>
    <Emp_Name>Meena</Emp_Name>
    <Address>Chinchwad</Address>
    <Age>30</Age>
    <company>RCA</company>
    <Experience>11 year</Experience>

  </cd>
  <cd>
</catalog>
```

Style.xsl :

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
<xsl:template match="/">
<html>
<body>
  <h2>Employee Details</h2>
  <table border="1">
    <tr bgcolor="Red">
      <th style="text-align:left">Emp_Name</th>
      <th style="text-align:left">Address</th>

    </tr>
    <xsl:for-each select="catalog/cd">
    <tr>
      <td><xsl:value-of select="Emp_Name"/></td>
      <td><xsl:value-of select="Address"/></td>

    </tr>
    </xsl:for-each>
  </table>
</body>
</html>
</xsl:template>
</xsl:stylesheet>
```

Output :-



Employee Details

Emp_Name	Address
Rohan	Ravet
Riya	Akurdi
Meena	Chinchwad
Geeta	Ravet
Salman	Pimpri
Reena	Sector
Seema	Akurdi
Raman	Ratangiri
Kavita	Pune
Heena	Pimpri
Ankit	Delhi road
Mamta	Pune

Practical No. 4

Input :-

```
<!DOCTYPE html>
<html>
<head>
<title>
Calculator Program in JavaScript
</title>

<script>

function insert(num)
{
document.form1.textview.value = document.form1.textview.value + num;
}

function equal()
{
var exp = document.form1.textview.value;
if(exp)
{
document.form1.textview.value = eval(exp)
}
}

function backspace()
```

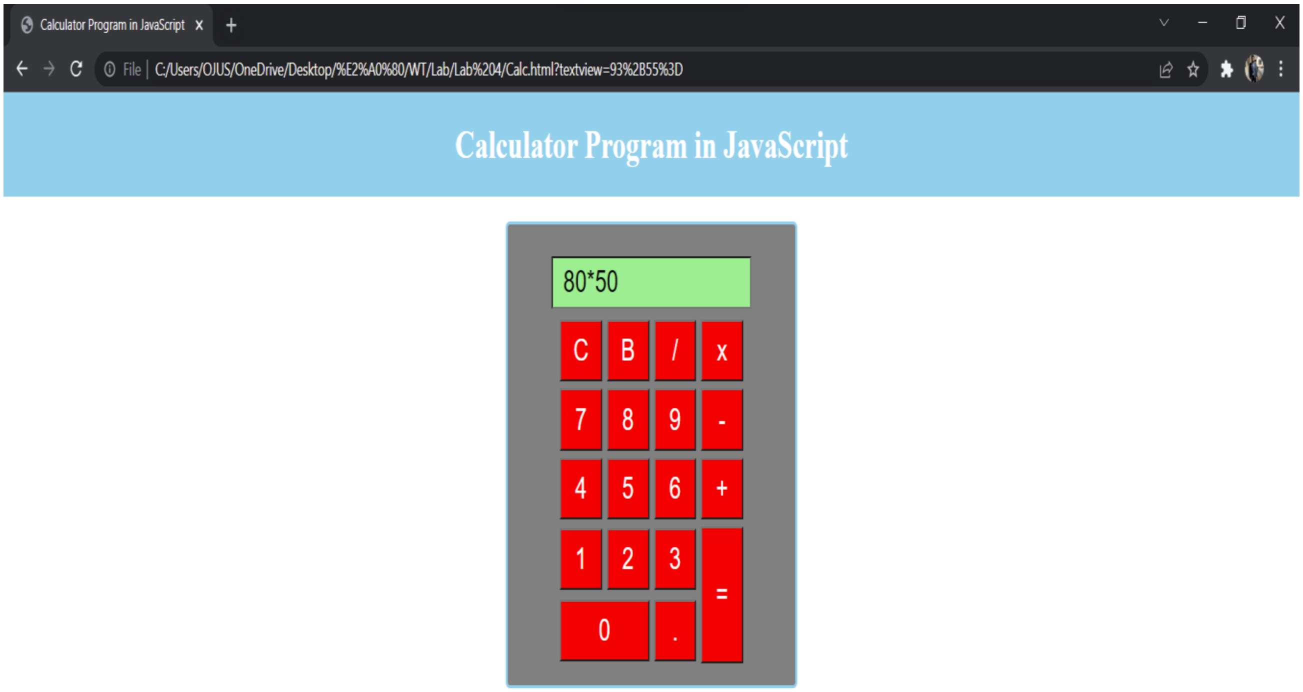
```
{
var exp = document.form1.textview.value;
document.form1.textview.value = exp.substring(0, exp.length - 1); /* remove the element from
total length ? 1 */
}

</script>

<style>

.formstyle
{
width: 300px;
height: 330px;
margin: 20px auto;
border: 3px solid skyblue;
border-radius: 5px;
padding: 20px;
text-align: center;
background-color: grey;
}

h1 {
        text-align: center;
        padding: 23px;
        background-color: skyblue;
        color: white;
        }
```

```
input:hover
{
background-color: green;
}

*{
margin: 0;
padding: 0;
}

.btn{
width: 50px;
height: 50px;
font-size: 25px;
margin: 2px;
cursor: pointer;
background-color: red;
color: white;
}

.textview{
width: 223px;
margin: 5px;
font-size: 25px;
padding: 5px;
background-color: lightgreen;
}
```

```
</style>
</head>
<body>
<h1> Calculator Program in JavaScript </h1>
 <div class= "formstyle">
 <form name = "form1">
 <input class= "textview" name = "textview">
 </form>
 <center>
 <table >
 <tr>
            <td> <input class = "btn" type = "button" value = "C" onclick = "form1.textview.value = '
' " > </td>
            <td> <input  class = "btn" type = "button" value = "B" onclick = "backspace()" > </td>
            <td> <input  class = "btn" type = "button" value = "/" onclick = "insert('/')" > </td>
            <td> <input class = "btn" type = "button" value = "x" onclick = "insert('*')" > </td>
            </tr>

             <tr>
            <td> <input class = "btn" type = "button" value = "7" onclick = "insert(7)" > </td>
            <td> <input class = "btn" type = "button" value = "8" onclick = "insert(8)" > </td>
            <td> <input class = "btn" type = "button" value = "9" onclick = "insert(9)" > </td>
            <td> <input class = "btn" type = "button" value = "-" onclick = "insert('-')" > </td>
            </tr>

             <tr>
            <td> <input class = "btn" type = "button" value = "4" onclick = "insert(4)" > </td>
            <td> <input class = "btn" type = "button" value = "5" onclick = "insert(5)" > </td>
            <td> <input class = "btn" type = "button" value = "6" onclick = "insert(6)" > </td>
```

```
        <td> <input class = "btn" type = "button" value = "+" onclick = "insert('+')" > </td>

        </tr>



         <tr>

        <td> <input class = "btn" type = "button" value = "1" onclick = "insert(1)" > </td>

        <td> <input class = "btn" type = "button" value = "2" onclick = "insert(2)" > </td>

        <td> <input class = "btn" type = "button" value = "3" onclick = "insert(3)" > </td>

        <td rowspan = 5> <input class = "btn" style = "height: 110px" type = "button" value =
"=" onclick = "equal()"> </td>

        </tr>

        <tr>

        <td colspan = 2> <input class = "btn" style = "width: 106px" type = "button" value = "0"
onclick = "insert(0)" > </td>

        <td> <input class = "btn" type = "button" value = "." onclick = "insert('.')"> </td>

        </tr>

        </table>

        </center>

 </div>

 </body>

 </html>
```

Output :-

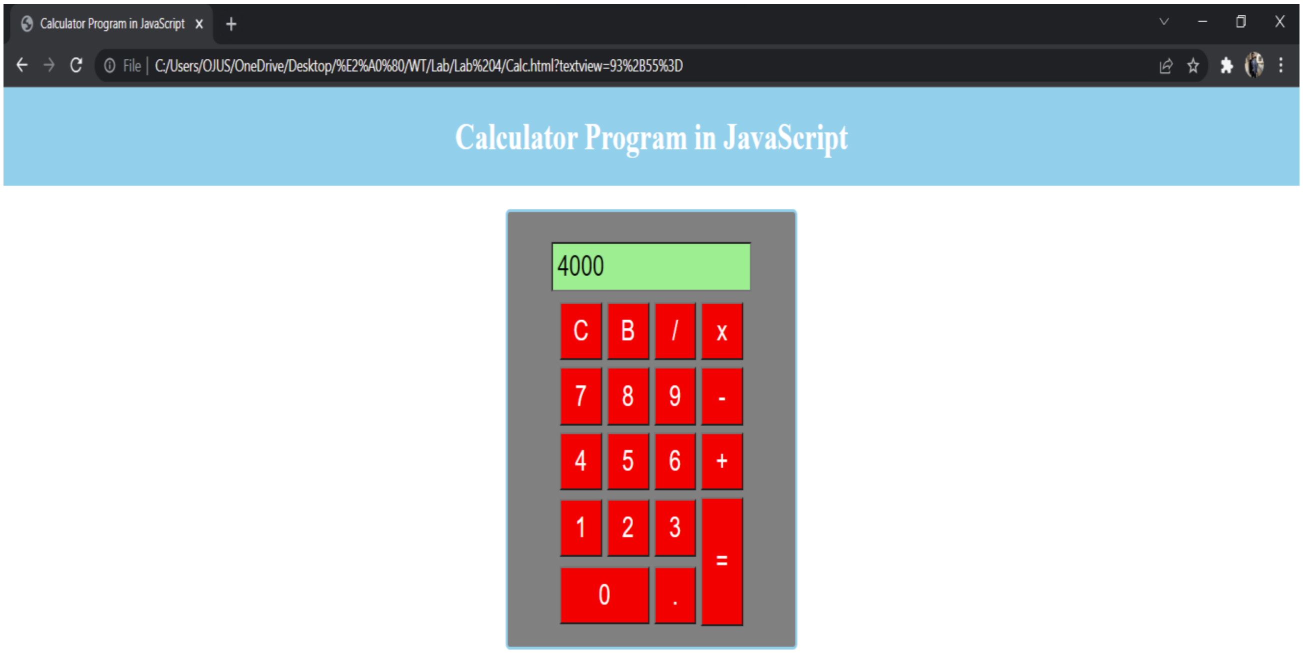


Calculator Program in JavaScript

C:/Users/OJUS/OneDrive/Desktop/%E2%A0%80/WT/Lab/Lab%204/Calc.html?textview=93%2B55%3D

Calculator Program in JavaScript

80*50



Calculator Program in JavaScript

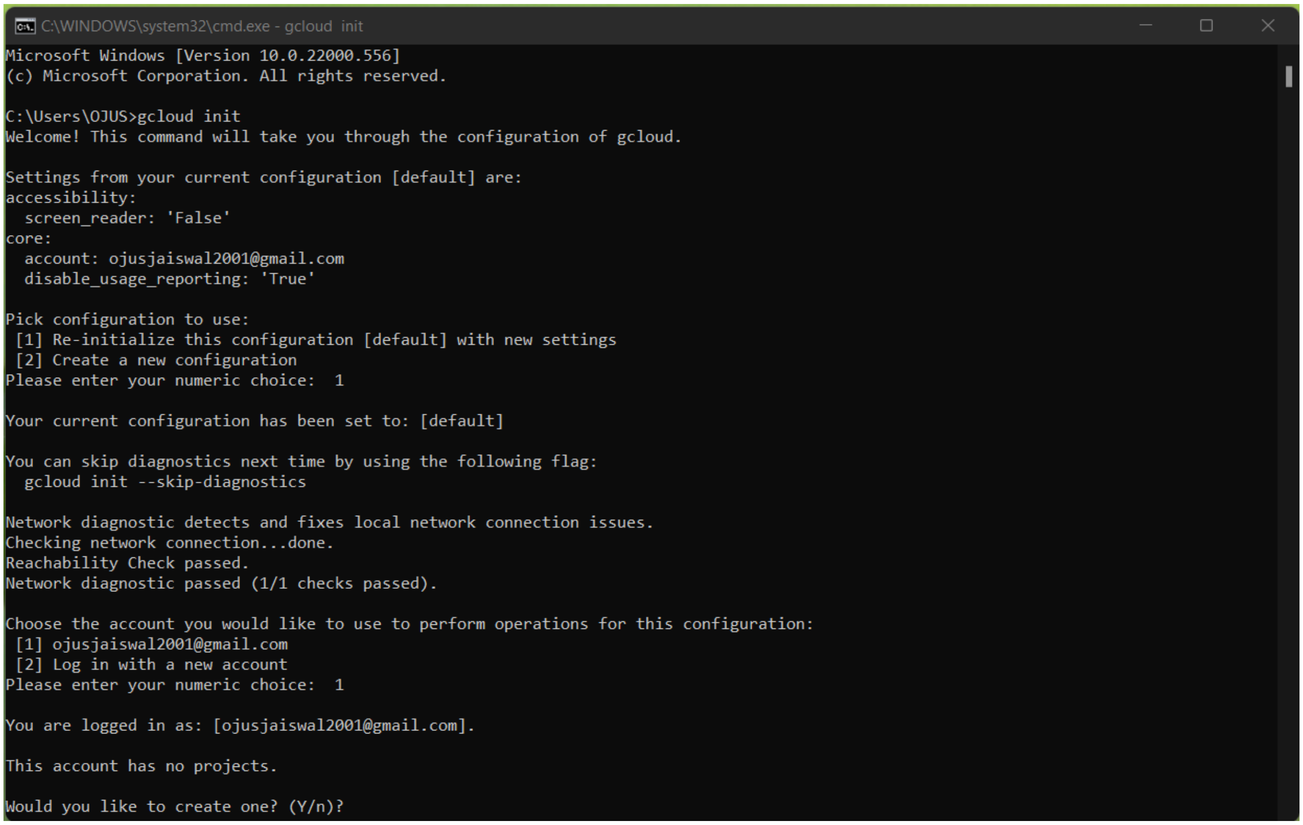
C:/Users/OJUS/OneDrive/Desktop/%E2%A0%80/WT/Lab/Lab%204/Calc.html?textview=93%2B55%3D

