b) Sum of Subsets

#include<stdio.h>

#include<stdlib.h>

#include <time.h>

#include<limits.h>

// Some data types and idk macro?

typedef enum boolean {true = 1, false = 0}bool;

#define non\_leaf\_node 0

#define leaf\_node 1

#define soloution\_node 2

typedef struct Node

{

    int level, nodeNo;

    int s,k,r;

    int\* set;

    bool type;

} node;

// Some global variables

int n, m, solCount = 0, nodeCount = 0;

int x[100], w[100], temp\_w[100];

node \*stack[100]; int stackTop=0;

// creatas the nodes to be put on the stack representing the tree

node\* createNode(int s, int k, int r, int \*\_x, int \_level, int \_nodeNo, int type)

{

    node \*\_node = malloc((int)1\*sizeof(node));

    \_node->s = s;

    \_node->k = k;

    \_node->r = r;

    \_node->level = \_level;

    \_node->nodeNo = \_nodeNo;

    \_node->type = type;

    \_node->set = malloc(n\*sizeof(int));

    for(int i=0; i<n; i++)

    {

        \_node->set[i] = 0;

    }

    for(int i=0; i<=k; i++)

    {

        \_node->set[i] = \_x[i];

    }

    return \_node;

}

void reverseInputaArray()

{

    for(int i=0 ; i<n; i++)

    {

        temp\_w[i] = w[i];

    }

    for(int i=0, j=n-1; i<n; i++, j--)

    {

        w[i] = temp\_w[j];

    }

}

void randomizeInputArray()

{

    for (int i = 0; i < n - 1; i++) {

        int j = i + rand() / (RAND\_MAX / (n - i) + 1);

        int temp = w[j];

        w[j] = w[i];

        w[i] = temp;

    }

}

void clearStack()

{

    for(int i=0; i<100; i++)

    {

        free(stack[i]);

    }

    stackTop=0;

}

// its just push

void pushOnStack(node \*\_node)

{

    stack[stackTop++] = \_node;

}

// drawing tree

void printTree()

{

    int \_stackTop = stackTop-1;

    while(\_stackTop != 0)

    {

        for(int i=0; i< stack[\_stackTop]->level; i++)

        {

            printf("    ");

        }

        printf("Node %d ( %d %d %d ) ",stack[\_stackTop]->nodeNo,stack[\_stackTop]->s,stack[\_stackTop]->k+2,stack[\_stackTop]->r);

        if(stack[\_stackTop]->type == leaf\_node)

        {

            printf("x[");

            for(int j=0; j<n; j++)

            {

                if(j!=n-1)

                    printf("%d,",stack[\_stackTop]->set[j]);

                else

                    printf("%d",stack[\_stackTop]->set[j]);

            }

            printf("]");

        }

        else if(stack[\_stackTop]->type == soloution\_node)

        {

            printf("x[");

            for(int j=0; j<n; j++)

            {

                if(j!=n-1)

                    printf("%d,",stack[\_stackTop]->set[j]);

                else

                    printf("%d",stack[\_stackTop]->set[j]);

            }

            printf("] w:[");

            for(int j=0; j<n; j++)

            {

                if(stack[\_stackTop]->set[j]){

                    if(j!=n-1)

                        printf("%d,",j+1);

                    else

                        printf("%d",j+1);

                }

            }

            printf("] Solution %d",++solCount);

        }

        \_stackTop--;

        printf("\n");

    }

}

// weird algorithm

void sumOfSub(int s, int k, int r) {

    x[k] = 1;

    int level = k+1;

    int nodeNo = nodeCount++;

    // Checks if this is the solution

    if (s + w[k] == m)

    {

        nodeNo++,nodeCount++;

        pushOnStack(createNode(s+w[k],k,r-w[k],x,level,nodeNo,soloution\_node));

        nodeNo--;

    }

    // possible solution still ahead

    else if (s + w[k] + w[k+1] <= m)

    {

        // goes to left child means there is a possible soloution with this combination of x

        sumOfSub(s + w[k], k + 1, r - w[k]);

    }

    pushOnStack(createNode(s,k-1,r,x,level-1,nodeNo,non\_leaf\_node));

    // checks if there is a possible solution without this combination of x

    if ((s + r - w[k] >= m) && (s + w[k+1] <= m))

    {

        x[k] = 0;

        // goes to next possible combination of x without the current node

        sumOfSub(s, k+1, r - w[k]);

    }

}

int main() {

    int sum=0;

    printf("Enter the number of elements in set : ");

    scanf("%d",&n);

    printf("Enter the weights of the elements of the set : ");

    for(int i = 0; i < n; i++)

    {

        scanf("%d",&w[i]);

        sum += w[i];

    }

    printf("Enter the desired sum : ");

    scanf("%d",&m);

    for (int i = 0; i < n; i++) {

        x[i] = 0;

    }

    w[n]=INT\_MAX;

    printf("\nSubsets using asscending input : CASE 1\n\n\n");

    pushOnStack(createNode(0,0,sum,x,0,++nodeCount,non\_leaf\_node));

    sumOfSub(0,0,sum);

    printTree();

    printf("\n\n\nSubsets using descending input : CASE 2\n\n\n");

    reverseInputaArray();

    solCount=0;

    nodeCount=0;

    clearStack();

    pushOnStack(createNode(0,0,sum,x,0,++nodeCount,non\_leaf\_node));

    sumOfSub(0,0,sum);

    printTree();

    printf("\n\n\nSubsets using jumbled input : CASE 3\n\n\n");

    srand(time(NULL));

    randomizeInputArray();

    printf("Randomized array\n");

    for(int i=0; i<n; i++)

    {

        if(i ==n-1)

        printf("%d",w[i]);

        else

        printf("%d,",w[i]);

    }

    printf("\n");

    solCount=0;

    nodeCount=0;

    clearStack();

    pushOnStack(createNode(0,0,sum,x,0,++nodeCount,non\_leaf\_node));

    sumOfSub(0,0,sum);

    printTree();

    return 0;

}

**Output:**

Enter the number of elements in set : 7

Enter the weights of the elements of the set : 1 2 4 9 19 24 29

Enter the desired sum : 29

Subsets using asscending input : CASE 1

Node 34 ( 0 7 29 )

Node 35 ( 29 8 0 ) x[0,0,0,0,0,0,1] w:[7] Solution 1

Node 33 ( 0 6 53 )

Node 32 ( 0 5 72 )

Node 30 ( 0 4 81 )

Node 31 ( 9 5 72 )

Node 26 ( 0 3 85 )

Node 29 ( 4 6 53 )

Node 28 ( 4 5 72 )

Node 27 ( 4 4 81 )

Node 19 ( 0 2 87 )

Node 25 ( 2 6 53 )

Node 24 ( 2 5 72 )

Node 23 ( 2 4 81 )

Node 20 ( 2 3 85 )

Node 22 ( 6 5 72 )

Node 21 ( 6 4 81 )

Node 1 ( 0 1 88 )

Node 18 ( 1 6 53 )

Node 17 ( 1 5 72 )

Node 14 ( 1 4 81 )

Node 15 ( 10 5 72 )

Node 16 ( 29 6 53 ) x[1,0,0,1,1,0,0] w:[1,4,5,] Solution 2

Node 9 ( 1 3 85 )

Node 12 ( 5 6 53 )

Node 13 ( 29 7 29 ) x[1,0,1,0,0,1,0] w:[1,3,6,] Solution 3

Node 11 ( 5 5 72 )

Node 10 ( 5 4 81 )

Node 2 ( 1 2 87 )

Node 8 ( 3 6 53 )

Node 7 ( 3 5 72 )

Node 6 ( 3 4 81 )

Node 3 ( 3 3 85 )

Node 5 ( 7 5 72 )

Node 4 ( 7 4 81 )

Subsets using descending input : CASE 2

Node 4 ( 0 3 35 )

Node 5 ( 19 4 16 )

Node 3 ( 0 2 59 )

Node 1 ( 0 1 88 )

Node 2 ( 29 2 59 ) x[1,0,0,0,0,0,0] w:[1,] Solution 1

Subsets using jumbled input : CASE 3

Randomized array

19,2,9,29,24,4,1

Node 9 ( 0 5 29 )

Node 10 ( 24 6 5 )

Node 11 ( 28 7 1 )

Node 12 ( 29 8 0 ) x[0,0,0,0,1,1,1] w:[5,6,7] Solution 1

Node 7 ( 0 4 58 )

Node 8 ( 29 5 29 ) x[0,0,0,1,0,0,0] w:[4,] Solution 2

Node 6 ( 0 3 67 )

Node 4 ( 0 2 69 )

Node 5 ( 2 3 67 )

Node 1 ( 0 1 88 )

Node 3 ( 19 3 67 )

Node 2 ( 19 2 69 )

**c) Graph Colouring**

#include <stdio.h>

#include <stdbool.h>

#include <stdlib.h>

#define MAX\_VERTICES 100

#define print\_output\_mode 1

#define test\_mode 0

// Global variables

int n;                                 // Number of vertices

int m;                                 // Number of colors

int graph[MAX\_VERTICES][MAX\_VERTICES]; // Adjacency matrix

int x[MAX\_VERTICES];                   // Color assignment

int solCount = 0;

int nodeCount = 0;

void initializeGraph()

{

    for (int i = 0; i < n; i++)

    {

        for (int j = 0; j < n; j++)

        {

            graph[i][j] = 0; // Set all values to -1 initially

        }

    }

}

void updateUserInput()

{

    int vertice1, vertice2;

    printf("Enter the vertices : \n");

    do

    {

        scanf("%d %d", &vertice1, &vertice2);

        if (vertice1 == -1 && vertice2 == -1)

            return;

        graph[--vertice1][--vertice2] = 1; // Change the value to 1

        graph[vertice2][vertice1] = 1;

    } while (true);

}

void write(int \_n, int isSol, int mode)

{

    if (!mode)

        return;

    printf("Leaf Node %d ", nodeCount);

    if (isSol)

        printf("solution %d ", solCount);

    else

        printf("Bound ");

    printf("x : {");

    for (int i = 0; i <= \_n; i++)

    {

        if (i == \_n)

            printf("%d", x[i] + 1);

        else

            printf("%d,", x[i] + 1);

    }

    printf("}\n");

}

void nextValue(int k, int mode)

{

    do

    {

        int j;

        x[k] = (x[k] + 1) % (m + 1); // Next highest color

        if (x[k] == -1 || x[k] == m)

        {

            x[k] = -1;

            return; // All colors have been used

        }

        for (j = 0; j < n; j++)

        {

            if (graph[k][j] == 1 && x[k] == x[j])

            { // Check adjacent vertices

                nodeCount++;

                write(k, 0, mode);

                break;

            }

        }

        if (j == n)

        {

            return;

        } // New color found

    } while (true); // Otherwise try to find another color

}

void mColouring(int k, int mode)

{

    int checked = 0;

    do

    {

        nextValue(k, mode);

        if (x[k] == -1)

        {

            return;

        }

        if (k == n - 1)

        {

            if (!checked)

            {

                solCount++;

                nodeCount++;

                write(k, 1, mode);

                checked++;

            }

        }

        else

        {

            mColouring(k + 1, mode);

        }

    } while (true);

}

int main()

{

    printf("Enter the number of vertices: ");

    scanf("%d", &n);

    initializeGraph();

    updateUserInput();

    for (int i = 0; i < n; i++)

        x[i] = -1;

    // Print the updated graph (optional)

    printf("Adjacency matrix :\n");

    for (int i = 0; i < n; i++)

    {

        for (int j = 0; j < n; j++)

        {

            printf("%2d ", graph[i][j]);

        }

        printf("\n");

    }

    for (int i = 0; i < n; i++)

    {

        m = i + 1;

        mColouring(0, test\_mode);

        nodeCount = 0;

        if (solCount != 0)

        {

            solCount = 0;

            printf("\nChromatic number : %d\n\n", m);

            mColouring(0, print\_output\_mode);

            printf("\nTotal number of solutions : %d\n",solCount);

            break;

        }

    }

    return 0;

}

**Output:**

Enter the number of vertices: 8

Enter the vertices :

1 2 1 4 2 4 2 5 2 6 3 6 3 7 4 5 4 8 5 6 6 7 6 8 -1 -1

Adjacency matrix :