Calculator Program in JavaScript

4000

Practical No. 2

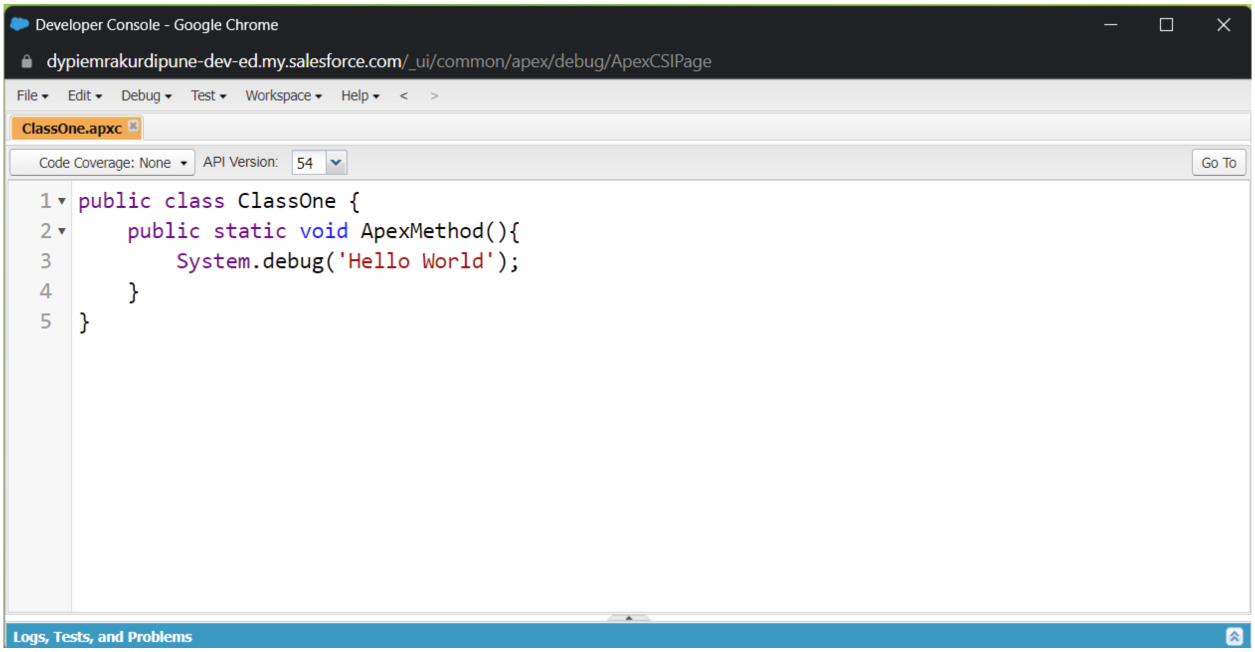
Output :-



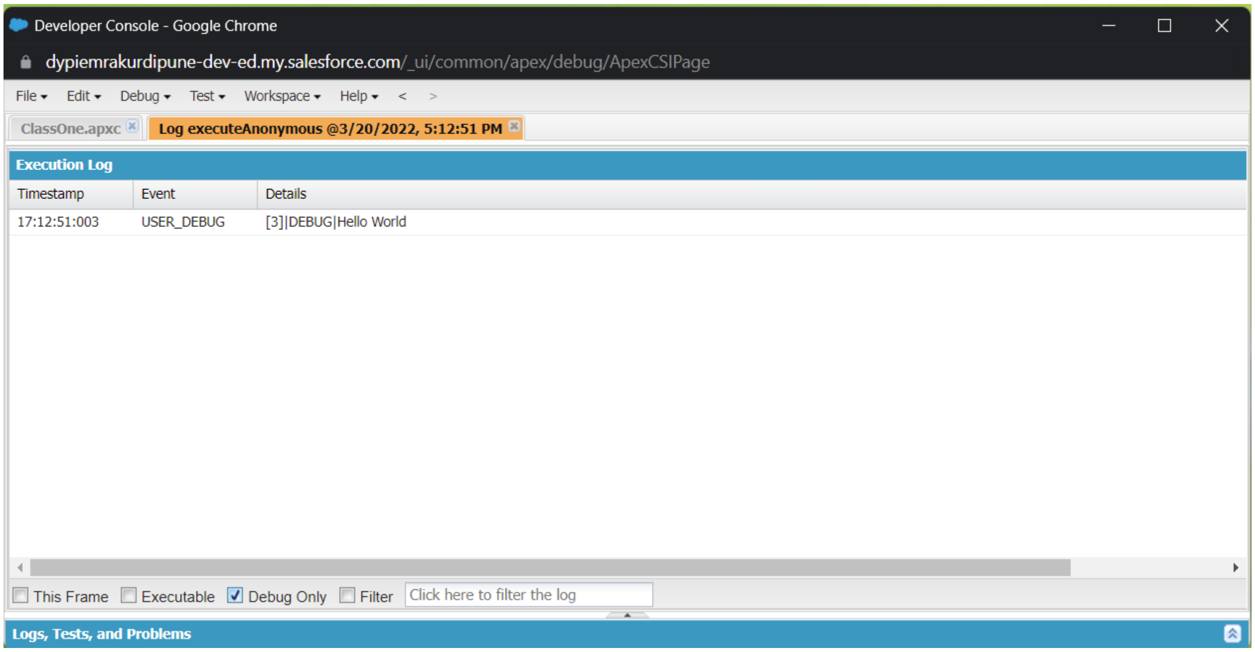
```
Microsoft Windows [Version 10.0.22000.556]
(c) Microsoft Corporation. All rights reserved.

C:\Users\OJUS>gcloud init
Welcome! This command will take you through the configuration of gcloud.

Settings from your current configuration [default] are:
accessibility:
  screen_reader: 'False'
core:
  account: ojusjaiswal2001@gmail.com
  disable_usage_reporting: 'True'

Pick configuration to use:
 [1] Re-initialize this configuration [default] with new settings
 [2] Create a new configuration
Please enter your numeric choice:  1

Your current configuration has been set to: [default]

You can skip diagnostics next time by using the following flag:
  gcloud init --skip-diagnostics

Network diagnostic detects and fixes local network connection issues.
Checking network connection...done.
Reachability Check passed.
Network diagnostic passed (1/1 checks passed).

Choose the account you would like to use to perform operations for this configuration:
 [1] ojusjaiswal2001@gmail.com
 [2] Log in with a new account
Please enter your numeric choice:  1

You are logged in as: [ojusjaiswal2001@gmail.com].

This account has no projects.

Would you like to create one? (Y/n)?
```

Practical No. 3

Output :-


Developer Console - Google Chrome
dypiemrakurdipune-dev-ed.my.salesforce.com/_ui/common/apex/debug/ApexCSIPage
File Edit Debug Test Workspace Help < >
ClassOne.apxc
Code Coverage: None
API Version: 54
Go To
Logs, Tests, and Problems

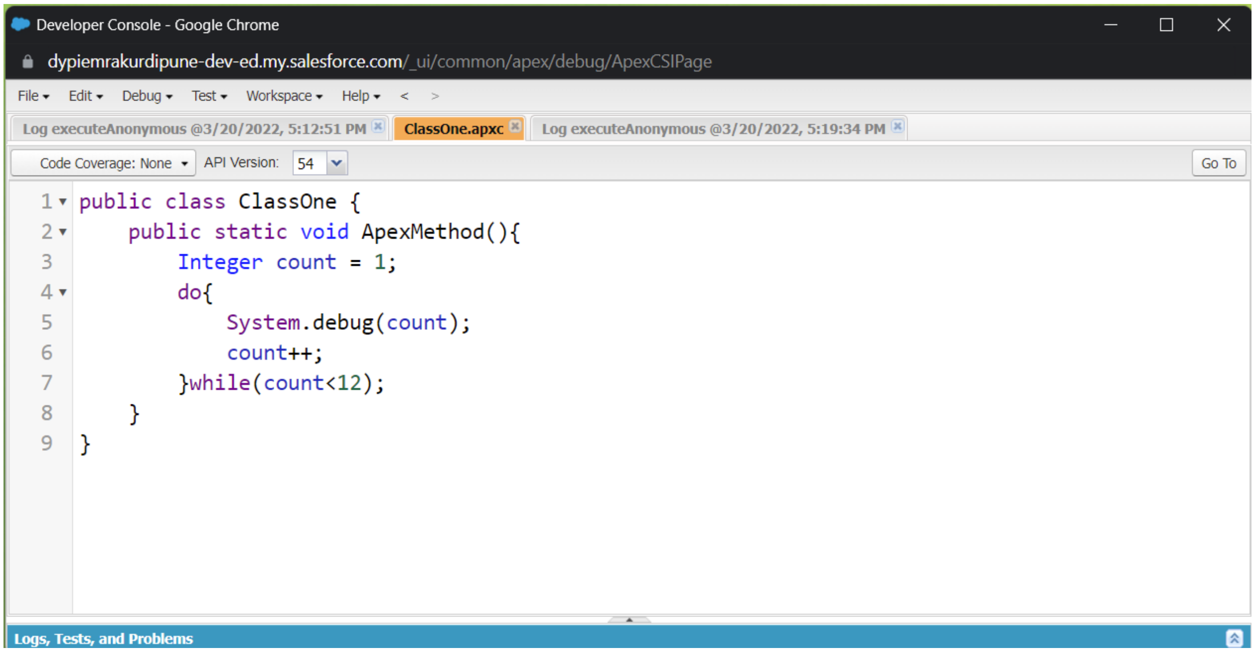
```
public class ClassOne {
    public static void ApexMethod(){
        System.debug('Hello World');
    }
}
```


Developer Console - Google Chrome
dypiemrakurdipune-dev-ed.my.salesforce.com/_ui/common/apex/debug/ApexCSIPage
File Edit Debug Test Workspace Help < >
ClassOne.apxc
Log executeAnonymous @3/20/2022, 5:12:51 PM
Execution Log

Timestamp	Event	Details
17:12:51:003	USER_DEBUG	[3]|DEBUG|Hello World

□ This Frame □ Executable ☑ Debug Only □ Filter Click here to filter the log

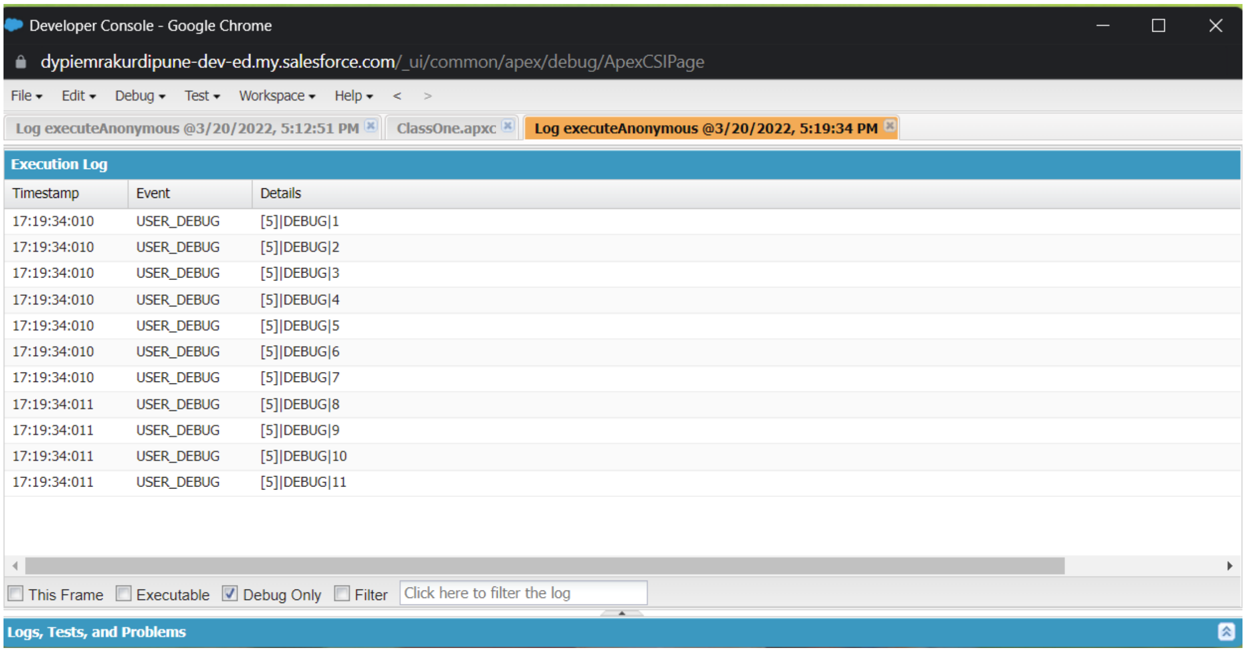
Logs, Tests, and Problems



Developer Console - Google Chrome
dypiemrakurdipune-dev-ed.my.salesforce.com/_ui/common/apex/debug/ApexCSIPage
File Edit Debug Test Workspace Help < >
Log executeAnonymous @3/20/2022, 5:12:51 PM
ClassOne.apxc
Log executeAnonymous @3/20/2022, 5:19:34 PM
Go To
Logs, Tests, and Problems

Code Coverage: None API Version: 54

```
public class ClassOne {
    public static void ApexMethod(){
        Integer count = 1;
        do{
            System.debug(count);
            count++;
        }while(count<12);
    }
}
```



Developer Console - Google Chrome
dypiemrakurdipune-dev-ed.my.salesforce.com/_ui/common/apex/debug/ApexCSIPage
File Edit Debug Test Workspace Help < >
Log executeAnonymous @3/20/2022, 5:12:51 PM
ClassOne.apxc
Log executeAnonymous @3/20/2022, 5:19:34 PM
Execution Log
Click here to filter the log
Logs, Tests, and Problems

```
Timestamp      Event        Details
17:19:34:010   USER_DEBUG   [5]|DEBUG|1
17:19:34:010   USER_DEBUG   [5]|DEBUG|2
17:19:34:010   USER_DEBUG   [5]|DEBUG|3
17:19:34:010   USER_DEBUG   [5]|DEBUG|4
17:19:34:010   USER_DEBUG   [5]|DEBUG|5
17:19:34:010   USER_DEBUG   [5]|DEBUG|6
17:19:34:010   USER_DEBUG   [5]|DEBUG|7
17:19:34:011   USER_DEBUG   [5]|DEBUG|8
17:19:34:011   USER_DEBUG   [5]|DEBUG|9
17:19:34:011   USER_DEBUG   [5]|DEBUG|10
17:19:34:011   USER_DEBUG   [5]|DEBUG|11
```

☐ This Frame ☐ Executable ☑ Debug Only ☐ Filter

1. Import all the required Python Libraries

In [4]:

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

In [ ]:

```

```

1. Load the Dataset into pandas data frame

In [12]:

```
data = {
    "Roll_No" : [1,2,3],
    "Marks" : [50,40,45]
}

#load data into a DataFrame object:
df = pd.DataFrame(data)

df
```

Out[12]:

	Roll_No	Marks
0	1	50
1	2	40
2	3	45

In [13]:

```
print(df)
```

```
   Roll_No  Marks
0        1     50
1        2     40
2        3     45
```

In [24]:

```
print(df.to_string)
```

```
<bound method DataFrame.to_string of      Roll_No  Marks
ABC        1     50
PQR        2     40
XYZ        3     45>
```

In [23]:

```
print(df.to_string())
```

```
     Roll_No  Marks
ABC        1     50
PQR        2     40
XYZ        3     45
```

In [18]:

```
print(df.loc[2])
```

```
Roll_No     3
Marks      45
Name: 2, dtype: int64
```

In [19]:

```
print(df.loc[[0,2]])
```

```
   Roll_No  Marks
0        1     50
2        3     45
```

In [20]:

```
#load data into a DataFrame object:
df = pd.DataFrame(data,index = ["ABC","PQR","XYZ"])
print(df)
```

```
     Roll_No  Marks
ABC        1     50
PQR        2     40
XYZ        3     45
```

In [21]:

```
print(df.loc["XYZ"])
```

```
Roll_No     3
Marks      45
Name: XYZ, dtype: int64
```

In [ ]:

```

```

1. Data Preprocessing

In [25]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df
```

Out[25]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3

	Duration	Date	Pulse	Maxpulse	Calories
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	NaN
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	NaN	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	NaN
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [26]:

```
df.head()
```

Out[26]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0

In [27]:

```
df.head(10)
```

Out[27]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0

In [28]:

```
df.tail()
```

Out[28]:

	Duration	Date	Pulse	Maxpulse	Calories
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	NaN
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [29]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 32 entries, 0 to 31
Data columns (total 5 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   Duration  32 non-null     int64  
 1   Date      31 non-null     object 
 2   Pulse     32 non-null     int64  
 3   Maxpulse  32 non-null     int64  
 4   Calories  30 non-null     float64
dtypes: float64(1), int64(3), object(1)
memory usage: 1.4+ KB
```

In [30]:

```
new_df = df.dropna()
print(new_df.to_string())
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [31]:

```
df
```

Out[31]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	NaN
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	NaN	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	NaN
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [33]:

```
df.dropna(inplace = True)
print(df.to_string())
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
```

```
10          60  '2020/12/11'    103        147      329.3
11          60  '2020/12/12'    100        120      250.7
12          60  '2020/12/12'    100        120      250.7
13          60  '2020/12/13'    106        128      345.3
14          60  '2020/12/14'    104        132      379.3
15          60  '2020/12/15'     98        123      275.0
16          60  '2020/12/16'     98        120      215.2
17          60  '2020/12/17'    100        120      300.0
19          60  '2020/12/19'    103        123      323.0
20          45  '2020/12/20'     97        125      243.0
21          60  '2020/12/21'    108        131      364.2
23          60  '2020/12/23'    130        101      300.0
24          45  '2020/12/24'    105        132      246.0
25          60  '2020/12/25'    102        126      334.5
26          60      20201226    100        120      250.0
27          60  '2020/12/27'     92        118      241.0
29          60  '2020/12/29'    100        132      280.0
30          60  '2020/12/30'    102        129      380.3
31          60  '2020/12/31'     92        115      243.0
```

In [34]:

```
df
```

Out[34]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
29	60	'2020/12/29'	100	132	280.0

	Duration	Date	Pulse	Maxpulse	Calories
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [36]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.fillna(130, inplace = True)
df
```

Out[36]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	130.0
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	130	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	130.0
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [37]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df["Calories"].fillna(130, inplace = True)
```

```
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112     130.0
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132     130.0
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [38]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
x = df["Calories"].mean()
df["Calories"].fillna(x, inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130    409.10
1         60  '2020/12/02'    117       145    479.00
2         60  '2020/12/03'    103       135    340.00
3         45  '2020/12/04'    109       175    282.40
4         45  '2020/12/05'    117       148    406.00
5         60  '2020/12/06'    102       127    300.00
6         60  '2020/12/07'    110       136    374.00
7        450  '2020/12/08'    104       134    253.30
8         30  '2020/12/09'    109       133    195.10
9         60  '2020/12/10'     98       124    269.00
10        60  '2020/12/11'    103       147    329.30
11        60  '2020/12/12'    100       120    250.70
12        60  '2020/12/12'    100       120    250.70
13        60  '2020/12/13'    106       128    345.30
14        60  '2020/12/14'    104       132    379.30
15        60  '2020/12/15'     98       123    275.00
16        60  '2020/12/16'     98       120    215.20
17        60  '2020/12/17'    100       120    300.00
18        45  '2020/12/18'     90       112    304.68
19        60  '2020/12/19'    103       123    323.00
20        45  '2020/12/20'     97       125    243.00
21        60  '2020/12/21'    108       131    364.20
22        45           NaN    100       119    282.00
23        60  '2020/12/23'    130       101    300.00
24        45  '2020/12/24'    105       132    246.00
25        60  '2020/12/25'    102       126    334.50
26        60      20201226    100       120    250.00
```

```
27          60  '2020/12/27'      92        118    241.00
28          60  '2020/12/28'     103        132    304.68
29          60  '2020/12/29'     100        132    280.00
30          60  '2020/12/30'     102        129    380.30
31          60  '2020/12/31'      92        115    243.00
```

In [39]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
x = df["Calories"].median()
df["Calories"].fillna(x, inplace = True)
df
```

Out[39]:

	Duration	Date	Pulse	Maxpulse	Calories
0	60	'2020/12/01'	110	130	409.1
1	60	'2020/12/02'	117	145	479.0
2	60	'2020/12/03'	103	135	340.0
3	45	'2020/12/04'	109	175	282.4
4	45	'2020/12/05'	117	148	406.0
5	60	'2020/12/06'	102	127	300.0
6	60	'2020/12/07'	110	136	374.0
7	450	'2020/12/08'	104	134	253.3
8	30	'2020/12/09'	109	133	195.1
9	60	'2020/12/10'	98	124	269.0
10	60	'2020/12/11'	103	147	329.3
11	60	'2020/12/12'	100	120	250.7
12	60	'2020/12/12'	100	120	250.7
13	60	'2020/12/13'	106	128	345.3
14	60	'2020/12/14'	104	132	379.3
15	60	'2020/12/15'	98	123	275.0
16	60	'2020/12/16'	98	120	215.2
17	60	'2020/12/17'	100	120	300.0
18	45	'2020/12/18'	90	112	291.2
19	60	'2020/12/19'	103	123	323.0
20	45	'2020/12/20'	97	125	243.0
21	60	'2020/12/21'	108	131	364.2
22	45	NaN	100	119	282.0
23	60	'2020/12/23'	130	101	300.0
24	45	'2020/12/24'	105	132	246.0
25	60	'2020/12/25'	102	126	334.5
26	60	20201226	100	120	250.0
27	60	'2020/12/27'	92	118	241.0
28	60	'2020/12/28'	103	132	291.2
29	60	'2020/12/29'	100	132	280.0
30	60	'2020/12/30'	102	129	380.3
31	60	'2020/12/31'	92	115	243.0

In [43]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df["Date"] = pd.to_datetime(df["Date"])
print(df)
```

```
    Duration       Date  Pulse  Maxpulse  Calories
0         60 2020-12-01    110       130     409.1
1         60 2020-12-02    117       145     479.0
2         60 2020-12-03    103       135     340.0
3         45 2020-12-04    109       175     282.4
4         45 2020-12-05    117       148     406.0
5         60 2020-12-06    102       127     300.0
6         60 2020-12-07    110       136     374.0
7        450 2020-12-08    104       134     253.3
8         30 2020-12-09    109       133     195.1
9         60 2020-12-10     98       124     269.0
10        60 2020-12-11    103       147     329.3
11        60 2020-12-12    100       120     250.7
12        60 2020-12-12    100       120     250.7
13        60 2020-12-13    106       128     345.3
14        60 2020-12-14    104       132     379.3
15        60 2020-12-15     98       123     275.0
16        60 2020-12-16     98       120     215.2
17        60 2020-12-17    100       120     300.0
18        45 2020-12-18     90       112       NaN
19        60 2020-12-19    103       123     323.0
20        45 2020-12-20     97       125     243.0
21        60 2020-12-21    108       131     364.2
22        45        NaT    100       119     282.0
23        60 2020-12-23    130       101     300.0
24        45 2020-12-24    105       132     246.0
25        60 2020-12-25    102       126     334.5
26        60 2020-12-26    100       120     250.0
27        60 2020-12-27     92       118     241.0
28        60 2020-12-28    103       132       NaN
29        60 2020-12-29    100       132     280.0
30        60 2020-12-30    102       129     380.3
31        60 2020-12-31     92       115     243.0
```

In [46]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.dropna(subset = ["Date"] , inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
```

```
26          60      20201226    100        120      250.0
27          60  '2020/12/27'     92        118      241.0
28          60  '2020/12/28'    103        132        NaN
29          60  '2020/12/29'    100        132      280.0
30          60  '2020/12/30'    102        129      380.3
31          60  '2020/12/31'     92        115      243.0
```

In [49]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.loc[7, "Duration"] = 45
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7         45  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132       NaN
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [50]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
for x in df.index :
    if df.loc[x, "Duration"] > 120 :
        df.loc[x, "Duration"] = 120
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        120  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
```

```
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132       NaN
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [51]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
for x in df.index :
    if df.loc[x, "Duration"] > 120 :
        df.drop(x, inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
12        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132       NaN
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [52]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
print(df.duplicated())
```

```
0     False
1     False
2     False
3     False
4     False
```

```
5     False
6     False
7     False
8     False
9     False
10    False
11    False
12     True
13    False
14    False
15    False
16    False
17    False
18    False
19    False
20    False
21    False
22    False
23    False
24    False
25    False
26    False
27    False
28    False
29    False
30    False
31    False
dtype: bool
```

In [53]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\dirtydata.csv"
df = pd.read_csv(path)
df.drop_duplicates(inplace = True)
print(df)
```

```
    Duration          Date  Pulse  Maxpulse  Calories
0         60  '2020/12/01'    110       130     409.1
1         60  '2020/12/02'    117       145     479.0
2         60  '2020/12/03'    103       135     340.0
3         45  '2020/12/04'    109       175     282.4
4         45  '2020/12/05'    117       148     406.0
5         60  '2020/12/06'    102       127     300.0
6         60  '2020/12/07'    110       136     374.0
7        450  '2020/12/08'    104       134     253.3
8         30  '2020/12/09'    109       133     195.1
9         60  '2020/12/10'     98       124     269.0
10        60  '2020/12/11'    103       147     329.3
11        60  '2020/12/12'    100       120     250.7
13        60  '2020/12/13'    106       128     345.3
14        60  '2020/12/14'    104       132     379.3
15        60  '2020/12/15'     98       123     275.0
16        60  '2020/12/16'     98       120     215.2
17        60  '2020/12/17'    100       120     300.0
18        45  '2020/12/18'     90       112       NaN
19        60  '2020/12/19'    103       123     323.0
20        45  '2020/12/20'     97       125     243.0
21        60  '2020/12/21'    108       131     364.2
22        45           NaN    100       119     282.0
23        60  '2020/12/23'    130       101     300.0
24        45  '2020/12/24'    105       132     246.0
25        60  '2020/12/25'    102       126     334.5
26        60      20201226    100       120     250.0
27        60  '2020/12/27'     92       118     241.0
28        60  '2020/12/28'    103       132       NaN
29        60  '2020/12/29'    100       132     280.0
30        60  '2020/12/30'    102       129     380.3
31        60  '2020/12/31'     92       115     243.0
```

In [10]:

```
data = pd.Series({'1st':1, '2nd':2, '3rd':3, '4th':4})
```

```
print(data,'\n')
print('Size = ',data.size)
```

```
1st    1
2nd    2
3rd    3
4th    4
dtype: int64

Size =  4
```

In [11]:

```
df = pd.DataFrame({'1st':[1,2], '2nd':[3,4], '3rd':[5,6], '4th':[7,8]})
print(df,'\n')
print('Size = ',df.size)
```

```
   1st  2nd  3rd  4th
0    1    3    5    7
1    2    4    6    8

Size =  8
```

In [12]:

```
df = pd.DataFrame({'1st':[1,2], '2nd':[3,4], '3rd':[5,6], '4th':[7,8]})
print(df,'\n')
print('Size = ',df.size)
print('Dimension = ',df.ndim)
print('Shape = ',df.shape)
```

```
   1st  2nd  3rd  4th
0    1    3    5    7
1    2    4    6    8

Size =  8
Dimension =  2
Shape =  (2, 4)
```

In [ ]:

```

```

1. Data Formatting and Data Normalization

In [13]:

```
df = pd.DataFrame({'Name':['Rohit', 'Raj', 'Shubh', 'Shivam'], 'Marks':[95,74,84,26], 'S
ubject':['Maths', 'Science', 'English', 'Social Science']})
column_names=df.columns
print(column_names)
```

```
Index(['Name', 'Marks', 'Subject'], dtype='object')
```

In [14]:

```
data = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam'], 'Marks':[95,74,84,26]}
df = pd.DataFrame(data)
column_names=df.columns
print(column_names)
```

```
Index(['Name', 'Marks'], dtype='object')
```

In [16]:

```
df = pd.DataFrame({'A':[21, 11, 19, None, 1],
                   'B':[7, 19, 57, 3, None],
                   'C':[10, 16, 11, 3, 8],
                   'D':[14 , 3, None, 2, 6]})
index_row = ['Row_1', 'Row_2', 'Row_3', 'Row_4', 'Row_5']
```

```
df.index = index_row
print(df)
print(df.columns)
```

```
           A     B   C     D
Row_1   21.0   7.0  10  14.0
Row_2   11.0  19.0  16   3.0
Row_3   19.0  57.0  11   NaN
Row_4    NaN   3.0   3   2.0
Row_5    1.0   NaN   8   6.0
Index(['A', 'B', 'C', 'D'], dtype='object')
```

In [17]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100]}
df = pd.DataFrame(dict)
print('The DataType of DataFrame is: ')
print(df.dtypes)
```

```
The DataType of DataFrame is: 
Phone     object
Price      int64
dtype: object
```

In [18]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100],
'Discount':[np.nan, np.nan, np.nan]}
df = pd.DataFrame(dict)
print('The DataType of DataFrame is: ')
print(df.dtypes)
```

```
The DataType of DataFrame is: 
Phone        object
Price         int64
Discount    float64
dtype: object
```

In [19]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100],
'Discount':[np.nan, np.nan, np.nan], 'ArrivalDate':[pd.Timestamp('20180310'), pd.Timesta
mp('20190310'), pd.Timestamp('20140310')]}
df = pd.DataFrame(dict)
print('The DataType of DataFrame is: ')
print(df.dtypes)
```

```
The DataType of DataFrame is: 
Phone                  object
Price                   int64
Discount              float64
ArrivalDate    datetime64[ns]
dtype: object
```

In [21]:

```
dict = {'Phone':['Samsung S20', 'iPhone 11', 'Reliance Jio'], 'Price':[1000, 1100, 100],
'Discount':[np.nan, np.nan, np.nan], 'ArrivalDate':[pd.Timestamp('20180310'), pd.Timesta
mp('20190310'), pd.Timestamp('20140310')]}
df = pd.DataFrame(dict)
print('The Info of DataFrame is: ')
print(df.info())
```

```
The Info of DataFrame is: 
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3 entries, 0 to 2
Data columns (total 4 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   Phone        3 non-null      object 
 1   Price        3 non-null      int64  
 2   Discount     0 non-null      float64
 3   ArrivalDate  3 non-null      datetime64[ns]
dtypes: datetime64[ns](1), float64(1), int64(1), object(1)
memory usage: 224.0+ bytes
None
```

In [25]:

```
dataset = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam', 'Arun'],
           'Roll_No':['01', '02', '03', '04', np.nan],
           'Maths':['93', '63', np.nan, '94', '83'],
           'Science':['88', np.nan, '66', '94', np.nan],
           'English':['93', '74', '84', '92', '87']}
df = pd.DataFrame(dataset)

print('DataFrame: \n\n',df)

print('\nCount: \n')
df2 = df.count()
print(df2)
```

```
DataFrame: 

      Name Roll_No Maths Science English
0   Rohit      01    93      88      93
1     Raj      02    63     NaN      74
2   Shubh      03   NaN      66      84
3  Shivam      04    94      94      92
4    Arun     NaN    83     NaN      87

Count: 

Name       5
Roll_No    4
Maths      4
Science    3
English    5
dtype: int64
```

In [26]:

```
dataset = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam', 'Arun'],
           'Roll_No':['01', '02', '03', '04', np.nan],
           'Maths':['93', '63', np.nan, '94', '83'],
           'Science':['88', np.nan, '66', '94', np.nan],
           'English':['93', '74', '84', '92', '87']}
df = pd.DataFrame(dataset)

print('DataFrame: \n\n',df)

print('\nCount: \n')
df2 = df.count(axis='columns')
print(df2)
```

```
DataFrame: 

      Name Roll_No Maths Science English
0   Rohit      01    93      88      93
1     Raj      02    63     NaN      74
2   Shubh      03   NaN      66      84
3  Shivam      04    94      94      92
4    Arun     NaN    83     NaN      87

Count: 

0    5
1    4
2    4
3    5
4    3
dtype: int64
```

In [27]:

```
dataset = {'Name':['Rohit', 'Raj', 'Shubh', 'Shivam', 'Arun'],
           'Roll_No':['01', '02', '03', '04', np.nan],
           'Maths':['93', '63', np.nan, '94', '83'],
           'Science':['88', np.nan, '66', '94', np.nan],
           'English':['93', '74', '84', '92', '87']}
df = pd.DataFrame(dataset)

print('DataFrame: \n\n',df)

print('\nCount: \n')
df2 = df.set_index(['Maths', 'English']).count(level='Maths')
print(df2)
```