0 1 0 1 0 0 0 0

1 0 0 1 1 1 0 0

0 0 0 0 0 1 1 0

1 1 0 0 1 0 0 1

0 1 0 1 0 1 0 0

0 1 1 0 1 0 1 1

0 0 1 0 0 1 0 0

0 0 0 1 0 1 0 0

Chromatic number : 3

Leaf Node 1 Bound x : {1,1}

Leaf Node 2 Bound x : {1,2,1,1}

Leaf Node 3 Bound x : {1,2,1,2}

Leaf Node 4 Bound x : {1,2,1,3,1,1}

Leaf Node 5 Bound x : {1,2,1,3,1,2}

Leaf Node 6 Bound x : {1,2,1,3,1,3,1}

Leaf Node 7 solution 1 x : {1,2,1,3,1,3,2,1}

Leaf Node 8 Bound x : {1,2,1,3,1,3,2,3}

Leaf Node 9 Bound x : {1,2,1,3,1,3,3}

Leaf Node 10 Bound x : {1,2,1,3,2}

Leaf Node 11 Bound x : {1,2,1,3,3}

Leaf Node 12 Bound x : {1,2,2,1}

Leaf Node 13 Bound x : {1,2,2,2}

Leaf Node 14 Bound x : {1,2,2,3,1,1}

Leaf Node 15 Bound x : {1,2,2,3,1,2}

Leaf Node 16 solution 2 x : {1,2,2,3,1,3,1,1}

Leaf Node 17 Bound x : {1,2,2,3,1,3,1,3}

Leaf Node 18 Bound x : {1,2,2,3,1,3,2}

Leaf Node 19 Bound x : {1,2,2,3,1,3,3}

Leaf Node 20 Bound x : {1,2,2,3,2}

Leaf Node 21 Bound x : {1,2,2,3,3}

Leaf Node 22 Bound x : {1,2,3,1}

Leaf Node 23 Bound x : {1,2,3,2}

Leaf Node 24 Bound x : {1,2,3,3,1,1}

Leaf Node 25 Bound x : {1,2,3,3,1,2}

Leaf Node 26 Bound x : {1,2,3,3,1,3}

Leaf Node 27 Bound x : {1,2,3,3,2}

Leaf Node 28 Bound x : {1,2,3,3,3}

Leaf Node 29 Bound x : {1,3,1,1}

Leaf Node 30 Bound x : {1,3,1,2,1,1}

Leaf Node 31 Bound x : {1,3,1,2,1,2,1}

Leaf Node 32 Bound x : {1,3,1,2,1,2,2}

Leaf Node 33 solution 3 x : {1,3,1,2,1,2,3,1}

Leaf Node 34 Bound x : {1,3,1,2,1,2,3,2}

Leaf Node 35 Bound x : {1,3,1,2,1,3}

Leaf Node 36 Bound x : {1,3,1,2,2}

Leaf Node 37 Bound x : {1,3,1,2,3}

Leaf Node 38 Bound x : {1,3,1,3}

Leaf Node 39 Bound x : {1,3,2,1}

Leaf Node 40 Bound x : {1,3,2,2,1,1}

Leaf Node 41 Bound x : {1,3,2,2,1,2}

Leaf Node 42 Bound x : {1,3,2,2,1,3}

Leaf Node 43 Bound x : {1,3,2,2,2}

Leaf Node 44 Bound x : {1,3,2,2,3}

Leaf Node 45 Bound x : {1,3,2,3}

Leaf Node 46 Bound x : {1,3,3,1}

Leaf Node 47 Bound x : {1,3,3,2,1,1}

Leaf Node 48 solution 4 x : {1,3,3,2,1,2,1,1}

Leaf Node 49 Bound x : {1,3,3,2,1,2,1,2}

Leaf Node 50 Bound x : {1,3,3,2,1,2,2}

Leaf Node 51 Bound x : {1,3,3,2,1,2,3}

Leaf Node 52 Bound x : {1,3,3,2,1,3}

Leaf Node 53 Bound x : {1,3,3,2,2}

Leaf Node 54 Bound x : {1,3,3,2,3}

Leaf Node 55 Bound x : {1,3,3,3}

Leaf Node 56 Bound x : {2,1,1,1}

Leaf Node 57 Bound x : {2,1,1,2}

Leaf Node 58 Bound x : {2,1,1,3,1}

Leaf Node 59 Bound x : {2,1,1,3,2,1}

Leaf Node 60 Bound x : {2,1,1,3,2,2}

Leaf Node 61 Bound x : {2,1,1,3,2,3,1}

Leaf Node 62 solution 5 x : {2,1,1,3,2,3,2,1}

Leaf Node 63 Bound x : {2,1,1,3,2,3,2,3}

Leaf Node 64 Bound x : {2,1,1,3,2,3,3}

Leaf Node 65 Bound x : {2,1,1,3,3}

Leaf Node 66 Bound x : {2,1,2,1}

Leaf Node 67 Bound x : {2,1,2,2}

Leaf Node 68 Bound x : {2,1,2,3,1}

Leaf Node 69 Bound x : {2,1,2,3,2,1}

Leaf Node 70 Bound x : {2,1,2,3,2,2}

Leaf Node 71 solution 6 x : {2,1,2,3,2,3,1,1}

Leaf Node 72 Bound x : {2,1,2,3,2,3,1,3}

Leaf Node 73 Bound x : {2,1,2,3,2,3,2}

Leaf Node 74 Bound x : {2,1,2,3,2,3,3}

Leaf Node 75 Bound x : {2,1,2,3,3}

Leaf Node 76 Bound x : {2,1,3,1}

Leaf Node 77 Bound x : {2,1,3,2}

Leaf Node 78 Bound x : {2,1,3,3,1}

Leaf Node 79 Bound x : {2,1,3,3,2,1}

Leaf Node 80 Bound x : {2,1,3,3,2,2}

Leaf Node 81 Bound x : {2,1,3,3,2,3}

Leaf Node 82 Bound x : {2,1,3,3,3}

Leaf Node 83 Bound x : {2,2}

Leaf Node 84 Bound x : {2,3,1,1,1}

Leaf Node 85 Bound x : {2,3,1,1,2,1}

Leaf Node 86 Bound x : {2,3,1,1,2,2}

Leaf Node 87 Bound x : {2,3,1,1,2,3}

Leaf Node 88 Bound x : {2,3,1,1,3}

Leaf Node 89 Bound x : {2,3,1,2}

Leaf Node 90 Bound x : {2,3,1,3}

Leaf Node 91 Bound x : {2,3,2,1,1}

Leaf Node 92 Bound x : {2,3,2,1,2,1,1}

Leaf Node 93 Bound x : {2,3,2,1,2,1,2}

Leaf Node 94 Bound x : {2,3,2,1,2,1,3,1}

Leaf Node 95 solution 7 x : {2,3,2,1,2,1,3,2}

Leaf Node 96 Bound x : {2,3,2,1,2,2}

Leaf Node 97 Bound x : {2,3,2,1,2,3}

Leaf Node 98 Bound x : {2,3,2,1,3}

Leaf Node 99 Bound x : {2,3,2,2}

Leaf Node 100 Bound x : {2,3,2,3}

Leaf Node 101 Bound x : {2,3,3,1,1}

Leaf Node 102 Bound x : {2,3,3,1,2,1,1}

Leaf Node 103 Bound x : {2,3,3,1,2,1,2,1}

Leaf Node 104 solution 8 x : {2,3,3,1,2,1,2,2}

Leaf Node 105 Bound x : {2,3,3,1,2,1,3}

Leaf Node 106 Bound x : {2,3,3,1,2,2}

Leaf Node 107 Bound x : {2,3,3,1,2,3}

Leaf Node 108 Bound x : {2,3,3,1,3}

Leaf Node 109 Bound x : {2,3,3,2}

Leaf Node 110 Bound x : {2,3,3,3}

Leaf Node 111 Bound x : {3,1,1,1}

Leaf Node 112 Bound x : {3,1,1,2,1}

Leaf Node 113 Bound x : {3,1,1,2,2}

Leaf Node 114 Bound x : {3,1,1,2,3,1}

Leaf Node 115 Bound x : {3,1,1,2,3,2,1}

Leaf Node 116 Bound x : {3,1,1,2,3,2,2}

Leaf Node 117 solution 9 x : {3,1,1,2,3,2,3,1}

Leaf Node 118 Bound x : {3,1,1,2,3,2,3,2}

Leaf Node 119 Bound x : {3,1,1,2,3,3}

Leaf Node 120 Bound x : {3,1,1,3}

Leaf Node 121 Bound x : {3,1,2,1}

Leaf Node 122 Bound x : {3,1,2,2,1}

Leaf Node 123 Bound x : {3,1,2,2,2}

Leaf Node 124 Bound x : {3,1,2,2,3,1}

Leaf Node 125 Bound x : {3,1,2,2,3,2}

Leaf Node 126 Bound x : {3,1,2,2,3,3}

Leaf Node 127 Bound x : {3,1,2,3}

Leaf Node 128 Bound x : {3,1,3,1}

Leaf Node 129 Bound x : {3,1,3,2,1}

Leaf Node 130 Bound x : {3,1,3,2,2}

Leaf Node 131 Bound x : {3,1,3,2,3,1}

Leaf Node 132 solution 10 x : {3,1,3,2,3,2,1,1}

Leaf Node 133 Bound x : {3,1,3,2,3,2,1,2}

Leaf Node 134 Bound x : {3,1,3,2,3,2,2}

Leaf Node 135 Bound x : {3,1,3,2,3,2,3}

Leaf Node 136 Bound x : {3,1,3,2,3,3}

Leaf Node 137 Bound x : {3,1,3,3}

Leaf Node 138 Bound x : {3,2,1,1,1}

Leaf Node 139 Bound x : {3,2,1,1,2}

Leaf Node 140 Bound x : {3,2,1,1,3,1}

Leaf Node 141 Bound x : {3,2,1,1,3,2}

Leaf Node 142 Bound x : {3,2,1,1,3,3}

Leaf Node 143 Bound x : {3,2,1,2}

Leaf Node 144 Bound x : {3,2,1,3}

Leaf Node 145 Bound x : {3,2,2,1,1}

Leaf Node 146 Bound x : {3,2,2,1,2}

Leaf Node 147 Bound x : {3,2,2,1,3,1,1}

Leaf Node 148 Bound x : {3,2,2,1,3,1,2}

Leaf Node 149 Bound x : {3,2,2,1,3,1,3,1}

Leaf Node 150 solution 11 x : {3,2,2,1,3,1,3,2}

Leaf Node 151 Bound x : {3,2,2,1,3,2}

Leaf Node 152 Bound x : {3,2,2,1,3,3}

Leaf Node 153 Bound x : {3,2,2,2}

Leaf Node 154 Bound x : {3,2,2,3}

Leaf Node 155 Bound x : {3,2,3,1,1}

Leaf Node 156 Bound x : {3,2,3,1,2}

Leaf Node 157 Bound x : {3,2,3,1,3,1,1}

Leaf Node 158 Bound x : {3,2,3,1,3,1,2,1}

Leaf Node 159 solution 12 x : {3,2,3,1,3,1,2,2}

Leaf Node 160 Bound x : {3,2,3,1,3,1,3}

Leaf Node 161 Bound x : {3,2,3,1,3,2}

Leaf Node 162 Bound x : {3,2,3,1,3,3}

Leaf Node 163 Bound x : {3,2,3,2}

Leaf Node 164 Bound x : {3,2,3,3}

Leaf Node 165 Bound x : {3,3}

Total number of solutions : 12

d) Hamiltonian Cycle

#include <stdio.h>

#include <stdlib.h>

#include <stdbool.h>

struct solution

{

    int \*x;

};

struct solution allSolution[100];

int solutionCount = 0;

int n;

int x[100];

int G[100][100];

int startVertex = 0;

int leafNodeCount = 0;

void InitializeGraph()

{

    for (int i = 0; i < n; i++)

    {

        for (int j = 0; j < n; j++)

        {

            G[i][j] = 0; // Set all values to 0 initially

        }

    }

}

void UpdateUserInput()

{

    int vertice1, vertice2;

    printf("Enter the vertices : (-1 -1) to exit\n");

    do

    {

        scanf("%d %d", &vertice1, &vertice2);

        if (vertice1 == -1 && vertice2 == -1)

            return;

        G[--vertice1][--vertice2] = 1; // Change the value to 1

        G[vertice2][vertice1] = 1;

    } while (true);

}

void PrintPath(int n)

{

    for (int i = 0; i < n; i++)

    {

        if (i == n - 1)

        {

            printf("%d", x[i] + 1);

        }

        else

        {

            printf("%d->", x[i] + 1);

        }

    }

}

void StoreSolution(int n)

{

    allSolution[solutionCount].x = malloc(sizeof(int) \* (n+1));

    for (int i = 0; i < n; i++)

    {

        allSolution[solutionCount].x[i] = x[i];

    }

    allSolution[solutionCount].x[n] = x[0];

    solutionCount++;

}

void SolutionFound(int n)

{

    x[n]=x[0];

    printf("Leaf Node %3d : ", ++leafNodeCount);

    printf("Path : ");

    PrintPath(n+1); // n+1 because of the extra node at the end to complete the cycle

    printf("(Solution)\n");

    StoreSolution(n);

}

void SolutionNotFound(int k)

{

    printf("Leaf Node %3d : ", ++leafNodeCount);

    printf("Path : ");

    PrintPath(k);

    printf("(Bound)\n");

}

void NextValue(int k)

{

    do

    {

        x[k] = (x[k] + 1) % (n + 1);

        if (x[k] == n)

        {

            x[k] = -1;

        }

        if (x[k] == -1)

            return;

        if (G[x[k - 1]][x[k]] != 0)

        {

            int j;

            for (j = 0; j < k; ++j)

            {

                if (x[j] == x[k])

                {

                    SolutionNotFound(k);

                    break;

                }

            }

            if (j == k)

            {

                if (k < n-1 || (k == n-1 && G[x[k]][x[0]] != 0))

                {

                    return;

                }

            }

        }

    } while (true);

}

void Hamiltonian(int k)

{

    do

    {

        NextValue(k);

        if (x[k] == -1)

        {

            return;

        }

        if (k == n - 1)

            SolutionFound(n);

        else

        {

            Hamiltonian(k + 1);

        }

    } while (true);

}

int main()

{

    printf("Enter number of vertices in a the graph : ");

    scanf("%d", &n);

    InitializeGraph();

    printf("Input Graph values : \n");

    UpdateUserInput();

    for (int i = 0; i < n; i++)

    {

        for (int j = 0; j < n; j++)

            printf("%d ", G[i][j]);

        printf("\n");

    }

    for (startVertex = 0; startVertex < n; startVertex++)

    {

        for (int i = 0; i <= n; i++)

            x[i] = -1;

        x[0] = startVertex;

        printf("\nStart Vertex %d\n", startVertex + 1);

        Hamiltonian(1);

        leafNodeCount = 0;

    }

    printf("\n\nAll the solutions are :\n");

    for (int i = 0; i < solutionCount; i++)

    {

        printf("\nSolution %3d : ", i + 1);

        for (int j = 0; j <= n; j++)

        {

            if (j == n )

            {

                printf("%d", allSolution[i].x[j] + 1);

            }

            else

            {

                printf("%d->", allSolution[i].x[j] + 1);

            }

        }

    }

    return 0;

}

**Output:**

Enter number of vertices in a the graph : 7

Input Graph values :

Enter the vertices : (-1 -1) to exit

1 2 1 3 1 7 2 3 2 4 2 5 3 4 3 7 4 6 5 6 6 7 -1 -1

0 1 1 0 0 0 1

1 0 1 1 1 0 0

1 1 0 1 0 0 1

0 1 1 0 0 1 0

0 1 0 0 0 1 0

0 0 0 1 1 0 1

1 0 1 0 0 1 0

Start Vertex 1

Leaf Node 1 : Path : 1->2(Bound)

Leaf Node 2 : Path : 1->2->3(Bound)

Leaf Node 3 : Path : 1->2->3(Bound)

Leaf Node 4 : Path : 1->2->3->4(Bound)

Leaf Node 5 : Path : 1->2->3->4(Bound)

Leaf Node 6 : Path : 1->2->3->4->6(Bound)

Leaf Node 7 : Path : 1->2->3->4->6->5(Bound)

Leaf Node 8 : Path : 1->2->3->4->6->5(Bound)

Leaf Node 9 : Path : 1->2->3->4->6->7(Bound)

Leaf Node 10 : Path : 1->2->3->4->6->7(Bound)

Leaf Node 11 : Path : 1->2->3->4->6->7(Bound)

Leaf Node 12 : Path : 1->2->3->7(Bound)

Leaf Node 13 : Path : 1->2->3->7(Bound)

Leaf Node 14 : Path : 1->2->3->7->6->4(Bound)

Leaf Node 15 : Path : 1->2->3->7->6->4(Bound)

Leaf Node 16 : Path : 1->2->3->7->6->4(Bound)

Leaf Node 17 : Path : 1->2->3->7->6->5(Bound)

Leaf Node 18 : Path : 1->2->3->7->6->5(Bound)

Leaf Node 19 : Path : 1->2->3->7->6(Bound)

Leaf Node 20 : Path : 1->2->4(Bound)

Leaf Node 21 : Path : 1->2->4->3(Bound)

Leaf Node 22 : Path : 1->2->4->3(Bound)

Leaf Node 23 : Path : 1->2->4->3(Bound)

Leaf Node 24 : Path : 1->2->4->3->7(Bound)

Leaf Node 25 : Path : 1->2->4->3->7(Bound)

Leaf Node 26 : Path : 1->2->4->3->7->6(Bound)

Leaf Node 27 : Path : 1->2->4->3->7->6(Bound)

Leaf Node 28 : Path : 1->2->4->6(Bound)

Leaf Node 29 : Path : 1->2->4->6->5(Bound)

Leaf Node 30 : Path : 1->2->4->6->5(Bound)

Leaf Node 31 : Path : 1->2->4->6->7(Bound)

Leaf Node 32 : Path : 1->2->4->6->7->3(Bound)

Leaf Node 33 : Path : 1->2->4->6->7->3(Bound)

Leaf Node 34 : Path : 1->2->4->6->7->3(Bound)

Leaf Node 35 : Path : 1->2->4->6->7->3(Bound)

Leaf Node 36 : Path : 1->2->4->6->7(Bound)

Leaf Node 37 : Path : 1->2->5(Bound)

Leaf Node 38 : Path : 1->2->5->6->4(Bound)

Leaf Node 39 : Path : 1->2->5->6->4->3(Bound)

Leaf Node 40 : Path : 1->2->5->6->4->3(Bound)

Leaf Node 41 : Path : 1->2->5->6->4->3(Bound)

Leaf Node 42 : Path : 1->2->5->6->4->3->7->1(Solution)

Leaf Node 43 : Path : 1->2->5->6->4(Bound)

Leaf Node 44 : Path : 1->2->5->6(Bound)

Leaf Node 45 : Path : 1->2->5->6->7(Bound)

Leaf Node 46 : Path : 1->2->5->6->7->3(Bound)

Leaf Node 47 : Path : 1->2->5->6->7->3(Bound)

Leaf Node 48 : Path : 1->2->5->6->7->3(Bound)

Leaf Node 49 : Path : 1->2->5->6->7(Bound)

Leaf Node 50 : Path : 1->3(Bound)

Leaf Node 51 : Path : 1->3->2(Bound)

Leaf Node 52 : Path : 1->3->2(Bound)

Leaf Node 53 : Path : 1->3->2->4(Bound)

Leaf Node 54 : Path : 1->3->2->4(Bound)

Leaf Node 55 : Path : 1->3->2->4->6(Bound)

Leaf Node 56 : Path : 1->3->2->4->6->5(Bound)

Leaf Node 57 : Path : 1->3->2->4->6->5(Bound)

Leaf Node 58 : Path : 1->3->2->4->6->7(Bound)

Leaf Node 59 : Path : 1->3->2->4->6->7(Bound)

Leaf Node 60 : Path : 1->3->2->4->6->7(Bound)

Leaf Node 61 : Path : 1->3->2->5(Bound)

Leaf Node 62 : Path : 1->3->2->5->6->4(Bound)

Leaf Node 63 : Path : 1->3->2->5->6->4(Bound)

Leaf Node 64 : Path : 1->3->2->5->6->4(Bound)

Leaf Node 65 : Path : 1->3->2->5->6(Bound)

Leaf Node 66 : Path : 1->3->2->5->6->7(Bound)

Leaf Node 67 : Path : 1->3->2->5->6->7(Bound)

Leaf Node 68 : Path : 1->3->2->5->6->7(Bound)

Leaf Node 69 : Path : 1->3->4->2(Bound)

Leaf Node 70 : Path : 1->3->4->2(Bound)

Leaf Node 71 : Path : 1->3->4->2(Bound)

Leaf Node 72 : Path : 1->3->4->2->5(Bound)

Leaf Node 73 : Path : 1->3->4->2->5->6(Bound)

Leaf Node 74 : Path : 1->3->4->2->5->6(Bound)

Leaf Node 75 : Path : 1->3->4->2->5->6->7->1(Solution)

Leaf Node 76 : Path : 1->3->4(Bound)

Leaf Node 77 : Path : 1->3->4->6(Bound)

Leaf Node 78 : Path : 1->3->4->6->5->2(Bound)

Leaf Node 79 : Path : 1->3->4->6->5->2(Bound)

Leaf Node 80 : Path : 1->3->4->6->5->2(Bound)

Leaf Node 81 : Path : 1->3->4->6->5->2(Bound)

Leaf Node 82 : Path : 1->3->4->6->5(Bound)

Leaf Node 83 : Path : 1->3->4->6->7(Bound)

Leaf Node 84 : Path : 1->3->4->6->7(Bound)

Leaf Node 85 : Path : 1->3->4->6->7(Bound)

Leaf Node 86 : Path : 1->3->7(Bound)

Leaf Node 87 : Path : 1->3->7(Bound)

Leaf Node 88 : Path : 1->3->7->6->4->2(Bound)

Leaf Node 89 : Path : 1->3->7->6->4->2(Bound)

Leaf Node 90 : Path : 1->3->7->6->4->2(Bound)

Leaf Node 91 : Path : 1->3->7->6->4(Bound)

Leaf Node 92 : Path : 1->3->7->6->4(Bound)

Leaf Node 93 : Path : 1->3->7->6->5->2(Bound)

Leaf Node 94 : Path : 1->3->7->6->5->2(Bound)

Leaf Node 95 : Path : 1->3->7->6->5->2(Bound)

Leaf Node 96 : Path : 1->3->7->6->5(Bound)

Leaf Node 97 : Path : 1->3->7->6(Bound)

Leaf Node 98 : Path : 1->7(Bound)

Leaf Node 99 : Path : 1->7->3(Bound)

Leaf Node 100 : Path : 1->7->3->2(Bound)

Leaf Node 101 : Path : 1->7->3->2(Bound)

Leaf Node 102 : Path : 1->7->3->2->4(Bound)

Leaf Node 103 : Path : 1->7->3->2->4(Bound)

Leaf Node 104 : Path : 1->7->3->2->4->6(Bound)

Leaf Node 105 : Path : 1->7->3->2->4->6(Bound)

Leaf Node 106 : Path : 1->7->3->2->5(Bound)

Leaf Node 107 : Path : 1->7->3->2->5->6(Bound)

Leaf Node 108 : Path : 1->7->3->2->5->6(Bound)

Leaf Node 109 : Path : 1->7->3->4->2(Bound)

Leaf Node 110 : Path : 1->7->3->4->2(Bound)

Leaf Node 111 : Path : 1->7->3->4->2(Bound)

Leaf Node 112 : Path : 1->7->3->4->2->5(Bound)

Leaf Node 113 : Path : 1->7->3->4(Bound)

Leaf Node 114 : Path : 1->7->3->4->6(Bound)

Leaf Node 115 : Path : 1->7->3->4->6->5->2->1(Solution)

Leaf Node 116 : Path : 1->7->3->4->6->5(Bound)

Leaf Node 117 : Path : 1->7->3->4->6(Bound)

Leaf Node 118 : Path : 1->7->3(Bound)

Leaf Node 119 : Path : 1->7->6->4->2(Bound)

Leaf Node 120 : Path : 1->7->6->4->2->3(Bound)

Leaf Node 121 : Path : 1->7->6->4->2->3(Bound)

Leaf Node 122 : Path : 1->7->6->4->2->3(Bound)

Leaf Node 123 : Path : 1->7->6->4->2->3(Bound)

Leaf Node 124 : Path : 1->7->6->4->2(Bound)

Leaf Node 125 : Path : 1->7->6->4->2->5(Bound)

Leaf Node 126 : Path : 1->7->6->4->2->5(Bound)