```
DataFrame: 

      Name Roll_No Maths Science English
0   Rohit      01    93      88      93
1     Raj      02    63     NaN      74
2   Shubh      03   NaN      66      84
3  Shivam      04    94      94      92
4    Arun     NaN    83     NaN      87

Count: 

       Name  Roll_No  Science
Maths                        
63        1        1        0
83        1        0        0
93        1        1        1
94        1        1        1
```

In [5]:

```
df = pd.DataFrame([
    [180000, 110, 18.9, 1400],
    [360000, 905, 23.4, 1800],
    [230000, 230, 14.0, 1300],
    [60000, 450, 13.5, 1500]],

    columns=['Col A', 'Col B', 'Col C', 'Col D'])

display(df)
```

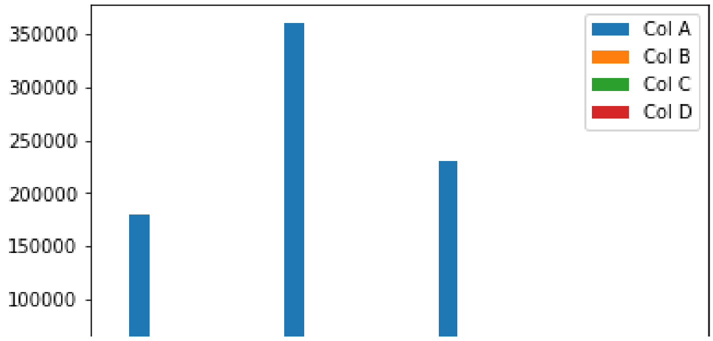
	Col A	Col B	Col C	Col D
0	180000	110	18.9	1400
1	360000	905	23.4	1800
2	230000	230	14.0	1300
3	60000	450	13.5	1500

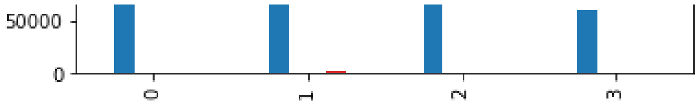
In [31]:

```
df.plot(kind = 'bar')
```

Out[31]:

```
<AxesSubplot:>
```





In [32]:

```
df_max_scaled = df.copy()

for column in df_max_scaled.columns:
    df_max_scaled[column] = df_max_scaled[column]/df_max_scaled[column].abs().max()

display(df_max_scaled)
```

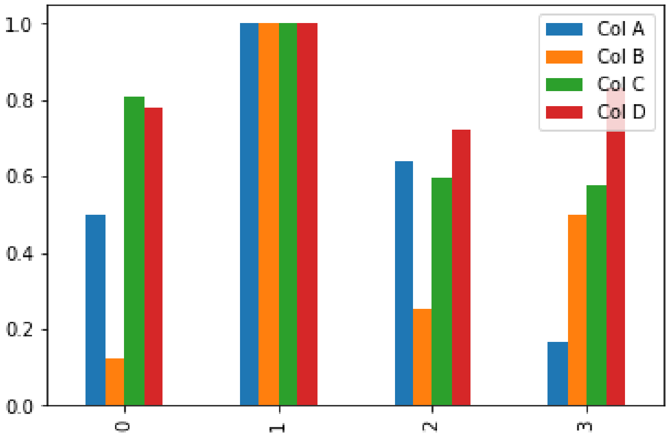
	Col A	Col B	Col C	Col D
0	0.500000	0.121547	0.807692	0.777778
1	1.000000	1.000000	1.000000	1.000000
2	0.638889	0.254144	0.598291	0.722222
3	0.166667	0.497238	0.576923	0.833333

In [33]:

```
df_max_scaled.plot(kind = 'bar')
```

Out[33]:

```
<AxesSubplot:>
```



In [6]:

```
df_min_max_scaled = df.copy()

for column in df_min_max_scaled.columns:
    df_min_max_scaled[column] = (df_min_max_scaled[column]-df_min_max_scaled[column].min
())/(df_min_max_scaled[column].max()-df_min_max_scaled[column].min())

display(df_min_max_scaled)
```

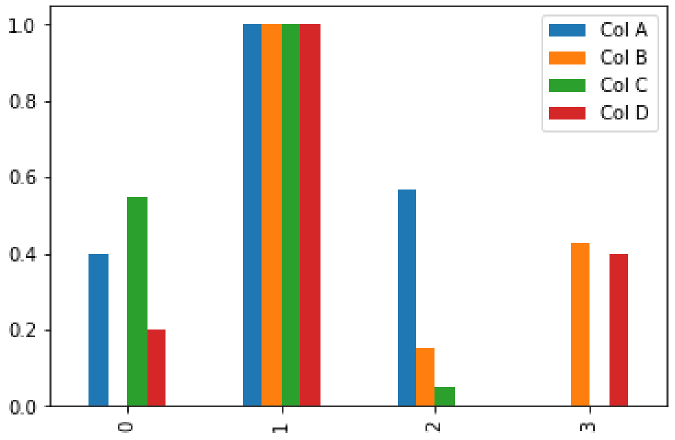
	Col A	Col B	Col C	Col D
0	0.400000	0.000000	0.545455	0.2
1	1.000000	1.000000	1.000000	1.0
2	0.566667	0.150943	0.050505	0.0
3	0.000000	0.427673	0.000000	0.4

In [7]:

```
df_min_max_scaled.plot(kind = 'bar')
```

Out[7]:

```
<AxesSubplot:>
```



In [8]:

```
df_z_scaled = df.copy()

for column in df_z_scaled.columns:
    df_z_scaled[column] = (df_z_scaled[column]-df_z_scaled[column].mean())/df_z_scaled[column].std()

display(df_z_scaled)
```

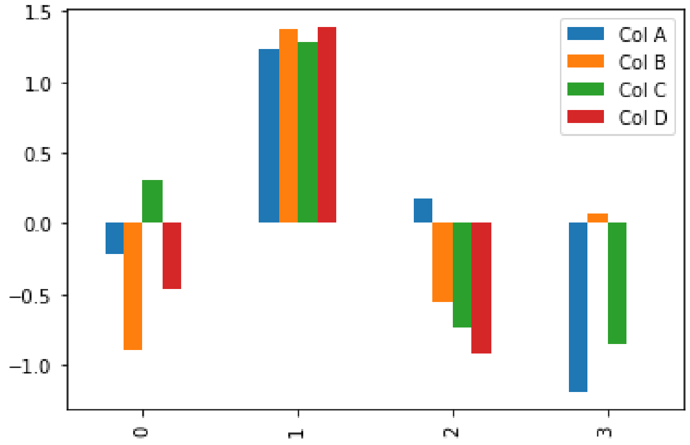
	Col A	Col B	Col C	Col D
0	-0.221422	-0.895492	0.311486	-0.46291
1	1.227884	1.373564	1.278167	1.38873
2	0.181163	-0.552993	-0.741122	-0.92582
3	-1.187625	0.074922	-0.848531	0.00000

In [12]:

```
df_z_scaled.plot(kind = 'bar')
```

Out[12]:

```
<AxesSubplot:>
```



In [ ]:

```

```

1. **Turn categorical variables into quantitative variables in Python**

In [13]:

```
d = {'col1': [1, 2], 'col2': [3, 4]}
df = pd.DataFrame(data=d)
df.dtypes
```

Out[13]:

```
col1    int64
col2    int64
dtype: object
```

In [14]:

```
df.astype('int32').dtypes
```

Out[14]:

```
col1    int32
col2    int32
dtype: object
```

In [15]:

```
df.astype({'col1': 'int32'}).dtypes
```

Out[15]:

```
col1    int32
col2    int64
dtype: object
```

In [18]:

```
ser = pd.Series([1, 2], dtype='int32')
ser
```

Out[18]:

```
0    1
1    2
dtype: int32
```

In [19]:

```
ser.astype('int64')
```

Out[19]:

```
0    1
1    2
dtype: int64
```

In [20]:

```
ser.astype('category')
```

Out[20]:

```
0    1
1    2
dtype: category
Categories (2, int64): [1, 2]
```

In [21]:

```
from pandas.api.types import CategoricalDtype
cat_dtype = CategoricalDtype(categories=[2, 1], ordered=True)
ser.astype(cat_dtype)
```

Out[21]:

```
0    1
1    2
dtype: category
Categories (2, int64): [2 < 1]
```

In [22]:

```
s1 = pd.Series([1, 2])
```

```
s1 = pd.Series([1, 2])
s2 = s1.astype('int64', copy=False)
s2[0] = 10
s1
```

Out[22]:

```
0    10
1     2
dtype: int64
```

In [23]:

```
ser_date = pd.Series(pd.date_range('20200101', periods=3))
ser_date
```

Out[23]:

```
0   2020-01-01
1   2020-01-02
2   2020-01-03
dtype: datetime64[ns]
```

In [40]:

```
path = "C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\sales_data_types.csv"
df = pd.read_csv(path)
df
```

Out[40]:

	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active
0	10002.0	Quest Industries	$125,000.00	$162500.00	30.00%	500	1	10	2015	Y
1	552278.0	Smith Plumbing	$920,000.00	$101,2000.00	10.00%	700	6	15	2014	Y
2	23477.0	ACME Industrial	$50,000.00	$62500.00	25.00%	125	3	29	2016	Y
3	24900.0	Brekke LTD	$350,000.00	$490000.00	4.00%	75	10	27	2015	Y
4	651029.0	Harbor Co	$15,000.00	$12750.00	-15.00%	Closed	2	2	2014	N

In [4]:

```
df['2016']+df['2017']
```

Out[4]:

```
0      $125,000.00$162500.00
1    $920,000.00$101,2000.00
2        $50,000.00$62500.00
3      $350,000.00$490000.00
4        $15,000.00$12750.00
dtype: object
```

In [6]:

```
df.dtypes
```

Out[6]:

```
Customer Number    float64
Customer Name       object
2016                object
2017                object
Percent Growth      object
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active              object
dtype: object
```

In [7]:

In [7]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5 entries, 0 to 4
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   Customer Number  5 non-null      float64
 1   Customer Name    5 non-null      object 
 2   2016             5 non-null      object 
 3   2017             5 non-null      object 
 4   Percent Growth   5 non-null      object 
 5   Jan Units        5 non-null      object 
 6   Month            5 non-null      int64  
 7   Day              5 non-null      int64  
 8   Year             5 non-null      int64  
 9   Active           5 non-null      object 
dtypes: float64(1), int64(3), object(6)
memory usage: 528.0+ bytes
```

In [8]:

```
df['Customer Number'].astype('int')
```

Out[8]:

```
0     10002
1    552278
2     23477
3     24900
4    651029
Name: Customer Number, dtype: int32
```

In [29]:

```
df['Customer Number'] = df['Customer Number'].astype('int')
df.dtypes
```

Out[29]:

```
Customer Number      int32
Customer Name       object
2016               float64
2017               float64
Percent Growth      object
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active                bool
dtype: object
```

In [13]:

```
df['2016'].astype('float')
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-13-999869d577b0> in <module>
----> 1 df['2016'].astype('float')

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\generic.py in astype(self, dtype
, copy, errors)
   5875         else:
   5876             # else, only a single dtype is given
-> 5877             new_data = self._mgr.astype(dtype=dtype, copy=copy, errors=errors)
   5878             return self._constructor(new_data).__finalize__(self, method="astype
")
   5879 

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in astype(
self, dtype, copy, errors)
```

```
    629         self, dtype, copy: bool = False, errors: str = "raise"
    630     ) -> "BlockManager":
--> 631         return self.apply("astype", dtype=dtype, copy=copy, errors=errors)
    632 
    633     def convert(

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in apply(s
elf, f, align_keys, ignore_failures, **kwargs)
    425                     applied = b.apply(f, **kwargs)
    426                 else:
--> 427                     applied = getattr(b, f)(**kwargs)
    428             except (TypeError, NotImplementedError):
    429                 if not ignore_failures:

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\blocks.py in astype(se
lf, dtype, copy, errors)
    671             vals1d = values.ravel()
    672             try:
--> 673                 values = astype_nansafe(vals1d, dtype, copy=True)
    674             except (ValueError, TypeError):
    675                 # e.g. astype_nansafe can fail on object-dtype of strings

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\dtypes\cast.py in astype_nansafe
(arr, dtype, copy, skipna)
   1095     if copy or is_object_dtype(arr) or is_object_dtype(dtype):
   1096         # Explicit copy, or required since NumPy can't view from / to object.
-> 1097         return arr.astype(dtype, copy=True)
   1098 
   1099     return arr.view(dtype)

ValueError: could not convert string to float: '$125,000.00'
```

In [14]:

```
df['Jan Units'].astype('int')
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-14-31333711e4a4> in <module>
----> 1 df['Jan Units'].astype('int')

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\generic.py in astype(self, dtype
, copy, errors)
   5875         else:
   5876             # else, only a single dtype is given
-> 5877             new_data = self._mgr.astype(dtype=dtype, copy=copy, errors=errors)
   5878             return self._constructor(new_data).__finalize__(self, method="astype
")
   5879 

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in astype(
self, dtype, copy, errors)
    629         self, dtype, copy: bool = False, errors: str = "raise"
    630     ) -> "BlockManager":
--> 631         return self.apply("astype", dtype=dtype, copy=copy, errors=errors)
    632 
    633     def convert(

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\managers.py in apply(s
elf, f, align_keys, ignore_failures, **kwargs)
    425                     applied = b.apply(f, **kwargs)
    426                 else:
--> 427                     applied = getattr(b, f)(**kwargs)
    428             except (TypeError, NotImplementedError):
    429                 if not ignore_failures:

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\internals\blocks.py in astype(se
lf, dtype, copy, errors)
    671             vals1d = values.ravel()
    672             try:
--> 673                 values = astype_nansafe(vals1d, dtype, copy=True)
    674             except (ValueError, TypeError):
```

```
    675                 # e.g. astype_nansafe can fail on object-dtype of strings

D:\Program Files\Anaconda3\lib\site-packages\pandas\core\dtypes\cast.py in astype_nansafe
(arr, dtype, copy, skipna)
   1072         # work around NumPy brokenness, #1987
   1073         if np.issubdtype(dtype.type, np.integer):
-> 1074             return lib.astype_intsafe(arr.ravel(), dtype).reshape(arr.shape)
   1075 
   1076         # if we have a datetime/timedelta array of objects

pandas\_libs\lib.pyx in pandas._libs.lib.astype_intsafe()

ValueError: invalid literal for int() with base 10: 'Closed'
```

In [15]:

```
df['Active'].astype('bool')
```

Out[15]:

```
0    True
1    True
2    True
3    True
4    True
Name: Active, dtype: bool
```

In [16]:

```
df
```

Out[16]:

	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active
0	10002	Quest Industries	$125,000.00	$162500.00	30.00%	500	1	10	2015	Y
1	552278	Smith Plumbing	$920,000.00	$101,2000.00	10.00%	700	6	15	2014	Y
2	23477	ACME Industrial	$50,000.00	$62500.00	25.00%	125	3	29	2016	Y
3	24900	Brekke LTD	$350,000.00	$490000.00	4.00%	75	10	27	2015	Y
4	651029	Harbor Co	$15,000.00	$12750.00	-15.00%	Closed	2	2	2014	N

In [45]:

```
def convert_currency(val):
    new_val = val.replace(',','').replace('$','')
    return float(new_val)
```

In [18]:

```
df['2016'].apply(convert_currency)
```

Out[18]:

```
0    125000.0
1    920000.0
2     50000.0
3    350000.0
4     15000.0
Name: 2016, dtype: float64
```

In [19]:

```
df['2016'].apply(lambda x: x.replace(',','').replace('$','')).astype('float')
```

Out[19]:

```
0    125000.0
1    920000.0
2     50000.0
3    350000.0
```

```
4     15000.0
Name: 2016, dtype: float64
```

In [24]:

```
df['2016'] = df['2016'].apply(convert_currency)
df['2017'] = df['2017'].apply(convert_currency)

df.dtypes
```

Out[24]:

```
Customer Number    float64
Customer Name       object
2016               float64
2017               float64
Percent Growth      object
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active              object
dtype: object
```

In [25]:

```
df['Percent Growth'].apply(lambda x: x.replace('%','')).astype('float')/100
```

Out[25]:

```
0    0.30
1    0.10
2    0.25
3    0.04
4   -0.15
Name: Percent Growth, dtype: float64
```

In [46]:

```
def convert_percent(val):
    new_val = val.replace('%','')
    return float(new_val)/100

df['Percent Growth'].apply(convert_percent)
```

Out[46]:

```
0    0.30
1    0.10
2    0.25
3    0.04
4   -0.15
Name: Percent Growth, dtype: float64
```

In [27]:

```
df['Active'] = np.where(df['Active'] == 'Y',True,False)
```

In [28]:

```
df
```

Out[28]:

	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active
0	10002.0	Quest Industries	125000.0	162500.0	30.00%	500	1	10	2015	True
1	552278.0	Smith Plumbing	920000.0	1012000.0	10.00%	700	6	15	2014	True
2	23477.0	ACME Industrial	50000.0	62500.0	25.00%	125	3	29	2016	True
3	24900.0	Brekke LTD	350000.0	490000.0	4.00%	75	10	27	2015	True

	Customer Number	Customer Name	2016	2017	Percent Growth	Jan Units	Month	Day	Year	Active
4	651029.0	Harbor Co	15000.0	12750.0	-15.00%	Closed	2	2	2014	False

In [30]:

```
df.dtypes
```

Out[30]:

```
Customer Number      int32
Customer Name       object
2016               float64
2017               float64
Percent Growth      object
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active                bool
dtype: object
```

In [31]:

```
pd.to_numeric(df['Jan Units'], errors='coerce')
```

Out[31]:

```
0    500.0
1    700.0
2    125.0
3     75.0
4      NaN
Name: Jan Units, dtype: float64
```

In [32]:

```
pd.to_numeric(df['Jan Units'], errors='coerce').fillna(0)
```

Out[32]:

```
0    500.0
1    700.0
2    125.0
3     75.0
4      0.0
Name: Jan Units, dtype: float64
```

In [33]:

```
pd.to_datetime(df[['Month','Day','Year']])
```

Out[33]:

```
0   2015-01-10
1   2014-06-15
2   2016-03-29
3   2015-10-27
4   2014-02-02
dtype: datetime64[ns]
```

In [34]:

```
df['Jan Units'] = pd.to_numeric(df['Jan Units'], errors='coerce')
df['Start Date'] = pd.to_datetime(df[['Month','Day','Year']])

df.dtypes
```

Out[34]:

```
Customer Number             int32
Customer Name              object
2016                      float64
2017                      float64
Percent Growth             object
Jan Units                 float64
Jan Units                  float64
Month                        int64
Day                          int64
Year                         int64
Active                        bool
Start Date          datetime64[ns]
dtype: object
```

In [64]:

```
df_2 = pd.read_csv("C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\sales_data_ty
pes.csv",
                   dtype={'Customer Number' : 'int'},
                   converters={'2016' : convert_currency,
                               '2017' : convert_currency,
                               'Percent Growth' : convert_percent,
                               'Jan Units' : lambda x: pd.to_numeric(df['Jan Units'], e
rrors='coerce').fillna(0),
                               'Active' : lambda x: np.where(df['Active'] == 'Y',True,Fa
lse)
                              }
                  )

df_2.dtypes
```

Out[64]:

```
Customer Number      int32
Customer Name       object
2016               float64
2017               float64
Percent Growth     float64
Jan Units           object
Month                int64
Day                  int64
Year                 int64
Active              object
dtype: object
```

In [5]:

```
dictionary = {'OUTLOOK' : ['Rainy', 'Rainy',
                           'Overcast', 'Sunny',
                           'Sunny', 'Sunny',
                           'Overcast', 'Rainy',
                           'Rainy', 'Sunny',
                           'Rainy', 'Overcast',
                           'Overcast', 'Sunny'],
              'TEMPERATURE' : ['Hot', 'Hot',
                              'Hot', 'Mild',
                              'Cool', 'Cool',
                              'Cool', 'Mild',
                              'Cool', 'Mild',
                              'Mild', 'Mild',
                              'Hot', 'Mild'],
              'HUMIDITY': ['High', 'High', 'High',
                           'High', 'Normal', 'Normal',
                           'Normal', 'High', 'Normal',
                           'Normal', 'Normal', 'High',
                           'Normal', 'High'],
              'WINDY': ['No', 'Yes', 'No', 'No',
                        'No','Yes', 'Yes', 'No',
                        'No', 'No', 'Yes', 'Yes',
                        'No','Yes']
             }

df = pd.DataFrame(dictionary)

df
```

Out[5]:

	OUTLOOK	TEMPERATURE	HUMIDITY	WINDY
0	Rainy	Hot	High	No
1	Rainy	Hot	High	Yes
2	Overcast	Hot	High	No
3	Sunny	Mild	High	No
4	Sunny	Cool	Normal	No
5	Sunny	Cool	Normal	Yes
6	Overcast	Cool	Normal	Yes
7	Rainy	Mild	High	No
8	Rainy	Cool	Normal	No
9	Sunny	Mild	Normal	No
10	Rainy	Mild	Normal	Yes
11	Overcast	Mild	High	Yes
12	Overcast	Hot	Normal	No
13	Sunny	Mild	High	Yes

In [66]:

```
df2 = df.copy()
df2 = pd.get_dummies(df2, columns = ['WINDY', 'OUTLOOK'])
df2
```

Out[66]:

	TEMPERATURE	HUMIDITY	WINDY_No	WINDY_Yes	OUTLOOK_Overcast	OUTLOOK_Rainy	OUTLOOK_Sunny
0	Hot	High	1	0	0	1	0
1	Hot	High	0	1	0	1	0
2	Hot	High	1	0	1	0	0
3	Mild	High	1	0	0	0	1
4	Cool	Normal	1	0	0	0	1
5	Cool	Normal	0	1	0	0	1
6	Cool	Normal	0	1	1	0	0
7	Mild	High	1	0	0	1	0
8	Cool	Normal	1	0	0	1	0
9	Mild	Normal	1	0	0	0	1
10	Mild	Normal	0	1	0	1	0
11	Mild	High	0	1	1	0	0
12	Hot	Normal	1	0	1	0	0
13	Mild	High	0	1	0	0	1

In [68]:

```
from sklearn.preprocessing import LabelBinarizer

df3 = df.copy()
label_binarizer = LabelBinarizer()
label_binarizer_output = label_binarizer.fit_transform(df3['TEMPERATURE'])
result_df = pd.DataFrame (label_binarizer_output, columns = label_binarizer.classes_)

display(result_df)
```

	Cool	Hot	Mild
0	0	1	0

	Cool	Hot	Mild
0	0	1	0
1	0	1	0
2	0	1	0
3	0	0	1
4	1	0	0
5	1	0	0
6	1	0	0
7	0	0	1
8	1	0	0
9	0	0	1
10	0	0	1
11	0	0	1
12	0	1	0
13	0	0	1

In [1]:

```
!pip install category_encoders
```

```
Collecting category_encoders
  Downloading category_encoders-2.3.0-py2.py3-none-any.whl (82 kB)
Requirement already satisfied: scikit-learn>=0.20.0 in d:\program files\anaconda3\lib\sit
e-packages (from category_encoders) (0.24.1)
Requirement already satisfied: patsy>=0.5.1 in d:\program files\anaconda3\lib\site-packag
es (from category_encoders) (0.5.1)
Requirement already satisfied: statsmodels>=0.9.0 in d:\program files\anaconda3\lib\site-
packages (from category_encoders) (0.12.2)
Requirement already satisfied: scipy>=1.0.0 in d:\program files\anaconda3\lib\site-packag
es (from category_encoders) (1.6.2)
Requirement already satisfied: pandas>=0.21.1 in d:\program files\anaconda3\lib\site-pack
ages (from category_encoders) (1.2.4)
Requirement already satisfied: numpy>=1.14.0 in d:\program files\anaconda3\lib\site-packa
ges (from category_encoders) (1.20.1)
Requirement already satisfied: pytz>=2017.3 in d:\program files\anaconda3\lib\site-packag
es (from pandas>=0.21.1->category_encoders) (2021.1)
Requirement already satisfied: python-dateutil>=2.7.3 in d:\program files\anaconda3\lib\s
ite-packages (from pandas>=0.21.1->category_encoders) (2.8.1)
Requirement already satisfied: six in d:\program files\anaconda3\lib\site-packages (from
patsy>=0.5.1->category_encoders) (1.15.0)
Requirement already satisfied: threadpoolctl>=2.0.0 in d:\program files\anaconda3\lib\sit
e-packages (from scikit-learn>=0.20.0->category_encoders) (2.1.0)
Requirement already satisfied: joblib>=0.11 in d:\program files\anaconda3\lib\site-packag
es (from scikit-learn>=0.20.0->category_encoders) (1.0.1)
Installing collected packages: category-encoders
Successfully installed category-encoders-2.3.0
```

In [6]:

```
import category_encoders as cat_encoder

df4 = df.copy()

encoder = cat_encoder.BinaryEncoder (cols = df4.columns)
df_category_encoder = encoder.fit_transform(df4)

display(df_category_encoder)
```

	OUTLOOK_0	OUTLOOK_1	TEMPERATURE_0	TEMPERATURE_1	HUMIDITY_0	HUMIDITY_1	WINDY_0	WINDY_1
0	0	1	0	1	0	1	0	1
1	0	1	0	1	0	1	1	0
2	1	0	0	1	0	1	0	1

	OUTLOOK_0	OUTLOOK_1	TEMPERATURE_0	TEMPERATURE_1	HUMIDITY_0	HUMIDITY_1	WINDY_0	WINDY_1
3	1	1	1	0	0	1	0	1
4	1	1	1	1	1	0	0	1
5	1	1	1	1	1	0	1	0
6	1	0	1	1	1	0	1	0
7	0	1	1	0	0	1	0	1
8	0	1	1	1	1	0	0	1
9	1	1	1	0	1	0	0	1
10	0	1	1	0	1	0	1	0
11	1	0	1	0	0	1	1	0
12	1	0	0	1	1	0	0	1
13	1	1	1	0	0	1	1	0

Missing Values

In [1]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np
```

In [3]:

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
        'Second Score': [30, 45, 56, np.nan],
        'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from list
df = pd.DataFrame(dict)

print(df,"\n")
# using isnull() function
df.isnull()
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[3]:

	First Score	Second Score	Third Score
0	False	False	True
1	False	False	False
2	True	False	False
3	False	True	False

In [5]:

```
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\employees.csv"
df = pd.read_csv(path)
print(df)
```

```
    First Name  Gender  Start Date Last Login Time  Salary  Bonus %  \
0      Douglas    Male    8/6/1993        12:42 PM   97308    6.945
1       Thomas    Male   3/31/1996         6:53 AM   61933    4.170
2        Maria  Female   4/23/1993        11:17 AM  130590   11.858
3        Jerry    Male    3/4/2005         1:00 PM  138705    9.340
4        Larry    Male   1/24/1998         4:47 PM  101004    1.389
..         ...     ...         ...             ...     ...      ...
995      Henry     NaN  11/23/2014         6:09 AM  132483   16.655
996    Phillip    Male   1/31/1984         6:30 AM   42392   19.675
997    Russell    Male   5/20/2013        12:39 PM   96914    1.421
998      Larry    Male   4/20/2013         4:45 PM   60500   11.985
999     Albert    Male   5/15/2012         6:24 PM  129949   10.169

    Senior Management                  Team
0                True             Marketing
1                True                   NaN
2               False               Finance
3                True               Finance
4                True       Client Services
```

```
..             ...             ...
995          False    Distribution
996          False         Finance
997          False         Product
998          False  Business Development
999           True           Sales

[1000 rows x 8 columns]
```

In [6]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   First Name         933 non-null    object 
 1   Gender             855 non-null    object 
 2   Start Date         1000 non-null   object 
 3   Last Login Time    1000 non-null   object 
 4   Salary             1000 non-null   int64  
 5   Bonus %            1000 non-null   float64
 6   Senior Management  933 non-null    object 
 7   Team               957 non-null    object 
dtypes: float64(1), int64(1), object(6)
memory usage: 62.6+ KB
```

In [7]:

```
df.describe()
```

Out[7]:

	Salary	Bonus %
count	1000.000000	1000.000000
mean	90662.181000	10.207555
std	32923.693342	5.528481
min	35013.000000	1.015000
25%	62613.000000	5.401750
50%	90428.000000	9.838500
75%	118740.250000	14.838000
max	149908.000000	19.944000

In [8]:

```
# creating bool series True for NaN values
bool_series = pd.isnull(df["Gender"])

# filtering data
# displaying data only with Gender = NaN
df[bool_series]
```

Out[8]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
20	Lois	NaN	4/22/1995	7:18 PM	64714	4.934	True	Legal
22	Joshua	NaN	3/8/2012	1:58 AM	90816	18.816	True	Client Services
27	Scott	NaN	7/11/1991	6:58 PM	122367	5.218	False	Legal
31	Joyce	NaN	2/20/2005	2:40 PM	88657	12.752	False	Product
41	Christine	NaN	6/28/2015	1:08 AM	66582	11.308	True	Business Development
...	...	...	...	...	...	...	...	...