Leaf Node 127 : Path : 1->7->6->4->3(Bound)

Leaf Node 128 : Path : 1->7->6->4->3->2(Bound)

Leaf Node 129 : Path : 1->7->6->4->3->2(Bound)

Leaf Node 130 : Path : 1->7->6->4->3->2(Bound)

Leaf Node 131 : Path : 1->7->6->4->3(Bound)

Leaf Node 132 : Path : 1->7->6->4->3(Bound)

Leaf Node 133 : Path : 1->7->6->4(Bound)

Leaf Node 134 : Path : 1->7->6->5->2(Bound)

Leaf Node 135 : Path : 1->7->6->5->2->3(Bound)

Leaf Node 136 : Path : 1->7->6->5->2->3(Bound)

Leaf Node 137 : Path : 1->7->6->5->2->3(Bound)

Leaf Node 138 : Path : 1->7->6->5->2->4(Bound)

Leaf Node 139 : Path : 1->7->6->5->2->4->3->1(Solution)

Leaf Node 140 : Path : 1->7->6->5->2->4(Bound)

Leaf Node 141 : Path : 1->7->6->5->2(Bound)

Leaf Node 142 : Path : 1->7->6->5(Bound)

Leaf Node 143 : Path : 1->7->6(Bound)

Start Vertex 2

Leaf Node 1 : Path : 2->1(Bound)

Leaf Node 2 : Path : 2->1->3(Bound)

Leaf Node 3 : Path : 2->1->3(Bound)

Leaf Node 4 : Path : 2->1->3->4(Bound)

Leaf Node 5 : Path : 2->1->3->4(Bound)

Leaf Node 6 : Path : 2->1->3->4->6(Bound)

Leaf Node 7 : Path : 2->1->3->4->6->5(Bound)

Leaf Node 8 : Path : 2->1->3->4->6->5(Bound)

Leaf Node 9 : Path : 2->1->3->4->6->7(Bound)

Leaf Node 10 : Path : 2->1->3->4->6->7(Bound)

Leaf Node 11 : Path : 2->1->3->4->6->7(Bound)

Leaf Node 12 : Path : 2->1->3->7(Bound)

Leaf Node 13 : Path : 2->1->3->7(Bound)

Leaf Node 14 : Path : 2->1->3->7->6->4(Bound)

Leaf Node 15 : Path : 2->1->3->7->6->4(Bound)

Leaf Node 16 : Path : 2->1->3->7->6->4(Bound)

Leaf Node 17 : Path : 2->1->3->7->6->5(Bound)

Leaf Node 18 : Path : 2->1->3->7->6->5(Bound)

Leaf Node 19 : Path : 2->1->3->7->6(Bound)

Leaf Node 20 : Path : 2->1->7(Bound)

Leaf Node 21 : Path : 2->1->7->3(Bound)

Leaf Node 22 : Path : 2->1->7->3(Bound)

Leaf Node 23 : Path : 2->1->7->3->4(Bound)

Leaf Node 24 : Path : 2->1->7->3->4(Bound)

Leaf Node 25 : Path : 2->1->7->3->4->6(Bound)

Leaf Node 26 : Path : 2->1->7->3->4->6->5->2(Solution)

Leaf Node 27 : Path : 2->1->7->3->4->6(Bound)

Leaf Node 28 : Path : 2->1->7->3(Bound)

Leaf Node 29 : Path : 2->1->7->6->4(Bound)

Leaf Node 30 : Path : 2->1->7->6->4->3(Bound)

Leaf Node 31 : Path : 2->1->7->6->4->3(Bound)

Leaf Node 32 : Path : 2->1->7->6->4->3(Bound)

Leaf Node 33 : Path : 2->1->7->6->4->3(Bound)

Leaf Node 34 : Path : 2->1->7->6->4(Bound)

Leaf Node 35 : Path : 2->1->7->6->5(Bound)

Leaf Node 36 : Path : 2->1->7->6->5(Bound)

Leaf Node 37 : Path : 2->1->7->6(Bound)

Leaf Node 38 : Path : 2->3->1(Bound)

Leaf Node 39 : Path : 2->3->1(Bound)

Leaf Node 40 : Path : 2->3->1->7(Bound)

Leaf Node 41 : Path : 2->3->1->7(Bound)

Leaf Node 42 : Path : 2->3->1->7->6->4(Bound)

Leaf Node 43 : Path : 2->3->1->7->6->4(Bound)

Leaf Node 44 : Path : 2->3->1->7->6->4(Bound)

Leaf Node 45 : Path : 2->3->1->7->6->5(Bound)

Leaf Node 46 : Path : 2->3->1->7->6->5(Bound)

Leaf Node 47 : Path : 2->3->1->7->6(Bound)

Leaf Node 48 : Path : 2->3(Bound)

Leaf Node 49 : Path : 2->3->4(Bound)

Leaf Node 50 : Path : 2->3->4(Bound)

Leaf Node 51 : Path : 2->3->4->6(Bound)

Leaf Node 52 : Path : 2->3->4->6->5(Bound)

Leaf Node 53 : Path : 2->3->4->6->5(Bound)

Leaf Node 54 : Path : 2->3->4->6->7->1(Bound)

Leaf Node 55 : Path : 2->3->4->6->7->1(Bound)

Leaf Node 56 : Path : 2->3->4->6->7->1(Bound)

Leaf Node 57 : Path : 2->3->4->6->7(Bound)

Leaf Node 58 : Path : 2->3->4->6->7(Bound)

Leaf Node 59 : Path : 2->3->7->1(Bound)

Leaf Node 60 : Path : 2->3->7->1(Bound)

Leaf Node 61 : Path : 2->3->7->1(Bound)

Leaf Node 62 : Path : 2->3->7(Bound)

Leaf Node 63 : Path : 2->3->7->6->4(Bound)

Leaf Node 64 : Path : 2->3->7->6->4(Bound)

Leaf Node 65 : Path : 2->3->7->6->4(Bound)

Leaf Node 66 : Path : 2->3->7->6->5(Bound)

Leaf Node 67 : Path : 2->3->7->6->5(Bound)

Leaf Node 68 : Path : 2->3->7->6(Bound)

Leaf Node 69 : Path : 2->4(Bound)

Leaf Node 70 : Path : 2->4->3->1(Bound)

Leaf Node 71 : Path : 2->4->3->1(Bound)

Leaf Node 72 : Path : 2->4->3->1->7(Bound)

Leaf Node 73 : Path : 2->4->3->1->7(Bound)

Leaf Node 74 : Path : 2->4->3->1->7->6(Bound)

Leaf Node 75 : Path : 2->4->3->1->7->6->5->2(Solution)

Leaf Node 76 : Path : 2->4->3->1->7->6(Bound)

Leaf Node 77 : Path : 2->4->3(Bound)

Leaf Node 78 : Path : 2->4->3(Bound)

Leaf Node 79 : Path : 2->4->3->7->1(Bound)

Leaf Node 80 : Path : 2->4->3->7->1(Bound)

Leaf Node 81 : Path : 2->4->3->7->1(Bound)

Leaf Node 82 : Path : 2->4->3->7(Bound)

Leaf Node 83 : Path : 2->4->3->7->6(Bound)

Leaf Node 84 : Path : 2->4->3->7->6->5(Bound)

Leaf Node 85 : Path : 2->4->3->7->6->5(Bound)

Leaf Node 86 : Path : 2->4->3->7->6(Bound)

Leaf Node 87 : Path : 2->4->6(Bound)

Leaf Node 88 : Path : 2->4->6->5(Bound)

Leaf Node 89 : Path : 2->4->6->5(Bound)

Leaf Node 90 : Path : 2->4->6->7->1(Bound)

Leaf Node 91 : Path : 2->4->6->7->1->3(Bound)

Leaf Node 92 : Path : 2->4->6->7->1->3(Bound)

Leaf Node 93 : Path : 2->4->6->7->1->3(Bound)

Leaf Node 94 : Path : 2->4->6->7->1->3(Bound)

Leaf Node 95 : Path : 2->4->6->7->1(Bound)

Leaf Node 96 : Path : 2->4->6->7->3->1(Bound)

Leaf Node 97 : Path : 2->4->6->7->3->1(Bound)

Leaf Node 98 : Path : 2->4->6->7->3->1(Bound)

Leaf Node 99 : Path : 2->4->6->7->3(Bound)

Leaf Node 100 : Path : 2->4->6->7->3(Bound)

Leaf Node 101 : Path : 2->4->6->7->3(Bound)

Leaf Node 102 : Path : 2->4->6->7(Bound)

Leaf Node 103 : Path : 2->5(Bound)

Leaf Node 104 : Path : 2->5->6->4(Bound)

Leaf Node 105 : Path : 2->5->6->4->3->1(Bound)

Leaf Node 106 : Path : 2->5->6->4->3->1(Bound)

Leaf Node 107 : Path : 2->5->6->4->3(Bound)

Leaf Node 108 : Path : 2->5->6->4->3(Bound)

Leaf Node 109 : Path : 2->5->6->4->3->7->1->2(Solution)

Leaf Node 110 : Path : 2->5->6->4->3->7(Bound)

Leaf Node 111 : Path : 2->5->6->4->3->7(Bound)

Leaf Node 112 : Path : 2->5->6->4(Bound)

Leaf Node 113 : Path : 2->5->6(Bound)

Leaf Node 114 : Path : 2->5->6->7->1(Bound)

Leaf Node 115 : Path : 2->5->6->7->1->3(Bound)

Leaf Node 116 : Path : 2->5->6->7->1->3(Bound)

Leaf Node 117 : Path : 2->5->6->7->1->3->4->2(Solution)

Leaf Node 118 : Path : 2->5->6->7->1->3(Bound)

Leaf Node 119 : Path : 2->5->6->7->1(Bound)

Leaf Node 120 : Path : 2->5->6->7->3->1(Bound)

Leaf Node 121 : Path : 2->5->6->7->3->1(Bound)

Leaf Node 122 : Path : 2->5->6->7->3->1(Bound)

Leaf Node 123 : Path : 2->5->6->7->3(Bound)

Leaf Node 124 : Path : 2->5->6->7->3->4(Bound)

Leaf Node 125 : Path : 2->5->6->7->3->4(Bound)

Leaf Node 126 : Path : 2->5->6->7->3->4(Bound)

Leaf Node 127 : Path : 2->5->6->7->3(Bound)

Leaf Node 128 : Path : 2->5->6->7(Bound)

Start Vertex 3

Leaf Node 1 : Path : 3->1->2(Bound)

Leaf Node 2 : Path : 3->1->2(Bound)

Leaf Node 3 : Path : 3->1->2->4(Bound)

Leaf Node 4 : Path : 3->1->2->4(Bound)

Leaf Node 5 : Path : 3->1->2->4->6(Bound)

Leaf Node 6 : Path : 3->1->2->4->6->5(Bound)

Leaf Node 7 : Path : 3->1->2->4->6->5(Bound)

Leaf Node 8 : Path : 3->1->2->4->6->7(Bound)

Leaf Node 9 : Path : 3->1->2->4->6->7(Bound)

Leaf Node 10 : Path : 3->1->2->4->6->7(Bound)

Leaf Node 11 : Path : 3->1->2->5(Bound)

Leaf Node 12 : Path : 3->1->2->5->6->4(Bound)

Leaf Node 13 : Path : 3->1->2->5->6->4(Bound)

Leaf Node 14 : Path : 3->1->2->5->6->4(Bound)

Leaf Node 15 : Path : 3->1->2->5->6(Bound)

Leaf Node 16 : Path : 3->1->2->5->6->7(Bound)

Leaf Node 17 : Path : 3->1->2->5->6->7(Bound)

Leaf Node 18 : Path : 3->1->2->5->6->7(Bound)

Leaf Node 19 : Path : 3->1(Bound)

Leaf Node 20 : Path : 3->1->7(Bound)

Leaf Node 21 : Path : 3->1->7(Bound)

Leaf Node 22 : Path : 3->1->7->6->4->2(Bound)

Leaf Node 23 : Path : 3->1->7->6->4->2(Bound)

Leaf Node 24 : Path : 3->1->7->6->4->2(Bound)

Leaf Node 25 : Path : 3->1->7->6->4(Bound)

Leaf Node 26 : Path : 3->1->7->6->4(Bound)

Leaf Node 27 : Path : 3->1->7->6->5->2(Bound)

Leaf Node 28 : Path : 3->1->7->6->5->2(Bound)

Leaf Node 29 : Path : 3->1->7->6->5->2->4->3(Solution)

Leaf Node 30 : Path : 3->1->7->6->5->2(Bound)

Leaf Node 31 : Path : 3->1->7->6->5(Bound)

Leaf Node 32 : Path : 3->1->7->6(Bound)

Leaf Node 33 : Path : 3->2->1(Bound)

Leaf Node 34 : Path : 3->2->1(Bound)

Leaf Node 35 : Path : 3->2->1->7(Bound)

Leaf Node 36 : Path : 3->2->1->7(Bound)

Leaf Node 37 : Path : 3->2->1->7->6->4(Bound)

Leaf Node 38 : Path : 3->2->1->7->6->4(Bound)

Leaf Node 39 : Path : 3->2->1->7->6->4(Bound)

Leaf Node 40 : Path : 3->2->1->7->6->5(Bound)

Leaf Node 41 : Path : 3->2->1->7->6->5(Bound)

Leaf Node 42 : Path : 3->2->1->7->6(Bound)

Leaf Node 43 : Path : 3->2(Bound)

Leaf Node 44 : Path : 3->2->4(Bound)

Leaf Node 45 : Path : 3->2->4(Bound)

Leaf Node 46 : Path : 3->2->4->6(Bound)

Leaf Node 47 : Path : 3->2->4->6->5(Bound)

Leaf Node 48 : Path : 3->2->4->6->5(Bound)

Leaf Node 49 : Path : 3->2->4->6->7->1(Bound)

Leaf Node 50 : Path : 3->2->4->6->7->1(Bound)

Leaf Node 51 : Path : 3->2->4->6->7->1(Bound)

Leaf Node 52 : Path : 3->2->4->6->7(Bound)

Leaf Node 53 : Path : 3->2->4->6->7(Bound)

Leaf Node 54 : Path : 3->2->5(Bound)

Leaf Node 55 : Path : 3->2->5->6->4(Bound)

Leaf Node 56 : Path : 3->2->5->6->4(Bound)

Leaf Node 57 : Path : 3->2->5->6->4(Bound)

Leaf Node 58 : Path : 3->2->5->6(Bound)

Leaf Node 59 : Path : 3->2->5->6->7->1(Bound)

Leaf Node 60 : Path : 3->2->5->6->7->1(Bound)

Leaf Node 61 : Path : 3->2->5->6->7->1(Bound)

Leaf Node 62 : Path : 3->2->5->6->7(Bound)

Leaf Node 63 : Path : 3->2->5->6->7(Bound)

Leaf Node 64 : Path : 3->4->2->1(Bound)

Leaf Node 65 : Path : 3->4->2->1(Bound)

Leaf Node 66 : Path : 3->4->2->1->7(Bound)

Leaf Node 67 : Path : 3->4->2->1->7(Bound)

Leaf Node 68 : Path : 3->4->2->1->7->6(Bound)

Leaf Node 69 : Path : 3->4->2->1->7->6(Bound)

Leaf Node 70 : Path : 3->4->2(Bound)

Leaf Node 71 : Path : 3->4->2(Bound)

Leaf Node 72 : Path : 3->4->2->5(Bound)

Leaf Node 73 : Path : 3->4->2->5->6(Bound)

Leaf Node 74 : Path : 3->4->2->5->6(Bound)

Leaf Node 75 : Path : 3->4->2->5->6->7->1->3(Solution)

Leaf Node 76 : Path : 3->4->2->5->6->7(Bound)

Leaf Node 77 : Path : 3->4->2->5->6->7(Bound)

Leaf Node 78 : Path : 3->4(Bound)

Leaf Node 79 : Path : 3->4->6(Bound)

Leaf Node 80 : Path : 3->4->6->5->2->1(Bound)

Leaf Node 81 : Path : 3->4->6->5->2->1(Bound)

Leaf Node 82 : Path : 3->4->6->5->2->1->7->3(Solution)

Leaf Node 83 : Path : 3->4->6->5->2(Bound)

Leaf Node 84 : Path : 3->4->6->5->2(Bound)

Leaf Node 85 : Path : 3->4->6->5->2(Bound)

Leaf Node 86 : Path : 3->4->6->5(Bound)

Leaf Node 87 : Path : 3->4->6->7->1->2(Bound)

Leaf Node 88 : Path : 3->4->6->7->1->2(Bound)

Leaf Node 89 : Path : 3->4->6->7->1->2(Bound)

Leaf Node 90 : Path : 3->4->6->7->1(Bound)

Leaf Node 91 : Path : 3->4->6->7->1(Bound)

Leaf Node 92 : Path : 3->4->6->7(Bound)

Leaf Node 93 : Path : 3->4->6->7(Bound)

Leaf Node 94 : Path : 3->7->1->2(Bound)

Leaf Node 95 : Path : 3->7->1->2(Bound)

Leaf Node 96 : Path : 3->7->1->2->4(Bound)

Leaf Node 97 : Path : 3->7->1->2->4(Bound)

Leaf Node 98 : Path : 3->7->1->2->4->6(Bound)

Leaf Node 99 : Path : 3->7->1->2->4->6(Bound)

Leaf Node 100 : Path : 3->7->1->2->5(Bound)

Leaf Node 101 : Path : 3->7->1->2->5->6->4->3(Solution)

Leaf Node 102 : Path : 3->7->1->2->5->6(Bound)

Leaf Node 103 : Path : 3->7->1->2->5->6(Bound)

Leaf Node 104 : Path : 3->7->1(Bound)

Leaf Node 105 : Path : 3->7->1(Bound)

Leaf Node 106 : Path : 3->7(Bound)

Leaf Node 107 : Path : 3->7->6->4->2->1(Bound)

Leaf Node 108 : Path : 3->7->6->4->2->1(Bound)

Leaf Node 109 : Path : 3->7->6->4->2->1(Bound)

Leaf Node 110 : Path : 3->7->6->4->2(Bound)

Leaf Node 111 : Path : 3->7->6->4->2(Bound)

Leaf Node 112 : Path : 3->7->6->4->2->5(Bound)

Leaf Node 113 : Path : 3->7->6->4->2->5(Bound)

Leaf Node 114 : Path : 3->7->6->4(Bound)

Leaf Node 115 : Path : 3->7->6->4(Bound)

Leaf Node 116 : Path : 3->7->6->5->2->1(Bound)

Leaf Node 117 : Path : 3->7->6->5->2->1(Bound)

Leaf Node 118 : Path : 3->7->6->5->2->1(Bound)

Leaf Node 119 : Path : 3->7->6->5->2(Bound)

Leaf Node 120 : Path : 3->7->6->5->2->4(Bound)

Leaf Node 121 : Path : 3->7->6->5->2->4(Bound)

Leaf Node 122 : Path : 3->7->6->5->2->4(Bound)

Leaf Node 123 : Path : 3->7->6->5->2(Bound)

Leaf Node 124 : Path : 3->7->6->5(Bound)

Leaf Node 125 : Path : 3->7->6(Bound)

Start Vertex 4

Leaf Node 1 : Path : 4->2->1(Bound)

Leaf Node 2 : Path : 4->2->1->3(Bound)

Leaf Node 3 : Path : 4->2->1->3(Bound)

Leaf Node 4 : Path : 4->2->1->3(Bound)

Leaf Node 5 : Path : 4->2->1->3->7(Bound)

Leaf Node 6 : Path : 4->2->1->3->7(Bound)

Leaf Node 7 : Path : 4->2->1->3->7->6(Bound)

Leaf Node 8 : Path : 4->2->1->3->7->6(Bound)

Leaf Node 9 : Path : 4->2->1->7(Bound)

Leaf Node 10 : Path : 4->2->1->7->3(Bound)

Leaf Node 11 : Path : 4->2->1->7->3(Bound)

Leaf Node 12 : Path : 4->2->1->7->3(Bound)

Leaf Node 13 : Path : 4->2->1->7->3(Bound)

Leaf Node 14 : Path : 4->2->1->7->6(Bound)

Leaf Node 15 : Path : 4->2->1->7->6->5(Bound)

Leaf Node 16 : Path : 4->2->1->7->6->5(Bound)

Leaf Node 17 : Path : 4->2->1->7->6(Bound)

Leaf Node 18 : Path : 4->2->3->1(Bound)

Leaf Node 19 : Path : 4->2->3->1(Bound)

Leaf Node 20 : Path : 4->2->3->1->7(Bound)

Leaf Node 21 : Path : 4->2->3->1->7(Bound)

Leaf Node 22 : Path : 4->2->3->1->7->6(Bound)

Leaf Node 23 : Path : 4->2->3->1->7->6(Bound)

Leaf Node 24 : Path : 4->2->3(Bound)

Leaf Node 25 : Path : 4->2->3(Bound)

Leaf Node 26 : Path : 4->2->3->7->1(Bound)

Leaf Node 27 : Path : 4->2->3->7->1(Bound)

Leaf Node 28 : Path : 4->2->3->7->1(Bound)

Leaf Node 29 : Path : 4->2->3->7(Bound)

Leaf Node 30 : Path : 4->2->3->7->6(Bound)

Leaf Node 31 : Path : 4->2->3->7->6->5(Bound)

Leaf Node 32 : Path : 4->2->3->7->6->5(Bound)

Leaf Node 33 : Path : 4->2->3->7->6(Bound)

Leaf Node 34 : Path : 4->2(Bound)

Leaf Node 35 : Path : 4->2->5(Bound)

Leaf Node 36 : Path : 4->2->5->6(Bound)

Leaf Node 37 : Path : 4->2->5->6(Bound)

Leaf Node 38 : Path : 4->2->5->6->7->1(Bound)

Leaf Node 39 : Path : 4->2->5->6->7->1->3->4(Solution)

Leaf Node 40 : Path : 4->2->5->6->7->1(Bound)

Leaf Node 41 : Path : 4->2->5->6->7->3(Bound)

Leaf Node 42 : Path : 4->2->5->6->7->3(Bound)

Leaf Node 43 : Path : 4->2->5->6->7->3(Bound)

Leaf Node 44 : Path : 4->2->5->6->7(Bound)

Leaf Node 45 : Path : 4->3->1->2(Bound)

Leaf Node 46 : Path : 4->3->1->2(Bound)

Leaf Node 47 : Path : 4->3->1->2(Bound)

Leaf Node 48 : Path : 4->3->1->2->5(Bound)

Leaf Node 49 : Path : 4->3->1->2->5->6(Bound)

Leaf Node 50 : Path : 4->3->1->2->5->6(Bound)

Leaf Node 51 : Path : 4->3->1(Bound)

Leaf Node 52 : Path : 4->3->1->7(Bound)

Leaf Node 53 : Path : 4->3->1->7(Bound)

Leaf Node 54 : Path : 4->3->1->7->6(Bound)

Leaf Node 55 : Path : 4->3->1->7->6->5->2->4(Solution)

Leaf Node 56 : Path : 4->3->1->7->6->5(Bound)

Leaf Node 57 : Path : 4->3->1->7->6(Bound)

Leaf Node 58 : Path : 4->3->2->1(Bound)

Leaf Node 59 : Path : 4->3->2->1(Bound)

Leaf Node 60 : Path : 4->3->2->1->7(Bound)

Leaf Node 61 : Path : 4->3->2->1->7(Bound)

Leaf Node 62 : Path : 4->3->2->1->7->6(Bound)

Leaf Node 63 : Path : 4->3->2->1->7->6(Bound)

Leaf Node 64 : Path : 4->3->2(Bound)

Leaf Node 65 : Path : 4->3->2(Bound)

Leaf Node 66 : Path : 4->3->2->5(Bound)

Leaf Node 67 : Path : 4->3->2->5->6(Bound)

Leaf Node 68 : Path : 4->3->2->5->6(Bound)

Leaf Node 69 : Path : 4->3->2->5->6->7(Bound)

Leaf Node 70 : Path : 4->3->2->5->6->7(Bound)

Leaf Node 71 : Path : 4->3(Bound)

Leaf Node 72 : Path : 4->3->7->1->2(Bound)

Leaf Node 73 : Path : 4->3->7->1->2(Bound)

Leaf Node 74 : Path : 4->3->7->1->2(Bound)

Leaf Node 75 : Path : 4->3->7->1->2->5(Bound)

Leaf Node 76 : Path : 4->3->7->1->2->5->6->4(Solution)

Leaf Node 77 : Path : 4->3->7->1(Bound)

Leaf Node 78 : Path : 4->3->7->1(Bound)