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
...	...	...	...	...	...	...	...	...
961	Antonio	NaN	6/18/1989	9:37 PM	103050	3.050	False	Legal
972	Victor	NaN	7/28/2006	2:49 PM	76381	11.159	True	Sales
985	Stephen	NaN	7/10/1983	8:10 PM	85668	1.909	False	Legal
989	Justin	NaN	2/10/1991	4:58 PM	38344	3.794	False	Legal
995	Henry	NaN	11/23/2014	6:09 AM	132483	16.655	False	Distribution

145 rows × 8 columns

In [11]:

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
        'Second Score': [30, 45, 56, np.nan],
        'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe using dictionary
df = pd.DataFrame(dict)

# using notnull() function
df.notnull()
```

Out[11]:

	First Score	Second Score	Third Score
0	True	True	False
1	True	True	True
2	False	True	True
3	True	False	True

In [12]:

```
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\employees.csv"
df = pd.read_csv(path)
# creating bool series True for NaN values
bool_series = pd.notnull(df["Gender"])

# filtering data
# displayind data only with Gender = Not NaN
df[bool_series]
```

Out[12]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing
1	Thomas	Male	3/31/1996	6:53 AM	61933	4.170	True	NaN
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
...	...	...	...	...	...	...	...	...
994	George	Male	6/21/2013	5:47 PM	98874	4.479	True	Marketing
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

855 rows × 8 columns

In [13]:

In [13]:

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
        'Second Score': [30, 45, 56, np.nan],
        'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)
print(df)
# filling missing value using fillna()
df.fillna(0)
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[13]:

	First Score	Second Score	Third Score
0	100.0	30.0	0.0
1	90.0	45.0	40.0
2	0.0	56.0	80.0
3	95.0	0.0	98.0

In [1]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
  'Second Score': [30, 45, 56, np.nan],
  'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)
print(df)
# filling a missing value with
# previous ones
df.fillna(method ='pad')
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[1]:

	First Score	Second Score	Third Score
0	100.0	30.0	NaN
1	90.0	45.0	40.0
2	90.0	56.0	80.0
3	95.0	56.0	98.0

In [2]:

```
# importing pandas as pd
import pandas as pd
```

```
# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
  'Second Score': [30, 45, 56, np.nan],
  'Third Score':[np.nan, 40, 80, 98]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)
print(df)
# filling null value using fillna() function
df.fillna(method ='bfill')
```

```
   First Score  Second Score  Third Score
0        100.0          30.0          NaN
1         90.0          45.0         40.0
2          NaN          56.0         80.0
3         95.0           NaN         98.0
```

Out[2]:

	First Score	Second Score	Third Score
0	100.0	30.0	40.0
1	90.0	45.0	40.0
2	95.0	56.0	80.0
3	95.0	NaN	98.0

In [3]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\  \\DBDA\\Data Set\\employees.csv"
df = pd.read_csv(path)
# Printing the first 10 to 24 rows of
# the data frame for visualization
df[10:25]
```

Out[3]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
10	Louise	Female	8/12/1980	9:01 AM	63241	15.132	True	NaN
11	Julie	Female	10/26/1997	3:19 PM	102508	12.637	True	Legal
12	Brandon	Male	12/1/1980	1:08 AM	112807	17.492	True	Human Resources
13	Gary	Male	1/27/2008	11:40 PM	109831	5.831	False	Sales
14	Kimberly	Female	1/14/1999	7:13 AM	41426	14.543	True	Finance
15	Lillian	Female	6/5/2016	6:09 AM	59414	1.256	False	Product
16	Jeremy	Male	9/21/2010	5:56 AM	90370	7.369	False	Human Resources
17	Shawn	Male	12/7/1986	7:45 PM	111737	6.414	False	Product
18	Diana	Female	10/23/1981	10:27 AM	132940	19.082	False	Client Services
19	Donna	Female	7/22/2010	3:48 AM	81014	1.894	False	Product
20	Lois	NaN	4/22/1995	7:18 PM	64714	4.934	True	Legal
21	Matthew	Male	9/5/1995	2:12 AM	100612	13.645	False	Marketing
22	Joshua	NaN	3/8/2012	1:58 AM	90816	18.816	True	Client Services
23	NaN	Male	6/14/2012	4:19 PM	125792	5.042	NaN	NaN
24	John	Male	7/1/1992	10:08 PM	97950	13.873	False	Client Services

In [5]:

```
df["Gender"].fillna("No Gender", inplace = True)
```

```
df
```

Out[5]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing
1	Thomas	Male	3/31/1996	6:53 AM	61933	4.170	True	NaN
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
...	...	...	...	...	...	...	...	...
995	Henry	No Gender	11/23/2014	6:09 AM	132483	16.655	False	Distribution
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

1000 rows × 8 columns

In [6]:

```
df[10:25]
```

Out[6]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
10	Louise	Female	8/12/1980	9:01 AM	63241	15.132	True	NaN
11	Julie	Female	10/26/1997	3:19 PM	102508	12.637	True	Legal
12	Brandon	Male	12/1/1980	1:08 AM	112807	17.492	True	Human Resources
13	Gary	Male	1/27/2008	11:40 PM	109831	5.831	False	Sales
14	Kimberly	Female	1/14/1999	7:13 AM	41426	14.543	True	Finance
15	Lillian	Female	6/5/2016	6:09 AM	59414	1.256	False	Product
16	Jeremy	Male	9/21/2010	5:56 AM	90370	7.369	False	Human Resources
17	Shawn	Male	12/7/1986	7:45 PM	111737	6.414	False	Product
18	Diana	Female	10/23/1981	10:27 AM	132940	19.082	False	Client Services
19	Donna	Female	7/22/2010	3:48 AM	81014	1.894	False	Product
20	Lois	No Gender	4/22/1995	7:18 PM	64714	4.934	True	Legal
21	Matthew	Male	9/5/1995	2:12 AM	100612	13.645	False	Marketing
22	Joshua	No Gender	3/8/2012	1:58 AM	90816	18.816	True	Client Services
23	NaN	Male	6/14/2012	4:19 PM	125792	5.042	NaN	NaN
24	John	Male	7/1/1992	10:08 PM	97950	13.873	False	Client Services

In [7]:

```
df.replace(to_replace = np.nan, value = -99)
```

Out[7]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
1	Thomas	Male	3/31/1996	6:53 AM	61933	4.170	True	-99
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
...	...	...	...	...	...	...	...	...
995	Henry	No Gender	11/23/2014	6:09 AM	132483	16.655	False	Distribution
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

1000 rows × 8 columns

In [8]:

```
import pandas as pd

# Creating the dataframe
df = pd.DataFrame({"A":[12, 4, 5, None, 1],
    "B":[None, 2, 54, 3, None],
    "C":[20, 16, None, 3, 8],
    "D":[14, 3, None, None, 6]})

# Print the dataframe
df
```

Out[8]:

	A	B	C	D
0	12.0	NaN	20.0	14.0
1	4.0	2.0	16.0	3.0
2	5.0	54.0	NaN	NaN
3	NaN	3.0	3.0	NaN
4	1.0	NaN	8.0	6.0

In [9]:

```
df.interpolate(method ='linear', limit_direction ='forward')
```

Out[9]:

	A	B	C	D
0	12.0	NaN	20.0	14.0
1	4.0	2.0	16.0	3.0
2	5.0	54.0	9.5	4.0
3	3.0	3.0	3.0	5.0
4	1.0	3.0	8.0	6.0

In [10]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np
```

```
# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
  'Second Score': [30, np.nan, 45, 56],
  'Third Score':[52, 40, 80, 98],
  'Fourth Score':[np.nan, np.nan, np.nan, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

df
```

Out[10]:

	First Score	Second Score	Third Score	Fourth Score
0	100.0	30.0	52	NaN
1	90.0	NaN	40	NaN
2	NaN	45.0	80	NaN
3	95.0	56.0	98	65.0

In [11]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, 90, np.nan, 95],
  'Second Score': [30, np.nan, 45, 56],
  'Third Score':[52, 40, 80, 98],
  'Fourth Score':[np.nan, np.nan, np.nan, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

# using dropna() function
df.dropna()
```

Out[11]:

	First Score	Second Score	Third Score	Fourth Score
3	95.0	56.0	98	65.0

In [12]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
  'Second Score': [30, np.nan, 45, 56],
  'Third Score':[52, np.nan, 80, 98],
  'Fourth Score':[np.nan, np.nan, np.nan, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

df
```

Out[12]:

	First Score	Second Score	Third Score	Fourth Score

	First Score	Second Score	Third Score	Fourth Score
0	100.0	30.0	52.0	NaN
1	NaN	NaN	NaN	NaN
2	NaN	45.0	80.0	NaN
3	95.0	56.0	98.0	65.0

In [14]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
  'Second Score': [30, np.nan, 45, 56],
  'Third Score':[52, np.nan, 80, 98],
  'Fourth Score':[np.nan, np.nan, np.nan, 65]}

df = pd.DataFrame(dict)

# using dropna() function
df.dropna(how = 'all')
```

Out[14]:

	First Score	Second Score	Third Score	Fourth Score
0	100.0	30.0	52.0	NaN
2	NaN	45.0	80.0	NaN
3	95.0	56.0	98.0	65.0

In [15]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
  'Second Score': [30, np.nan, 45, 56],
  'Third Score':[52, np.nan, 80, 98],
  'Fourth Score':[60, 67, 68, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

df
```

Out[15]:

	First Score	Second Score	Third Score	Fourth Score
0	100.0	30.0	52.0	60
1	NaN	NaN	NaN	67
2	NaN	45.0	80.0	68
3	95.0	56.0	98.0	65

In [16]:

```
# importing pandas as pd
import pandas as pd

# importing numpy as np
```

```
import numpy as np

# dictionary of lists
dict = {'First Score':[100, np.nan, np.nan, 95],
  'Second Score': [30, np.nan, 45, 56],
  'Third Score':[52, np.nan, 80, 98],
  'Fourth Score':[60, 67, 68, 65]}

# creating a dataframe from dictionary
df = pd.DataFrame(dict)

# using dropna() function
df.dropna(axis = 1)
```

Out[16]:

	Fourth Score
0	60
1	67
2	68
3	65

In [17]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\employees.csv"
data = pd.read_csv(path)

# making new data frame with dropped NA values
new_data = data.dropna(axis = 0, how ='any')

new_data
```

Out[17]:

	First Name	Gender	Start Date	Last Login Time	Salary	Bonus %	Senior Management	Team
0	Douglas	Male	8/6/1993	12:42 PM	97308	6.945	True	Marketing
2	Maria	Female	4/23/1993	11:17 AM	130590	11.858	False	Finance
3	Jerry	Male	3/4/2005	1:00 PM	138705	9.340	True	Finance
4	Larry	Male	1/24/1998	4:47 PM	101004	1.389	True	Client Services
5	Dennis	Male	4/18/1987	1:35 AM	115163	10.125	False	Legal
...	...	...	...	...	...	...	...	...
994	George	Male	6/21/2013	5:47 PM	98874	4.479	True	Marketing
996	Phillip	Male	1/31/1984	6:30 AM	42392	19.675	False	Finance
997	Russell	Male	5/20/2013	12:39 PM	96914	1.421	False	Product
998	Larry	Male	4/20/2013	4:45 PM	60500	11.985	False	Business Development
999	Albert	Male	5/15/2012	6:24 PM	129949	10.169	True	Sales

764 rows × 8 columns

In [18]:

```
print("Old data frame length:", len(data))
print("New data frame length:", len(new_data))
print("Number of rows with at least 1 NA value: ", (len(data)-len(new_data)))
```

```
Old data frame length: 1000
New data frame length: 764
Number of rows with at least 1 NA value:  236
```

In [19]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [20]:

```
df.shape
```

Out[20]:

```
(100, 5)
```

In [21]:

```
print(df.isnull().sum())
```

```
Rollno     0
Marks      0
Gender     0
Age       16
PhD       13
dtype: int64
```

In [22]:

```
df.dropna(inplace=True)
print(df.isnull().sum())
```

```
Rollno    0
Marks     0
Gender    0
Age       0
PhD       0
dtype: int64
```

In [24]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [25]:

```
df["Age"] = df["Age"].replace(np.NaN,df["Age"].mean())
print(df["Age"][:10])
```

```
0    47.000000
1    65.000000
2    56.000000
3    23.000000
4    47.821429
5    27.000000
6    53.000000
7    47.821429
8    44.000000
9    63.000000
Name: Age, dtype: float64
```

In [26]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [28]:

```
df["Age"] = df["Age"].replace(np.NaN,df["Age"].median())
print(df["Age"][:10])
```

```
0    47.0
1    65.0
2    56.0
3    23.0
4    50.0
5    27.0
6    53.0
7    50.0
8    44.0
9    63.0
Name: Age, dtype: float64
```

In [29]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
```

```
96       97  152.0       1  56.0  Yes
97       98    1.8       1  28.0   No
98       99   35.0       0  44.0  NaN
99      100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [30]:

```
import statistics
df["Age"] = df["Age"].replace(np.NaN, statistics.mode(df["Age"]))
print(df["Age"][:10])
```

```
0    47.0
1    65.0
2    56.0
3    23.0
4    65.0
5    27.0
6    53.0
7    65.0
8    44.0
9    63.0
Name: Age, dtype: float64
```

In [31]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
df = pd.read_csv(path)
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [32]:

```
df.isnull().sum()
```

Out[32]:

```
Rollno     0
Marks      0
Gender     0
Age       16
PhD       13
dtype: int64
```

In [33]:

```
df["PhD"] = df["PhD"].fillna('U')
df.isnull().sum()
```

Out[33]:

```
Rollno     0
Marks      0
Gender     0
Age       16
PhD        0
dtype: int64
```

```
dtype: int64
```

In [34]:

```
print(df)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0    U
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [35]:

```
import pandas as pd
path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
dataset = pd.read_csv(path)

#LOCF - last observation carried forward

dataset["Age"] = dataset["Age"].fillna(method ='ffill')

dataset.isnull().sum()

print(dataset)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0  23.0  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
97      98    1.8       1  28.0   No
98      99   35.0       0  44.0  NaN
99     100    4.0       0  24.0   No

[100 rows x 5 columns]
```

In [36]:

```
import pandas as pd
import numpy as np

path="C:\\Users\\OJUS\\OneDrive\\Desktop\\ \\DBDA\\Data Set\\AcademicPerformance.csv"
dataset = pd.read_csv(path)

#interpolation - linear

dataset["Age"] = dataset["Age"].interpolate(method='linear', limit_direction='forward',
axis=0)

print(dataset)

dataset.isnull().sum()
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0  25.0  Yes
```

```
4         5    80.0       0  25.0  Yes
..      ...     ...     ...   ...  ...
95       96    18.6       1  26.0   No
96       97   152.0       1  56.0  Yes
97       98     1.8       1  28.0   No
98       99    35.0       0  44.0  NaN
99      100     4.0       0  24.0   No

[100 rows x 5 columns]
```

Out[36]:

```
Rollno     0
Marks      0
Gender     0
Age        0
PhD       13
dtype: int64
```

In [37]:

```
#for knn imputation - we need to remove normalize the data and categorical data we need t
o convert
cat_variables = dataset[['PhD']]
cat_dummies = pd.get_dummies(cat_variables, drop_first=True)
cat_dummies.head()
dataset = dataset.drop(['PhD'], axis=1)
dataset = pd.concat([dataset, cat_dummies], axis=1)
dataset.head()

#removing unwanted features
dataset = dataset.drop(['Gender'], axis=1)
dataset.head()

#scaling mandatory before knn
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
dataset = pd.DataFrame(scaler.fit_transform(dataset), columns = dataset.columns)
dataset.head()

#knn imputer
from sklearn.impute import KNNImputer
imputer = KNNImputer(n_neighbors=3)
dataset = pd.DataFrame(imputer.fit_transform(dataset),columns = dataset.columns)

#checking for missing
dataset.isnull().sum()
```

Out[37]:

```
Rollno     0
Marks      0
Age        0
PhD_Yes    0
dtype: int64
```

In [2]:

```
import pandas as pd
import numpy as np

path="C:\\Users\\OJUS\\OneDrive\\Desktop\\  \\DBDA\\Data Set\\AcademicPerformance.csv"
dataset = pd.read_csv(path)
print(dataset)
```

```
    Rollno  Marks  Gender   Age  PhD
0        1  140.0       1  47.0  Yes
1        2   30.0       0  65.0  Yes
2        3   35.1       0  56.0   No
3        4   30.0       1  23.0   No
4        5   80.0       0   NaN  Yes
..     ...    ...     ...   ...  ...
95      96   18.6       1  26.0   No
96      97  152.0       1  56.0  Yes
```

```
96        97   152.0         1   56.0   Yes
97        98     1.8         1   28.0    No
98        99    35.0         0   44.0   NaN
99       100     4.0         0   24.0    No

[100 rows x 5 columns]
```

In [39]:

```
dataset["PhD"].isnull()
```

Out[39]:

```
0      False
1      False
2      False
3      False
4      False
       ...  
95     False
96     False
97     False
98      True
99     False
Name: PhD, Length: 100, dtype: bool
```

In [40]:

```
# Detecting numbers
cnt=0
for row in dataset['PhD']:
    try:
        int(row)
        dataset.loc[cnt, 'PhD']=np.nan
    except ValueError:
        pass
    cnt+=1
```

In [41]:

```
dataset["PhD"].isnull()
print(dataset)
```

```
    Rollno   Marks  Gender   Age  PhD
0        1   140.0       1  47.0  Yes
1        2    30.0       0  65.0  Yes
2        3    35.1       0  56.0   No
3        4    30.0       1  23.0   No
4        5    80.0       0   NaN  Yes
..     ...     ...     ...   ...  ...
95      96    18.6       1  26.0   No
96      97   152.0       1  56.0  Yes
97      98     1.8       1  28.0   No
98      99    35.0       0  44.0  NaN
99     100     4.0       0  24.0   No

[100 rows x 5 columns]
```

In [4]:

```
dataset.skew(axis=0)
```

Out[4]:

```
Rollno     0.000000
Marks      1.077026
Gender     0.000000
Age       -0.236916
dtype: float64
```

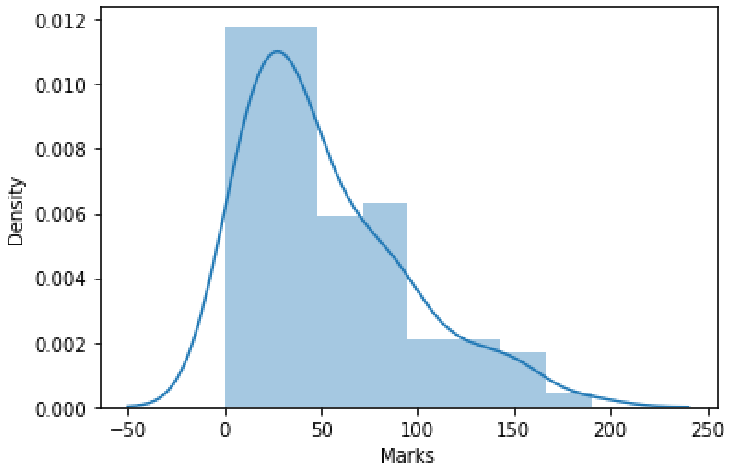
In [5]:

```
import seaborn as sn
import seaborn as sn
sn.distplot(dataset["Marks"])
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[5]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [6]:

```
np.log(1.077026)
```

Out[6]:

```
0.07420353901563533
```

In [7]:

```
log_Marks=np.log(dataset["Marks"])
```

In [8]:

```
log_Marks.head()
```

Out[8]:

```
0    4.941642
1    3.401197
2    3.558201
3    3.401197
4    4.382027
Name: Marks, dtype: float64
```

In [9]:

```
log_Marks.skew()
```

Out[9]:

```
-1.3980101345258154
```

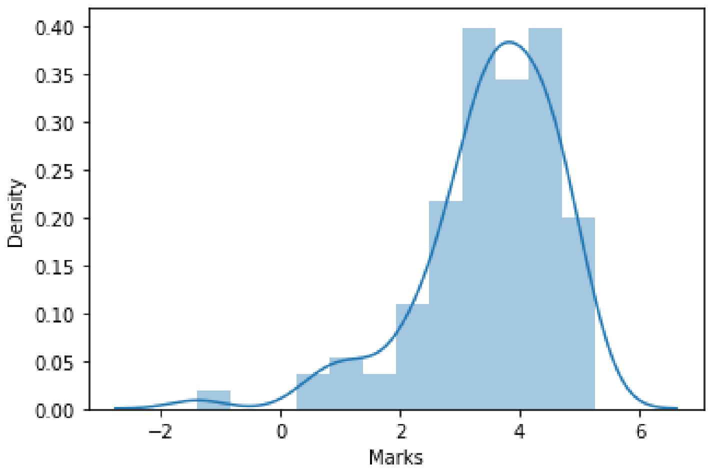
In [10]:

```
import seaborn as sn
sn.distplot(log_Marks)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[10]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [11]:

```
log_Marks_sq=np.sqrt(dataset["Marks"])
```

In [12]:

```
log_Marks_sq.head()
```

Out[12]:

```
0    11.832160
1     5.477226
2     5.924525
3     5.477226
4     8.944272
Name: Marks, dtype: float64
```

In [13]:

```
log_Marks_sq.skew()
```

Out[13]:

```
0.21202620353224017
```

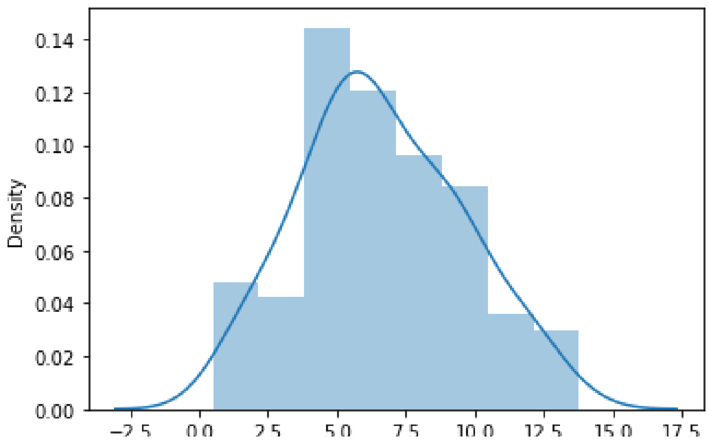
In [14]:

```
import seaborn as sn
sn.distplot(log_Marks_sq)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[14]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [15]:

```
log_Marks_cb=np.cbrt(dataset["Marks"])
```

In [16]:

```
log_Marks_cb.head()
```

Out[16]:

```
0    5.192494
1    3.107233
2    3.274179
3    3.107233
4    4.308869
Name: Marks, dtype: float64
```

In [17]:

```
log_Marks_cb.head()
```

Out[17]:

```
0    5.192494
1    3.107233
2    3.274179
3    3.107233
4    4.308869
Name: Marks, dtype: float64
```

In [18]:

```
log_Marks_cb.skew()
```

Out[18]:

```
-0.18525230594632391
```

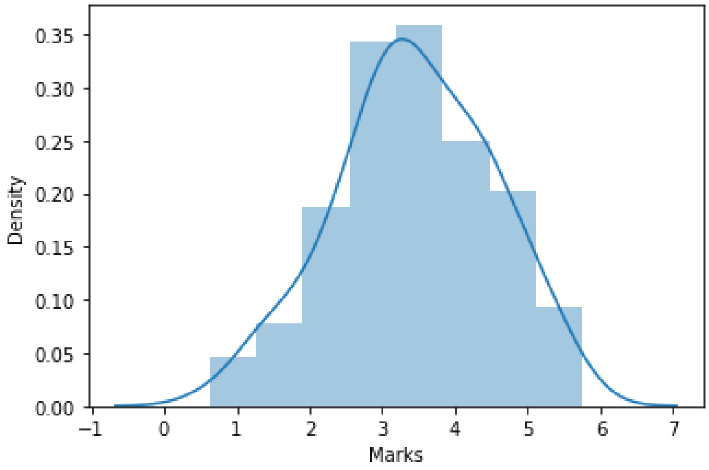
In [19]:

```
import seaborn as sn
sn.distplot(log_Marks_cb)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[19]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [21]:

```
Marks_reci=np.reciprocal(dataset["Marks"])
```

In [22]:

```
Marks_reci.head()
```

Out[22]:

```
0    0.007143
1    0.033333
2    0.028490
3    0.033333
4    0.012500
Name: Marks, dtype: float64
```

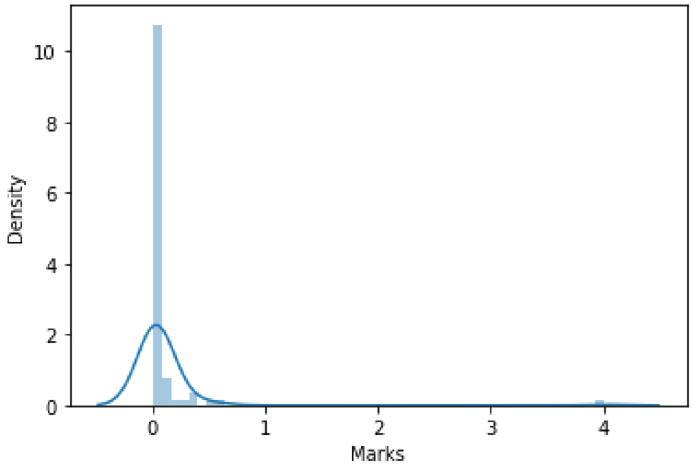
In [23]:

```
import seaborn as sn
sn.distplot(Marks_reci)
```

```
D:\Program Files\Anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning
: `distplot` is a deprecated function and will be removed in a future version. Please ada
pt your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[23]:

```
<AxesSubplot:xlabel='Marks', ylabel='Density'>
```



In [24]:

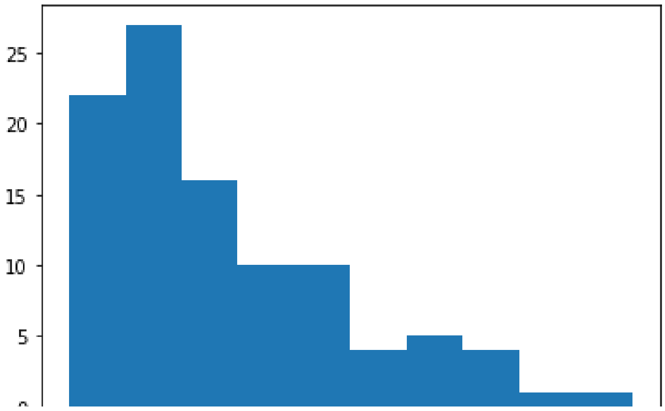
```
Marks_reci.skew()
```

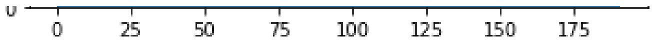
Out[24]:

```
9.14246062263327
```

In [25]:

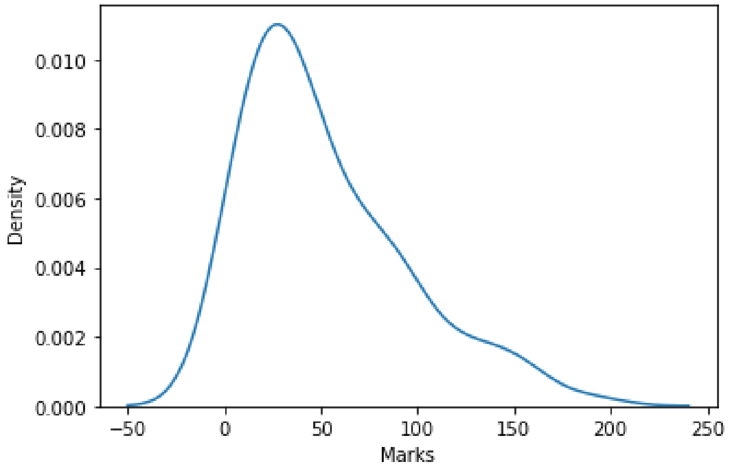
```
import matplotlib.pyplot as plt
his_Marks_cplt=plt.hist(dataset["Marks"])
```





In [26]:

```
plot_marks=sn.kdeplot(dataset["Marks"])
```



In [27]:

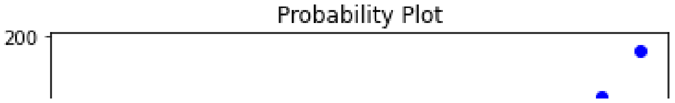
```
import scipy.stats as stats
import pylab
```

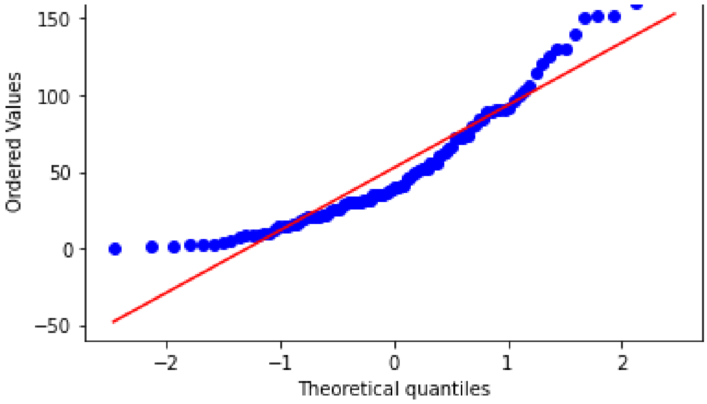
In [28]:

```
stats.probplot(dataset["Marks"],plot=pylab)
```

Out[28]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
         -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([  0.25,    1.7 ,    1.8 ,    2.5 ,    3.  ,    3.  ,    4.  ,    4.6 ,
           7.  ,    9.  ,    9.  ,    9.  ,    9.5 ,   10.  ,   12.  ,   14.7 ,
          15.  ,   15.  ,   15.2 ,   16.  ,   18.6 ,   19.  ,   20.  ,   20.  ,
          20.  ,   20.  ,   22.  ,   22.3 ,   24.  ,   25.  ,   25.  ,   25.8 ,
          28.  ,   28.6 ,   30.  ,   30.  ,   30.  ,   30.  ,   30.  ,   31.1 ,
          32.  ,   32.  ,   34.8 ,   35.  ,   35.  ,   35.  ,   35.1 ,   36.  ,
          38.  ,   38.8 ,   39.8 ,   40.  ,   40.7 ,   41.  ,   45.6 ,   46.  ,
          48.  ,   50.  ,   51.  ,   52.  ,   52.  ,   52.  ,   55.  ,   55.  ,
          55.  ,   60.  ,   62.  ,   63.  ,   65.  ,   66.  ,   72.  ,   72.  ,
          72.  ,   73.  ,   74.  ,   80.  ,   81.  ,   84.  ,   84.  ,   89.  ,
          89.  ,   90.  ,   90.  ,   90.  ,   92.  ,   96.  ,  100.  ,  102.  ,
         106.  ,  115.  ,  120.  ,  125.  ,  130.  ,  130.  ,  140.  ,  150.  ,
         152.  ,  152.  ,  160.  ,  190.  ])),
 (40.79054296233955, 52.52449999999999, 0.9515395328716016))
```





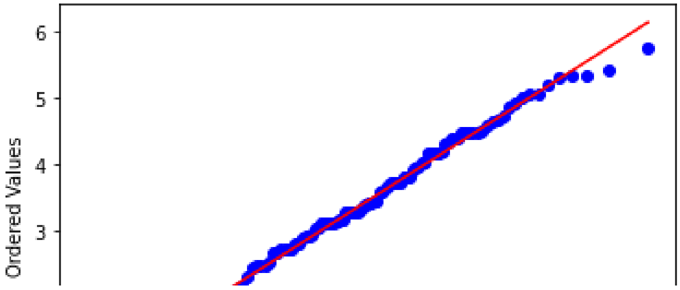
In [29]:

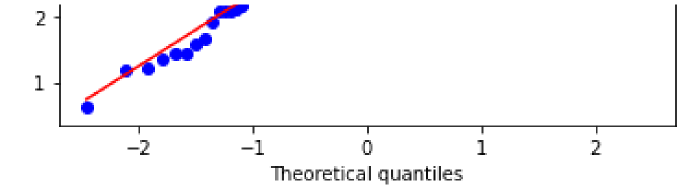
```
stats.probplot(log_Marks_cb,plot=pylab)
```

Out[29]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
         -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([0.62996052, 1.19348319, 1.2164404 , 1.35720881, 1.44224957,
         1.44224957, 1.58740105, 1.6631035 , 1.91293118, 2.08008382,
         2.08008382, 2.08008382, 2.11791179, 2.15443469, 2.28942849,
         2.44965982, 2.46621207, 2.46621207, 2.47712466, 2.5198421 ,
         2.64954306, 2.66840165, 2.71441762, 2.71441762, 2.71441762,
         2.71441762, 2.80203933, 2.81471841, 2.88449914, 2.92401774,
         2.92401774, 2.95488036, 3.03658897, 3.05812578, 3.10723251,
         3.10723251, 3.10723251, 3.10723251, 3.10723251, 3.14475486,
         3.1748021 , 3.1748021 , 3.2648238 , 3.27106631, 3.27106631,
         3.27106631, 3.27417865, 3.30192725, 3.36197541, 3.38540456,
         3.41424245, 3.41995189, 3.43978636, 3.44821724, 3.57263198,
         3.58304787, 3.63424119, 3.6840315 , 3.70842977, 3.73251116,
         3.73251116, 3.73251116, 3.80295246, 3.80295246, 3.80295246,
         3.91486764, 3.95789161, 3.97905721, 4.02072576, 4.04124002,
         4.16016765, 4.16016765, 4.16016765, 4.1793392 , 4.19833645,
         4.30886938, 4.32674871, 4.37951914, 4.37951914, 4.4647451 ,
         4.4647451 , 4.48140475, 4.48140475, 4.48140475, 4.51435744,
         4.57885697, 4.64158883, 4.67232873, 4.73262349, 4.86294413,
         4.93242415, 5.        , 5.06579702, 5.06579702, 5.1924941 ,
         5.31329285, 5.3368033 , 5.3368033 , 5.42883523, 5.74889708])),
 (1.0964930316814503, 3.441077741563151, 0.9963217176950497))
```