Leaf Node 79 : Path : 4->3->7(Bound)

Leaf Node 80 : Path : 4->3->7->6(Bound)

Leaf Node 81 : Path : 4->3->7->6->5->2(Bound)

Leaf Node 82 : Path : 4->3->7->6->5->2(Bound)

Leaf Node 83 : Path : 4->3->7->6->5->2(Bound)

Leaf Node 84 : Path : 4->3->7->6->5(Bound)

Leaf Node 85 : Path : 4->3->7->6(Bound)

Leaf Node 86 : Path : 4->6(Bound)

Leaf Node 87 : Path : 4->6->5->2->1(Bound)

Leaf Node 88 : Path : 4->6->5->2->1->3(Bound)

Leaf Node 89 : Path : 4->6->5->2->1->3(Bound)

Leaf Node 90 : Path : 4->6->5->2->1->3(Bound)

Leaf Node 91 : Path : 4->6->5->2->1->7(Bound)

Leaf Node 92 : Path : 4->6->5->2->1->7->3->4(Solution)

Leaf Node 93 : Path : 4->6->5->2->1->7(Bound)

Leaf Node 94 : Path : 4->6->5->2->3->1(Bound)

Leaf Node 95 : Path : 4->6->5->2->3->1(Bound)

Leaf Node 96 : Path : 4->6->5->2->3(Bound)

Leaf Node 97 : Path : 4->6->5->2->3(Bound)

Leaf Node 98 : Path : 4->6->5->2->3->7(Bound)

Leaf Node 99 : Path : 4->6->5->2->3->7(Bound)

Leaf Node 100 : Path : 4->6->5->2(Bound)

Leaf Node 101 : Path : 4->6->5->2(Bound)

Leaf Node 102 : Path : 4->6->5(Bound)

Leaf Node 103 : Path : 4->6->7->1->2(Bound)

Leaf Node 104 : Path : 4->6->7->1->2->3(Bound)

Leaf Node 105 : Path : 4->6->7->1->2->3(Bound)

Leaf Node 106 : Path : 4->6->7->1->2->3(Bound)

Leaf Node 107 : Path : 4->6->7->1->2->3(Bound)

Leaf Node 108 : Path : 4->6->7->1->2(Bound)

Leaf Node 109 : Path : 4->6->7->1->2->5(Bound)

Leaf Node 110 : Path : 4->6->7->1->2->5(Bound)

Leaf Node 111 : Path : 4->6->7->1->3(Bound)

Leaf Node 112 : Path : 4->6->7->1->3->2(Bound)

Leaf Node 113 : Path : 4->6->7->1->3->2(Bound)

Leaf Node 114 : Path : 4->6->7->1->3->2(Bound)

Leaf Node 115 : Path : 4->6->7->1->3(Bound)

Leaf Node 116 : Path : 4->6->7->1->3(Bound)

Leaf Node 117 : Path : 4->6->7->1(Bound)

Leaf Node 118 : Path : 4->6->7->3->1->2(Bound)

Leaf Node 119 : Path : 4->6->7->3->1->2(Bound)

Leaf Node 120 : Path : 4->6->7->3->1->2(Bound)

Leaf Node 121 : Path : 4->6->7->3->1(Bound)

Leaf Node 122 : Path : 4->6->7->3->1(Bound)

Leaf Node 123 : Path : 4->6->7->3->2->1(Bound)

Leaf Node 124 : Path : 4->6->7->3->2->1(Bound)

Leaf Node 125 : Path : 4->6->7->3->2->1(Bound)

Leaf Node 126 : Path : 4->6->7->3->2(Bound)

Leaf Node 127 : Path : 4->6->7->3->2(Bound)

Leaf Node 128 : Path : 4->6->7->3->2->5(Bound)

Leaf Node 129 : Path : 4->6->7->3->2->5(Bound)

Leaf Node 130 : Path : 4->6->7->3(Bound)

Leaf Node 131 : Path : 4->6->7->3(Bound)

Leaf Node 132 : Path : 4->6->7(Bound)

Start Vertex 5

Leaf Node 1 : Path : 5->2->1(Bound)

Leaf Node 2 : Path : 5->2->1->3(Bound)

Leaf Node 3 : Path : 5->2->1->3(Bound)

Leaf Node 4 : Path : 5->2->1->3->4(Bound)

Leaf Node 5 : Path : 5->2->1->3->4(Bound)

Leaf Node 6 : Path : 5->2->1->3->4->6(Bound)

Leaf Node 7 : Path : 5->2->1->3->4->6(Bound)

Leaf Node 8 : Path : 5->2->1->3->7(Bound)

Leaf Node 9 : Path : 5->2->1->3->7(Bound)

Leaf Node 10 : Path : 5->2->1->3->7->6(Bound)

Leaf Node 11 : Path : 5->2->1->3->7->6(Bound)

Leaf Node 12 : Path : 5->2->1->7(Bound)

Leaf Node 13 : Path : 5->2->1->7->3(Bound)

Leaf Node 14 : Path : 5->2->1->7->3(Bound)

Leaf Node 15 : Path : 5->2->1->7->3->4(Bound)

Leaf Node 16 : Path : 5->2->1->7->3->4(Bound)

Leaf Node 17 : Path : 5->2->1->7->3->4->6->5(Solution)

Leaf Node 18 : Path : 5->2->1->7->3(Bound)

Leaf Node 19 : Path : 5->2->1->7->6->4(Bound)

Leaf Node 20 : Path : 5->2->1->7->6->4(Bound)

Leaf Node 21 : Path : 5->2->1->7->6(Bound)

Leaf Node 22 : Path : 5->2->1->7->6(Bound)

Leaf Node 23 : Path : 5->2->3->1(Bound)

Leaf Node 24 : Path : 5->2->3->1(Bound)

Leaf Node 25 : Path : 5->2->3->1->7(Bound)

Leaf Node 26 : Path : 5->2->3->1->7(Bound)

Leaf Node 27 : Path : 5->2->3->1->7->6(Bound)

Leaf Node 28 : Path : 5->2->3->1->7->6(Bound)

Leaf Node 29 : Path : 5->2->3(Bound)

Leaf Node 30 : Path : 5->2->3->4(Bound)

Leaf Node 31 : Path : 5->2->3->4(Bound)

Leaf Node 32 : Path : 5->2->3->4->6(Bound)

Leaf Node 33 : Path : 5->2->3->4->6(Bound)

Leaf Node 34 : Path : 5->2->3->4->6->7(Bound)

Leaf Node 35 : Path : 5->2->3->4->6->7(Bound)

Leaf Node 36 : Path : 5->2->3->7->1(Bound)

Leaf Node 37 : Path : 5->2->3->7->1(Bound)

Leaf Node 38 : Path : 5->2->3->7->1(Bound)

Leaf Node 39 : Path : 5->2->3->7(Bound)

Leaf Node 40 : Path : 5->2->3->7->6->4(Bound)

Leaf Node 41 : Path : 5->2->3->7->6->4(Bound)

Leaf Node 42 : Path : 5->2->3->7->6->4(Bound)

Leaf Node 43 : Path : 5->2->3->7->6(Bound)

Leaf Node 44 : Path : 5->2->3->7->6(Bound)

Leaf Node 45 : Path : 5->2->4(Bound)

Leaf Node 46 : Path : 5->2->4->3->1(Bound)

Leaf Node 47 : Path : 5->2->4->3->1(Bound)

Leaf Node 48 : Path : 5->2->4->3->1->7(Bound)

Leaf Node 49 : Path : 5->2->4->3->1->7(Bound)

Leaf Node 50 : Path : 5->2->4->3->1->7->6->5(Solution)

Leaf Node 51 : Path : 5->2->4->3(Bound)

Leaf Node 52 : Path : 5->2->4->3(Bound)

Leaf Node 53 : Path : 5->2->4->3->7->1(Bound)

Leaf Node 54 : Path : 5->2->4->3->7->1(Bound)

Leaf Node 55 : Path : 5->2->4->3->7->1(Bound)

Leaf Node 56 : Path : 5->2->4->3->7(Bound)

Leaf Node 57 : Path : 5->2->4->3->7->6(Bound)

Leaf Node 58 : Path : 5->2->4->3->7->6(Bound)

Leaf Node 59 : Path : 5->2->4->3->7->6(Bound)

Leaf Node 60 : Path : 5->2->4->6(Bound)

Leaf Node 61 : Path : 5->2->4->6(Bound)

Leaf Node 62 : Path : 5->2->4->6->7->1(Bound)

Leaf Node 63 : Path : 5->2->4->6->7->1(Bound)

Leaf Node 64 : Path : 5->2->4->6->7->3(Bound)

Leaf Node 65 : Path : 5->2->4->6->7->3(Bound)

Leaf Node 66 : Path : 5->2->4->6->7->3(Bound)

Leaf Node 67 : Path : 5->2->4->6->7(Bound)

Leaf Node 68 : Path : 5->2(Bound)

Leaf Node 69 : Path : 5->6->4->2->1(Bound)

Leaf Node 70 : Path : 5->6->4->2->1->3(Bound)

Leaf Node 71 : Path : 5->6->4->2->1->3(Bound)

Leaf Node 72 : Path : 5->6->4->2->1->3(Bound)

Leaf Node 73 : Path : 5->6->4->2->1->7(Bound)

Leaf Node 74 : Path : 5->6->4->2->1->7(Bound)

Leaf Node 75 : Path : 5->6->4->2->3->1(Bound)

Leaf Node 76 : Path : 5->6->4->2->3->1(Bound)

Leaf Node 77 : Path : 5->6->4->2->3(Bound)

Leaf Node 78 : Path : 5->6->4->2->3(Bound)

Leaf Node 79 : Path : 5->6->4->2->3->7(Bound)

Leaf Node 80 : Path : 5->6->4->2->3->7(Bound)

Leaf Node 81 : Path : 5->6->4->2(Bound)

Leaf Node 82 : Path : 5->6->4->2(Bound)

Leaf Node 83 : Path : 5->6->4->3->1->2(Bound)

Leaf Node 84 : Path : 5->6->4->3->1->2(Bound)

Leaf Node 85 : Path : 5->6->4->3->1->2(Bound)

Leaf Node 86 : Path : 5->6->4->3->1->2(Bound)

Leaf Node 87 : Path : 5->6->4->3->1(Bound)

Leaf Node 88 : Path : 5->6->4->3->1->7(Bound)

Leaf Node 89 : Path : 5->6->4->3->1->7(Bound)

Leaf Node 90 : Path : 5->6->4->3->1->7(Bound)

Leaf Node 91 : Path : 5->6->4->3->2->1(Bound)

Leaf Node 92 : Path : 5->6->4->3->2->1(Bound)

Leaf Node 93 : Path : 5->6->4->3->2(Bound)

Leaf Node 94 : Path : 5->6->4->3->2(Bound)

Leaf Node 95 : Path : 5->6->4->3->2(Bound)

Leaf Node 96 : Path : 5->6->4->3(Bound)

Leaf Node 97 : Path : 5->6->4->3->7->1->2->5(Solution)

Leaf Node 98 : Path : 5->6->4->3->7->1(Bound)

Leaf Node 99 : Path : 5->6->4->3->7->1(Bound)

Leaf Node 100 : Path : 5->6->4->3->7(Bound)

Leaf Node 101 : Path : 5->6->4->3->7(Bound)

Leaf Node 102 : Path : 5->6->4(Bound)

Leaf Node 103 : Path : 5->6(Bound)

Leaf Node 104 : Path : 5->6->7->1->2(Bound)

Leaf Node 105 : Path : 5->6->7->1->2->3(Bound)

Leaf Node 106 : Path : 5->6->7->1->2->3(Bound)

Leaf Node 107 : Path : 5->6->7->1->2->3(Bound)

Leaf Node 108 : Path : 5->6->7->1->2->4(Bound)

Leaf Node 109 : Path : 5->6->7->1->2->4(Bound)

Leaf Node 110 : Path : 5->6->7->1->2(Bound)

Leaf Node 111 : Path : 5->6->7->1->3(Bound)

Leaf Node 112 : Path : 5->6->7->1->3->2(Bound)

Leaf Node 113 : Path : 5->6->7->1->3->2(Bound)

Leaf Node 114 : Path : 5->6->7->1->3->2(Bound)

Leaf Node 115 : Path : 5->6->7->1->3->4->2->5(Solution)

Leaf Node 116 : Path : 5->6->7->1->3->4(Bound)

Leaf Node 117 : Path : 5->6->7->1->3->4(Bound)

Leaf Node 118 : Path : 5->6->7->1->3(Bound)

Leaf Node 119 : Path : 5->6->7->1(Bound)

Leaf Node 120 : Path : 5->6->7->3->1->2(Bound)

Leaf Node 121 : Path : 5->6->7->3->1->2(Bound)

Leaf Node 122 : Path : 5->6->7->3->1->2(Bound)

Leaf Node 123 : Path : 5->6->7->3->1(Bound)

Leaf Node 124 : Path : 5->6->7->3->1(Bound)

Leaf Node 125 : Path : 5->6->7->3->2->1(Bound)

Leaf Node 126 : Path : 5->6->7->3->2->1(Bound)

Leaf Node 127 : Path : 5->6->7->3->2->1(Bound)

Leaf Node 128 : Path : 5->6->7->3->2(Bound)

Leaf Node 129 : Path : 5->6->7->3->2->4(Bound)

Leaf Node 130 : Path : 5->6->7->3->2->4(Bound)

Leaf Node 131 : Path : 5->6->7->3->2->4(Bound)

Leaf Node 132 : Path : 5->6->7->3->2(Bound)

Leaf Node 133 : Path : 5->6->7->3->4->2(Bound)

Leaf Node 134 : Path : 5->6->7->3->4->2(Bound)

Leaf Node 135 : Path : 5->6->7->3->4->2(Bound)

Leaf Node 136 : Path : 5->6->7->3->4(Bound)

Leaf Node 137 : Path : 5->6->7->3->4(Bound)

Leaf Node 138 : Path : 5->6->7->3(Bound)

Leaf Node 139 : Path : 5->6->7(Bound)

Start Vertex 6

Leaf Node 1 : Path : 6->4->2->1(Bound)

Leaf Node 2 : Path : 6->4->2->1->3(Bound)

Leaf Node 3 : Path : 6->4->2->1->3(Bound)

Leaf Node 4 : Path : 6->4->2->1->3(Bound)

Leaf Node 5 : Path : 6->4->2->1->3->7(Bound)

Leaf Node 6 : Path : 6->4->2->1->3->7(Bound)

Leaf Node 7 : Path : 6->4->2->1->3->7(Bound)

Leaf Node 8 : Path : 6->4->2->1->7(Bound)

Leaf Node 9 : Path : 6->4->2->1->7->3(Bound)

Leaf Node 10 : Path : 6->4->2->1->7->3(Bound)

Leaf Node 11 : Path : 6->4->2->1->7->3(Bound)

Leaf Node 12 : Path : 6->4->2->1->7->3(Bound)

Leaf Node 13 : Path : 6->4->2->1->7(Bound)

Leaf Node 14 : Path : 6->4->2->3->1(Bound)

Leaf Node 15 : Path : 6->4->2->3->1(Bound)

Leaf Node 16 : Path : 6->4->2->3->1->7(Bound)

Leaf Node 17 : Path : 6->4->2->3->1->7(Bound)

Leaf Node 18 : Path : 6->4->2->3->1->7(Bound)

Leaf Node 19 : Path : 6->4->2->3(Bound)

Leaf Node 20 : Path : 6->4->2->3(Bound)

Leaf Node 21 : Path : 6->4->2->3->7->1(Bound)

Leaf Node 22 : Path : 6->4->2->3->7->1(Bound)

Leaf Node 23 : Path : 6->4->2->3->7->1(Bound)

Leaf Node 24 : Path : 6->4->2->3->7(Bound)

Leaf Node 25 : Path : 6->4->2->3->7(Bound)

Leaf Node 26 : Path : 6->4->2(Bound)

Leaf Node 27 : Path : 6->4->2->5(Bound)

Leaf Node 28 : Path : 6->4->2->5(Bound)

Leaf Node 29 : Path : 6->4->3->1->2(Bound)

Leaf Node 30 : Path : 6->4->3->1->2(Bound)

Leaf Node 31 : Path : 6->4->3->1->2(Bound)

Leaf Node 32 : Path : 6->4->3->1->2->5(Bound)

Leaf Node 33 : Path : 6->4->3->1->2->5(Bound)

Leaf Node 34 : Path : 6->4->3->1(Bound)

Leaf Node 35 : Path : 6->4->3->1->7(Bound)

Leaf Node 36 : Path : 6->4->3->1->7(Bound)

Leaf Node 37 : Path : 6->4->3->1->7(Bound)

Leaf Node 38 : Path : 6->4->3->2->1(Bound)

Leaf Node 39 : Path : 6->4->3->2->1(Bound)

Leaf Node 40 : Path : 6->4->3->2->1->7(Bound)

Leaf Node 41 : Path : 6->4->3->2->1->7(Bound)

Leaf Node 42 : Path : 6->4->3->2->1->7(Bound)

Leaf Node 43 : Path : 6->4->3->2(Bound)

Leaf Node 44 : Path : 6->4->3->2(Bound)

Leaf Node 45 : Path : 6->4->3->2->5(Bound)

Leaf Node 46 : Path : 6->4->3->2->5(Bound)

Leaf Node 47 : Path : 6->4->3(Bound)

Leaf Node 48 : Path : 6->4->3->7->1->2(Bound)

Leaf Node 49 : Path : 6->4->3->7->1->2(Bound)

Leaf Node 50 : Path : 6->4->3->7->1->2(Bound)

Leaf Node 51 : Path : 6->4->3->7->1->2->5->6(Solution)

Leaf Node 52 : Path : 6->4->3->7->1(Bound)

Leaf Node 53 : Path : 6->4->3->7->1(Bound)

Leaf Node 54 : Path : 6->4->3->7(Bound)

Leaf Node 55 : Path : 6->4->3->7(Bound)

Leaf Node 56 : Path : 6->4(Bound)

Leaf Node 57 : Path : 6->5->2->1(Bound)

Leaf Node 58 : Path : 6->5->2->1->3(Bound)

Leaf Node 59 : Path : 6->5->2->1->3(Bound)

Leaf Node 60 : Path : 6->5->2->1->3->4(Bound)

Leaf Node 61 : Path : 6->5->2->1->3->4(Bound)

Leaf Node 62 : Path : 6->5->2->1->3->4(Bound)

Leaf Node 63 : Path : 6->5->2->1->3->7(Bound)

Leaf Node 64 : Path : 6->5->2->1->3->7(Bound)

Leaf Node 65 : Path : 6->5->2->1->3->7(Bound)

Leaf Node 66 : Path : 6->5->2->1->7(Bound)

Leaf Node 67 : Path : 6->5->2->1->7->3(Bound)

Leaf Node 68 : Path : 6->5->2->1->7->3(Bound)

Leaf Node 69 : Path : 6->5->2->1->7->3->4->6(Solution)

Leaf Node 70 : Path : 6->5->2->1->7->3(Bound)

Leaf Node 71 : Path : 6->5->2->1->7(Bound)

Leaf Node 72 : Path : 6->5->2->3->1(Bound)

Leaf Node 73 : Path : 6->5->2->3->1(Bound)

Leaf Node 74 : Path : 6->5->2->3->1->7(Bound)

Leaf Node 75 : Path : 6->5->2->3->1->7(Bound)

Leaf Node 76 : Path : 6->5->2->3->1->7(Bound)

Leaf Node 77 : Path : 6->5->2->3(Bound)

Leaf Node 78 : Path : 6->5->2->3->4(Bound)

Leaf Node 79 : Path : 6->5->2->3->4(Bound)

Leaf Node 80 : Path : 6->5->2->3->4(Bound)

Leaf Node 81 : Path : 6->5->2->3->7->1(Bound)

Leaf Node 82 : Path : 6->5->2->3->7->1(Bound)

Leaf Node 83 : Path : 6->5->2->3->7->1(Bound)

Leaf Node 84 : Path : 6->5->2->3->7(Bound)

Leaf Node 85 : Path : 6->5->2->3->7(Bound)

Leaf Node 86 : Path : 6->5->2->4(Bound)

Leaf Node 87 : Path : 6->5->2->4->3->1(Bound)

Leaf Node 88 : Path : 6->5->2->4->3->1(Bound)

Leaf Node 89 : Path : 6->5->2->4->3->1->7->6(Solution)

Leaf Node 90 : Path : 6->5->2->4->3(Bound)

Leaf Node 91 : Path : 6->5->2->4->3(Bound)

Leaf Node 92 : Path : 6->5->2->4->3->7(Bound)

Leaf Node 93 : Path : 6->5->2->4->3->7(Bound)

Leaf Node 94 : Path : 6->5->2->4(Bound)

Leaf Node 95 : Path : 6->5->2(Bound)

Leaf Node 96 : Path : 6->5(Bound)

Leaf Node 97 : Path : 6->7->1->2(Bound)

Leaf Node 98 : Path : 6->7->1->2->3(Bound)

Leaf Node 99 : Path : 6->7->1->2->3(Bound)

Leaf Node 100 : Path : 6->7->1->2->3->4(Bound)

Leaf Node 101 : Path : 6->7->1->2->3->4(Bound)

Leaf Node 102 : Path : 6->7->1->2->3->4(Bound)

Leaf Node 103 : Path : 6->7->1->2->3(Bound)

Leaf Node 104 : Path : 6->7->1->2->4(Bound)

Leaf Node 105 : Path : 6->7->1->2->4->3(Bound)

Leaf Node 106 : Path : 6->7->1->2->4->3(Bound)

Leaf Node 107 : Path : 6->7->1->2->4->3(Bound)

Leaf Node 108 : Path : 6->7->1->2->4->3(Bound)

Leaf Node 109 : Path : 6->7->1->2->4(Bound)

Leaf Node 110 : Path : 6->7->1->2->5(Bound)

Leaf Node 111 : Path : 6->7->1->2->5(Bound)

Leaf Node 112 : Path : 6->7->1->3(Bound)

Leaf Node 113 : Path : 6->7->1->3->2(Bound)

Leaf Node 114 : Path : 6->7->1->3->2(Bound)

Leaf Node 115 : Path : 6->7->1->3->2->4(Bound)

Leaf Node 116 : Path : 6->7->1->3->2->4(Bound)

Leaf Node 117 : Path : 6->7->1->3->2->4(Bound)

Leaf Node 118 : Path : 6->7->1->3->2->5(Bound)

Leaf Node 119 : Path : 6->7->1->3->2->5(Bound)

Leaf Node 120 : Path : 6->7->1->3->4->2(Bound)

Leaf Node 121 : Path : 6->7->1->3->4->2(Bound)

Leaf Node 122 : Path : 6->7->1->3->4->2(Bound)

Leaf Node 123 : Path : 6->7->1->3->4->2->5->6(Solution)

Leaf Node 124 : Path : 6->7->1->3->4(Bound)

Leaf Node 125 : Path : 6->7->1->3->4(Bound)

Leaf Node 126 : Path : 6->7->1->3(Bound)

Leaf Node 127 : Path : 6->7->1(Bound)

Leaf Node 128 : Path : 6->7->3->1->2(Bound)

Leaf Node 129 : Path : 6->7->3->1->2(Bound)

Leaf Node 130 : Path : 6->7->3->1->2->4(Bound)

Leaf Node 131 : Path : 6->7->3->1->2->4(Bound)

Leaf Node 132 : Path : 6->7->3->1->2->4(Bound)

Leaf Node 133 : Path : 6->7->3->1->2->5(Bound)

Leaf Node 134 : Path : 6->7->3->1->2->5(Bound)

Leaf Node 135 : Path : 6->7->3->1(Bound)

Leaf Node 136 : Path : 6->7->3->1(Bound)

Leaf Node 137 : Path : 6->7->3->2->1(Bound)

Leaf Node 138 : Path : 6->7->3->2->1(Bound)

Leaf Node 139 : Path : 6->7->3->2->1(Bound)

Leaf Node 140 : Path : 6->7->3->2(Bound)

Leaf Node 141 : Path : 6->7->3->2->4(Bound)

Leaf Node 142 : Path : 6->7->3->2->4(Bound)

Leaf Node 143 : Path : 6->7->3->2->4(Bound)

Leaf Node 144 : Path : 6->7->3->2->5(Bound)

Leaf Node 145 : Path : 6->7->3->2->5(Bound)

Leaf Node 146 : Path : 6->7->3->4->2->1(Bound)

Leaf Node 147 : Path : 6->7->3->4->2->1(Bound)

Leaf Node 148 : Path : 6->7->3->4->2->1(Bound)

Leaf Node 149 : Path : 6->7->3->4->2(Bound)

Leaf Node 150 : Path : 6->7->3->4->2(Bound)

Leaf Node 151 : Path : 6->7->3->4->2->5(Bound)

Leaf Node 152 : Path : 6->7->3->4->2->5(Bound)

Leaf Node 153 : Path : 6->7->3->4(Bound)

Leaf Node 154 : Path : 6->7->3->4(Bound)

Leaf Node 155 : Path : 6->7->3(Bound)

Leaf Node 156 : Path : 6->7(Bound)

Start Vertex 7

Leaf Node 1 : Path : 7->1->2(Bound)

Leaf Node 2 : Path : 7->1->2->3(Bound)

Leaf Node 3 : Path : 7->1->2->3(Bound)

Leaf Node 4 : Path : 7->1->2->3->4(Bound)

Leaf Node 5 : Path : 7->1->2->3->4(Bound)

Leaf Node 6 : Path : 7->1->2->3->4->6(Bound)

Leaf Node 7 : Path : 7->1->2->3->4->6(Bound)

Leaf Node 8 : Path : 7->1->2->3(Bound)

Leaf Node 9 : Path : 7->1->2->4(Bound)

Leaf Node 10 : Path : 7->1->2->4->3(Bound)

Leaf Node 11 : Path : 7->1->2->4->3(Bound)

Leaf Node 12 : Path : 7->1->2->4->3(Bound)

Leaf Node 13 : Path : 7->1->2->4->3(Bound)

Leaf Node 14 : Path : 7->1->2->4->6(Bound)

Leaf Node 15 : Path : 7->1->2->4->6->5(Bound)

Leaf Node 16 : Path : 7->1->2->4->6->5(Bound)

Leaf Node 17 : Path : 7->1->2->4->6(Bound)

Leaf Node 18 : Path : 7->1->2->5(Bound)

Leaf Node 19 : Path : 7->1->2->5->6->4(Bound)

Leaf Node 20 : Path : 7->1->2->5->6->4->3->7(Solution)

Leaf Node 21 : Path : 7->1->2->5->6->4(Bound)

Leaf Node 22 : Path : 7->1->2->5->6(Bound)

Leaf Node 23 : Path : 7->1->2->5->6(Bound)

Leaf Node 24 : Path : 7->1->3(Bound)

Leaf Node 25 : Path : 7->1->3->2(Bound)

Leaf Node 26 : Path : 7->1->3->2(Bound)

Leaf Node 27 : Path : 7->1->3->2->4(Bound)

Leaf Node 28 : Path : 7->1->3->2->4(Bound)

Leaf Node 29 : Path : 7->1->3->2->4->6(Bound)

Leaf Node 30 : Path : 7->1->3->2->4->6(Bound)

Leaf Node 31 : Path : 7->1->3->2->5(Bound)

Leaf Node 32 : Path : 7->1->3->2->5->6(Bound)

Leaf Node 33 : Path : 7->1->3->2->5->6(Bound)

Leaf Node 34 : Path : 7->1->3->4->2(Bound)

Leaf Node 35 : Path : 7->1->3->4->2(Bound)

Leaf Node 36 : Path : 7->1->3->4->2(Bound)

Leaf Node 37 : Path : 7->1->3->4->2->5(Bound)

Leaf Node 38 : Path : 7->1->3->4->2->5->6->7(Solution)

Leaf Node 39 : Path : 7->1->3->4(Bound)

Leaf Node 40 : Path : 7->1->3->4->6(Bound)

Leaf Node 41 : Path : 7->1->3->4->6->5(Bound)

Leaf Node 42 : Path : 7->1->3->4->6(Bound)

Leaf Node 43 : Path : 7->1->3(Bound)

Leaf Node 44 : Path : 7->1(Bound)

Leaf Node 45 : Path : 7->3->1->2(Bound)

Leaf Node 46 : Path : 7->3->1->2(Bound)

Leaf Node 47 : Path : 7->3->1->2->4(Bound)

Leaf Node 48 : Path : 7->3->1->2->4(Bound)

Leaf Node 49 : Path : 7->3->1->2->4->6(Bound)

Leaf Node 50 : Path : 7->3->1->2->4->6(Bound)

Leaf Node 51 : Path : 7->3->1->2->5(Bound)

Leaf Node 52 : Path : 7->3->1->2->5->6(Bound)

Leaf Node 53 : Path : 7->3->1->2->5->6(Bound)

Leaf Node 54 : Path : 7->3->1(Bound)

Leaf Node 55 : Path : 7->3->1(Bound)

Leaf Node 56 : Path : 7->3->2->1(Bound)

Leaf Node 57 : Path : 7->3->2->1(Bound)

Leaf Node 58 : Path : 7->3->2->1(Bound)

Leaf Node 59 : Path : 7->3->2(Bound)

Leaf Node 60 : Path : 7->3->2->4(Bound)

Leaf Node 61 : Path : 7->3->2->4(Bound)

Leaf Node 62 : Path : 7->3->2->4->6(Bound)

Leaf Node 63 : Path : 7->3->2->4->6->5(Bound)

Leaf Node 64 : Path : 7->3->2->4->6->5(Bound)

Leaf Node 65 : Path : 7->3->2->4->6(Bound)

Leaf Node 66 : Path : 7->3->2->5(Bound)

Leaf Node 67 : Path : 7->3->2->5->6->4(Bound)

Leaf Node 68 : Path : 7->3->2->5->6->4(Bound)

Leaf Node 69 : Path : 7->3->2->5->6->4(Bound)

Leaf Node 70 : Path : 7->3->2->5->6(Bound)

Leaf Node 71 : Path : 7->3->2->5->6(Bound)

Leaf Node 72 : Path : 7->3->4->2->1(Bound)

Leaf Node 73 : Path : 7->3->4->2->1(Bound)

Leaf Node 74 : Path : 7->3->4->2->1(Bound)

Leaf Node 75 : Path : 7->3->4->2(Bound)

Leaf Node 76 : Path : 7->3->4->2(Bound)

Leaf Node 77 : Path : 7->3->4->2->5(Bound)

Leaf Node 78 : Path : 7->3->4->2->5->6(Bound)

Leaf Node 79 : Path : 7->3->4->2->5->6(Bound)

Leaf Node 80 : Path : 7->3->4->2->5->6(Bound)

Leaf Node 81 : Path : 7->3->4(Bound)

Leaf Node 82 : Path : 7->3->4->6(Bound)

Leaf Node 83 : Path : 7->3->4->6->5->2->1->7(Solution)

Leaf Node 84 : Path : 7->3->4->6->5->2(Bound)

Leaf Node 85 : Path : 7->3->4->6->5->2(Bound)

Leaf Node 86 : Path : 7->3->4->6->5->2(Bound)

Leaf Node 87 : Path : 7->3->4->6->5(Bound)

Leaf Node 88 : Path : 7->3->4->6(Bound)

Leaf Node 89 : Path : 7->3(Bound)

Leaf Node 90 : Path : 7->6->4->2->1(Bound)

Leaf Node 91 : Path : 7->6->4->2->1->3(Bound)

Leaf Node 92 : Path : 7->6->4->2->1->3(Bound)

Leaf Node 93 : Path : 7->6->4->2->1->3(Bound)

Leaf Node 94 : Path : 7->6->4->2->1->3(Bound)

Leaf Node 95 : Path : 7->6->4->2->1(Bound)

Leaf Node 96 : Path : 7->6->4->2->3->1(Bound)

Leaf Node 97 : Path : 7->6->4->2->3->1(Bound)

Leaf Node 98 : Path : 7->6->4->2->3->1(Bound)

Leaf Node 99 : Path : 7->6->4->2->3(Bound)

Leaf Node 100 : Path : 7->6->4->2->3(Bound)

Leaf Node 101 : Path : 7->6->4->2->3(Bound)

Leaf Node 102 : Path : 7->6->4->2(Bound)

Leaf Node 103 : Path : 7->6->4->2->5(Bound)

Leaf Node 104 : Path : 7->6->4->2->5(Bound)

Leaf Node 105 : Path : 7->6->4->3->1->2(Bound)

Leaf Node 106 : Path : 7->6->4->3->1->2(Bound)

Leaf Node 107 : Path : 7->6->4->3->1->2(Bound)

Leaf Node 108 : Path : 7->6->4->3->1(Bound)

Leaf Node 109 : Path : 7->6->4->3->1(Bound)

Leaf Node 110 : Path : 7->6->4->3->2->1(Bound)

Leaf Node 111 : Path : 7->6->4->3->2->1(Bound)

Leaf Node 112 : Path : 7->6->4->3->2->1(Bound)

Leaf Node 113 : Path : 7->6->4->3->2(Bound)

Leaf Node 114 : Path : 7->6->4->3->2(Bound)

Leaf Node 115 : Path : 7->6->4->3->2->5(Bound)

Leaf Node 116 : Path : 7->6->4->3->2->5(Bound)

Leaf Node 117 : Path : 7->6->4->3(Bound)

Leaf Node 118 : Path : 7->6->4->3(Bound)

Leaf Node 119 : Path : 7->6->4(Bound)

Leaf Node 120 : Path : 7->6->5->2->1(Bound)

Leaf Node 121 : Path : 7->6->5->2->1->3(Bound)

Leaf Node 122 : Path : 7->6->5->2->1->3(Bound)

Leaf Node 123 : Path : 7->6->5->2->1->3(Bound)

Leaf Node 124 : Path : 7->6->5->2->1(Bound)

Leaf Node 125 : Path : 7->6->5->2->3->1(Bound)

Leaf Node 126 : Path : 7->6->5->2->3->1(Bound)

Leaf Node 127 : Path : 7->6->5->2->3->1(Bound)

Leaf Node 128 : Path : 7->6->5->2->3(Bound)

Leaf Node 129 : Path : 7->6->5->2->3->4(Bound)

Leaf Node 130 : Path : 7->6->5->2->3->4(Bound)

Leaf Node 131 : Path : 7->6->5->2->3->4(Bound)

Leaf Node 132 : Path : 7->6->5->2->3(Bound)

Leaf Node 133 : Path : 7->6->5->2->4(Bound)

Leaf Node 134 : Path : 7->6->5->2->4->3->1->7(Solution)

Leaf Node 135 : Path : 7->6->5->2->4->3(Bound)

Leaf Node 136 : Path : 7->6->5->2->4->3(Bound)

Leaf Node 137 : Path : 7->6->5->2->4->3(Bound)

Leaf Node 138 : Path : 7->6->5->2->4(Bound)

Leaf Node 139 : Path : 7->6->5->2(Bound)

Leaf Node 140 : Path : 7->6->5(Bound)

Leaf Node 141 : Path : 7->6(Bound)

All the solutions are :

Solution 1 : 1->2->5->6->4->3->7->1

Solution 2 : 1->3->4->2->5->6->7->1

Solution 3 : 1->7->3->4->6->5->2->1

Solution 4 : 1->7->6->5->2->4->3->1

Solution 5 : 2->1->7->3->4->6->5->2

Solution 6 : 2->4->3->1->7->6->5->2

Solution 7 : 2->5->6->4->3->7->1->2

Solution 8 : 2->5->6->7->1->3->4->2

Solution 9 : 3->1->7->6->5->2->4->3

Solution 10 : 3->4->2->5->6->7->1->3

Solution 11 : 3->4->6->5->2->1->7->3

Solution 12 : 3->7->1->2->5->6->4->3

Solution 13 : 4->2->5->6->7->1->3->4

Solution 14 : 4->3->1->7->6->5->2->4

Solution 15 : 4->3->7->1->2->5->6->4

Solution 16 : 4->6->5->2->1->7->3->4

Solution 17 : 5->2->1->7->3->4->6->5

Solution 18 : 5->2->4->3->1->7->6->5

Solution 19 : 5->6->4->3->7->1->2->5

Solution 20 : 5->6->7->1->3->4->2->5

Solution 21 : 6->4->3->7->1->2->5->6

Solution 22 : 6->5->2->1->7->3->4->6

Solution 23 : 6->5->2->4->3->1->7->6

Solution 24 : 6->7->1->3->4->2->5->6

Solution 25 : 7->1->2->5->6->4->3->7

Solution 26 : 7->1->3->4->2->5->6->7

Solution 27 : 7->3->4->6->5->2->1->7

Solution 28 : 7->6->5->2->4->3->1->7

Total number of solution: 28