Probability Plot



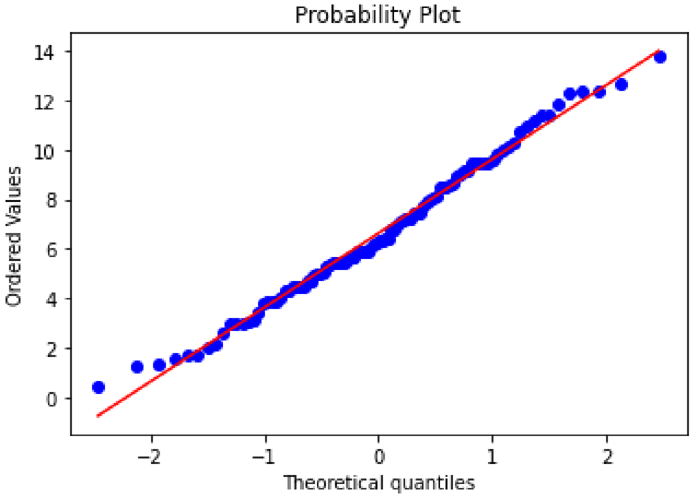


In [30]:

```
stats.probplot(log_Marks_sq,plot=pylab)
```

Out[30]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
         -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([ 0.5       ,  1.30384048,  1.34164079,  1.58113883,  1.73205081,
          1.73205081,  2.        ,  2.14476106,  2.64575131,  3.        ,
          3.        ,  3.        ,  3.082207  ,  3.16227766,  3.46410162,
          3.8340579 ,  3.87298335,  3.87298335,  3.89871774,  4.        ,
          4.31277173,  4.35889894,  4.47213595,  4.47213595,  4.47213595,
          4.47213595,  4.69041576,  4.72228758,  4.89897949,  5.        ,
          5.        ,  5.07937004,  5.29150262,  5.34789678,  5.47722558,
          5.47722558,  5.47722558,  5.47722558,  5.47722558,  5.5767374 ,
          5.65685425,  5.65685425,  5.89915248,  5.91607978,  5.91607978,
          5.91607978,  5.9245253 ,  6.        ,  6.164414  ,  6.2289646 ,
          6.30872412,  6.32455532,  6.37965516,  6.40312424,  6.75277721,
          6.78232998,  6.92820323,  7.07106781,  7.14142843,  7.21110255,
          7.21110255,  7.21110255,  7.41619849,  7.41619849,  7.41619849,
          7.74596669,  7.87400787,  7.93725393,  8.06225775,  8.1240384 ,
          8.48528137,  8.48528137,  8.48528137,  8.54400375,  8.60232527,
          8.94427191,  9.        ,  9.16515139,  9.16515139,  9.43398113,
          9.43398113,  9.48683298,  9.48683298,  9.48683298,  9.59166305,
          9.79795897, 10.        , 10.09950494, 10.29563014, 10.72380529,
         10.95445115, 11.18033989, 11.40175425, 11.40175425, 11.83215957,
         12.24744871, 12.32882801, 12.32882801, 12.64911064, 13.78404875])),
 (2.983044720739973, 6.6254088687442305, 0.9951899042212309))
```

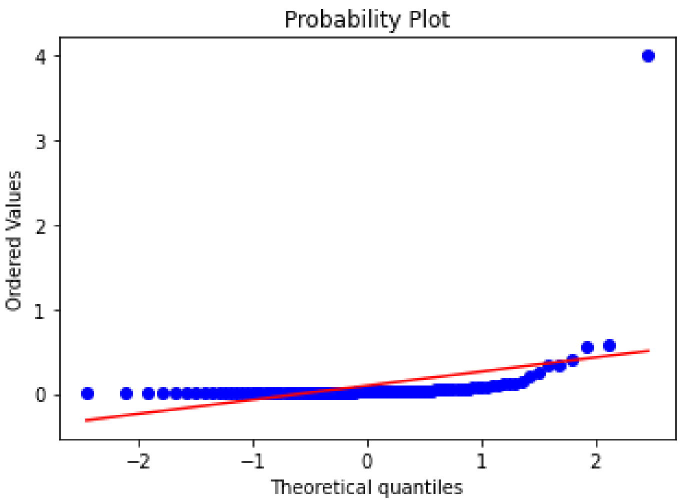


In [31]:

```
stats.probplot(Marks_reci,plot=pylab)
```

Out[31]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
         -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
         -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
         -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
         -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
         -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
         -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
         -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
         -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
         -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
          0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
          0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
          0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
          0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
          0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
          0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
          0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
          1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
          1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
          1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([0.00526316, 0.00625   , 0.00657895, 0.00657895, 0.00666667,
         0.00714286, 0.00769231, 0.00769231, 0.008     , 0.00833333,
         0.00869565, 0.00943396, 0.00980392, 0.01      , 0.01041667,
         0.01086957, 0.01111111, 0.01111111, 0.01111111, 0.01123596,
         0.01123596, 0.01190476, 0.01190476, 0.01234568, 0.0125    ,
         0.01351351, 0.01369863, 0.01388889, 0.01388889, 0.01388889,
         0.01515152, 0.01538462, 0.01587302, 0.01612903, 0.01666667,
         0.01818182, 0.01818182, 0.01818182, 0.01923077, 0.01923077,
         0.01923077, 0.01960784, 0.02      , 0.02083333, 0.02173913,
         0.02192982, 0.02439024, 0.02457002, 0.025     , 0.02512563,
         0.0257732 , 0.02631579, 0.02777778, 0.02849003, 0.02857143,
         0.02857143, 0.02857143, 0.02873563, 0.03125   , 0.03125   ,
         0.03215434, 0.03333333, 0.03333333, 0.03333333, 0.03333333,
         0.03333333, 0.03496503, 0.03571429, 0.03875969, 0.04      ,
         0.04      , 0.04166667, 0.04484305, 0.04545455, 0.05      ,
         0.05      , 0.05      , 0.05      , 0.05263158, 0.05376344,
         0.0625    , 0.06578947, 0.06666667, 0.06666667, 0.06802721,
         0.08333333, 0.1       , 0.10526316, 0.11111111, 0.11111111,
         0.11111111, 0.14285714, 0.2173913 , 0.25      , 0.33333333,
         0.33333333, 0.4       , 0.55555556, 0.58823529, 4.        ])),
 (0.16654238388625658, 0.0958160800017085, 0.4031270817229625))
```

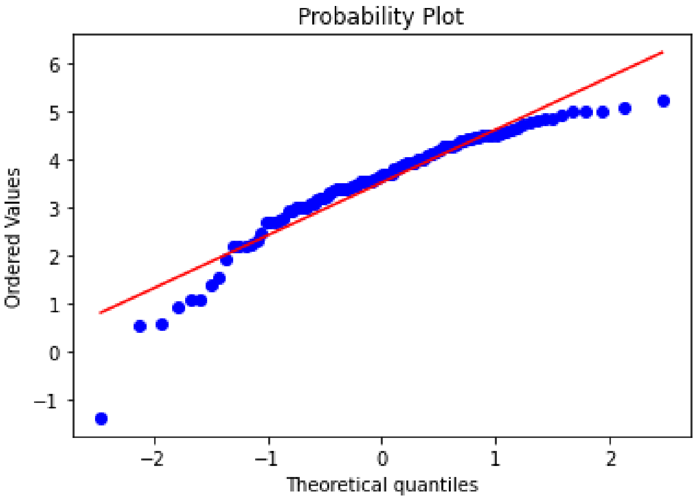


In [32]:

```
stats.probplot(log_Marks,plot=pylab)
```

Out[32]:

```
((array([-2.46203784, -2.12570747, -1.93122778, -1.79044653, -1.67819304,
        -1.58381122, -1.50174123, -1.42869743, -1.36256869, -1.30191411,
        -1.24570419, -1.19317644, -1.14374949, -1.09696931, -1.05247413,
        -1.00997067, -0.96921765, -0.93001393, -0.89218993, -0.85560121,
        -0.82012357, -0.78564937, -0.75208458, -0.71934648, -0.68736185,
        -0.65606548, -0.62539893, -0.59530962, -0.56574992, -0.53667655,
        -0.50804994, -0.47983378, -0.45199463, -0.42450149, -0.39732558,
        -0.37044003, -0.34381966, -0.31744076, -0.29128096, -0.26531902,
        -0.23953472, -0.21390872, -0.18842244, -0.16305799, -0.13779803,
        -0.1126257 , -0.08752455, -0.06247843, -0.03747145, -0.01248789,
         0.01248789,  0.03747145,  0.06247843,  0.08752455,  0.1126257 ,
         0.13779803,  0.16305799,  0.18842244,  0.21390872,  0.23953472,
         0.26531902,  0.29128096,  0.31744076,  0.34381966,  0.37044003,
         0.39732558,  0.42450149,  0.45199463,  0.47983378,  0.50804994,
         0.53667655,  0.56574992,  0.59530962,  0.62539893,  0.65606548,
         0.68736185,  0.71934648,  0.75208458,  0.78564937,  0.82012357,
         0.85560121,  0.89218993,  0.93001393,  0.96921765,  1.00997067,
         1.05247413,  1.09696931,  1.14374949,  1.19317644,  1.24570419,
         1.30191411,  1.36256869,  1.42869743,  1.50174123,  1.58381122,
         1.67819304,  1.79044653,  1.93122778,  2.12570747,  2.46203784]),
  array([-1.38629436,  0.53062825,  0.58778666,  0.91629073,  1.09861229,
         1.09861229,  1.38629436,  1.5260563 ,  1.94591015,  2.19722458,
         2.19722458,  2.19722458,  2.2512918 ,  2.30258509,  2.48490665,
         2.68784749,  2.7080502 ,  2.7080502 ,  2.72129543,  2.77258872,
         2.92316158,  2.94443898,  2.99573227,  2.99573227,  2.99573227,
         2.99573227,  3.09104245,  3.10458668,  3.17805383,  3.21887582,
         3.21887582,  3.25037449,  3.33220451,  3.35340672,  3.40119738,
         3.40119738,  3.40119738,  3.40119738,  3.40119738,  3.43720782,
         3.4657359 ,  3.4657359 ,  3.54961739,  3.55534806,  3.55534806,
         3.55534806,  3.55820113,  3.58351894,  3.63758616,  3.65842025,
         3.68386691,  3.68887945,  3.70622809,  3.71357207,  3.81990772,
         3.8286414 ,  3.87120101,  3.91202301,  3.93182563,  3.95124372,
         3.95124372,  3.95124372,  4.00733319,  4.00733319,  4.00733319,
         4.09434456,  4.12713439,  4.14313473,  4.17438727,  4.18965474,
         4.27666612,  4.27666612,  4.27666612,  4.29045944,  4.30406509,
         4.38202663,  4.39444915,  4.4308168 ,  4.4308168 ,  4.48863637,
         4.48863637,  4.49980967,  4.49980967,  4.49980967,  4.52178858,
         4.56434819,  4.60517019,  4.62497281,  4.66343909,  4.74493213,
         4.78749174,  4.82831374,  4.86753445,  4.86753445,  4.94164242,
         5.01063529,  5.02388052,  5.02388052,  5.07517382,  5.24702407])),
 (1.1033972747040552, 3.522558182933606, 0.9494491339528739))
```



In [ ]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [ ]:

```
df = pd.read_csv('Iris.csv')
df.head()
```

Out[ ]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

In [ ]:

```
df.drop(columns = ['Id'], axis = 1, inplace = True)
```

In [ ]:

```
df['Species'].value_counts()
```

Out[ ]:

```
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: Species, dtype: int64
```

In [ ]:

```
#Categorizing data species wise
setosa_df = df[df['Species'] == 'Iris-setosa']
versicolor_df = df[df['Species'] == 'Iris-versicolor']
virginica_df = df[df['Species'] == 'Iris-virginica']
```

In [ ]:

```
#Iris - setosa
setosa_df.head()
```

Out[ ]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

In [ ]:

```
#Iris - setosa statistical description
setosa_df.describe()
```

Out[ ]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	50.00000	50.000000	50.000000	50.00000
mean	5.00600	3.418000	1.464000	0.24400
std	0.35249	0.381024	0.173511	0.10721
min	4.30000	2.300000	1.000000	0.10000
25%	4.80000	3.125000	1.400000	0.20000
50%	5.00000	3.400000	1.500000	0.20000
75%	5.20000	3.675000	1.575000	0.30000
max	5.80000	4.400000	1.900000	0.60000

In [ ]:

```
#Iris - versicolor
versicolor_df.head()
```

Out[ ]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
50	7.0	3.2	4.7	1.4	Iris-versicolor
51	6.4	3.2	4.5	1.5	Iris-versicolor
52	6.9	3.1	4.9	1.5	Iris-versicolor
53	5.5	2.3	4.0	1.3	Iris-versicolor
54	6.5	2.8	4.6	1.5	Iris-versicolor

In [ ]:

```
#Iris - versicolor statistical description
versicolor_df.describe()
```

Out[ ]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	50.000000	50.000000	50.000000	50.000000
mean	5.936000	2.770000	4.260000	1.326000
std	0.516171	0.313798	0.469911	0.197753
min	4.900000	2.000000	3.000000	1.000000
25%	5.600000	2.525000	4.000000	1.200000
50%	5.900000	2.800000	4.350000	1.300000
75%	6.300000	3.000000	4.600000	1.500000
max	7.000000	3.400000	5.100000	1.800000

In [ ]:

```
#Iris - virginica
virginica_df.head()
```

Out[ ]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
100	6.3	3.3	6.0	2.5	Iris-virginica
101	5.8	2.7	5.1	1.9	Iris-virginica
102	7.1	3.0	5.9	2.1	Iris-virginica
103	6.3	2.9	5.6	1.8	Iris-virginica
104	6.5	3.0	5.8	2.2	Iris-virginica

In [ ]:

```
#Iris - virginica statistical description
virginica_df.describe()
```

Out[ ]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
count	50.00000	50.000000	50.000000	50.00000
mean	6.58800	2.974000	5.552000	2.02600
std	0.63588	0.322497	0.551895	0.27465
min	4.90000	2.200000	4.500000	1.40000
25%	6.22500	2.800000	5.100000	1.80000
50%	6.50000	3.000000	5.550000	2.00000
75%	6.90000	3.175000	5.875000	2.30000
max	7.90000	3.800000	6.900000	2.50000

In [ ]: