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DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC ACCREDITED with "A" GRADE (CGPA : 3.18)
DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CODE: DJ19ITL504 **DATE: 22/9/2021**

COURSE NAME: Artificial Intelligence Laboratory **CLASS:TY-IT**

EXPERIMENT NO.01

CO/LO: Formulate the problem as a state space and select appropriate technique from blind, heuristic or adversarial search to generate the solution.

AIM / OBJECTIVE:

Tutorial exercise for

a. Design of Intelligent System using PEAS.

b. Problem Definition with State Space Representation.

DESCRIPTION OF EXPERIMENT:

- Student shall design the following agents using PEAS(describe them) and Justify the environments for the same
    - Robot soccer player
    - Shopping for used AI books on the Internet
    - Agent playing Crossword puzzle
    - Bidding on an item in auction.
    - Face recognition for attendance system
    - Google maps
- Students shall formulate state space for the following problem.
    - 5 puzzle problem

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Explanation/Solutions(Design):

	Performance	**Environment**	**Actuators**	**Sensors**
Robot soccer player	Playing, Scoring goals, defending from opponents, winning	Playground space, teammates, opponents	Robotic legs/limbs movement	Camera, motion sensors
Shopping for used AI books on the Internet	Buying books of correct price range, category, authors	Vendor websites, books on the website	Placing an order, filling details	Web scraping
Agent playing Crossword puzzle	Completing the puzzle correctly, completing the puzzle in less amount of time	Puzzle board	Screen	Keyboard
Bidding on an item in auction.	Placing bids at the right time on correct objects, knowing when to stop bidding	Auction website, other bidders, Auctioneer, the items	Screen	Getting live updates from websites by scraping
Face recognition for attendance system	high degree of accuracy in detecting face	Students, teachers and staff	marking the student present.	camera
Google maps	finding routes correctly between two points, analyzing the traffic and other factors of roads to find	satellite images, stored data regarding roads, user	Screen	Keyboard, mic, touchscreen , UI

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	best route			

5 PUZZLE:

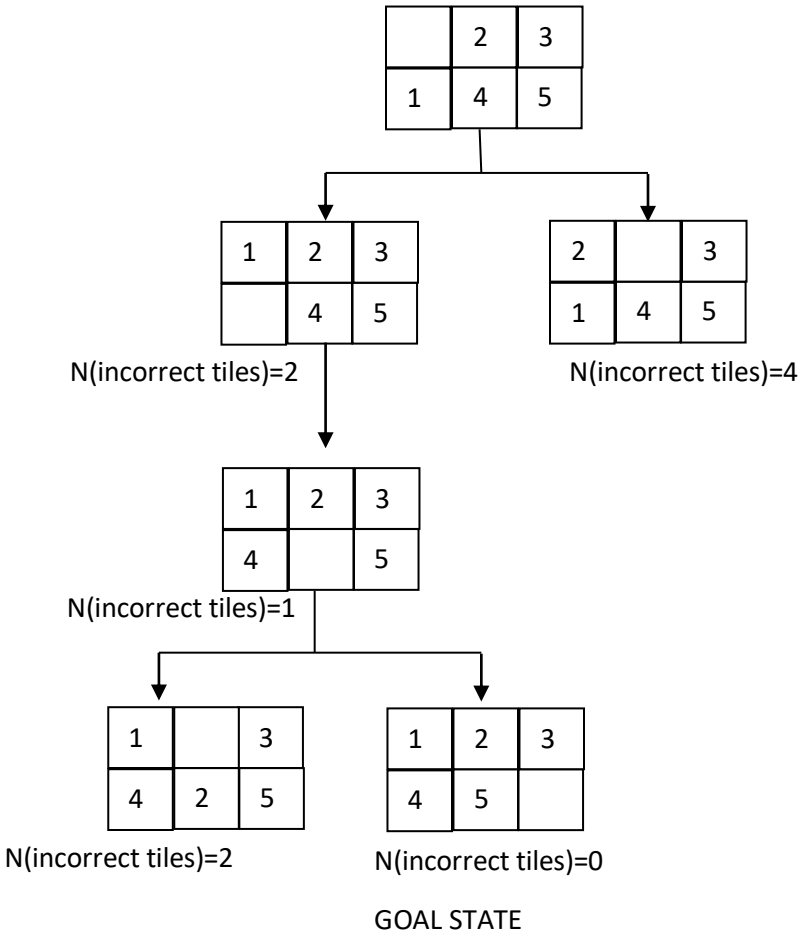
Initial configuration :

	2	3
1	4	5

Final configuration :

1	2	3
4	5	

State space tree**:**



Source code:

```
#include <stdio.h>
#include <stdlib.h>
int level = 0;
int upmatrix[m][n]={{0, 0, 0}, {0, 0, 0}};
int downmatrix[m][n]={{0, 0, 0}, {0, 0, 0}};
int leftmatrix[m][n]={{0, 0, 0}, {0, 0, 0}};
int rightmatrix[m][n]={{0, 0, 0}, {0, 0, 0}};
```

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```
int preprematrix[m][n];
// by default the matrix is going to call by reference only
void matrixprint(int matrix[m][n])
{
    // printf("\t\t");
    for (int i = 0; i < 2; i++)
    {
        for (int j = 0; j < 3; j++)
        {
            // matrix[i][j]=4;
            printf("%d ", matrix[i][j]);
        }
        printf("\n");
    }
}

int goalstate(int matrix[m][n], int goal[m][n])
{
    for (int i = 0; i < 2; i++)
    {
        for (int j = 0; j < 3; j++)
        {
            if (goal[i][j] != matrix[i][j])
            {
                return -1;
            }
        }
    }
    return 1;
}

int prevstate(int matrix[m][n], int pre[m][n])
{
    for (int i = 0; i < 2; i++)
    {
        for (int j = 0; j < 3; j++)
        {
            if (pre[i][j] != matrix[i][j])
            {
                return -1;
            }
        }
    }
    return 1;
}

void checkblank(int matrix[m][n], int arr[])
{
```

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```
    for (int i = 0; i < 2; i++)
    {
        for (int j = 0; j < 3; j++)
        {
            if (matrix[i][j] == -1)
            {
                arr[0] = i;
                arr[1] = j;
            }
        }
        printf("\n");
    }
}

void moveup(int matrix[m][n])
{
    int temp;
    int pos[2];
    checkblank(matrix, pos);
    temp = matrix[pos[0] - 1][pos[1]];
    matrix[pos[0] - 1][pos[1]] = -1;
    matrix[pos[0]][pos[1]] = temp;
}

void movedown(int matrix[m][n])
{
    int temp;
    int pos[2];
    checkblank(matrix, pos);
    temp = matrix[pos[0]+1][pos[1]];
    matrix[pos[0]+1][pos[1]] = -1;
    matrix[pos[0]][pos[1]] = temp;
}

void moveleft(int matrix[m][n])
{
    int temp;
    int pos[2];
    checkblank(matrix, pos);
    temp = matrix[pos[0]][pos[1]-1];
    matrix[pos[0]][pos[1]-1] = -1;
    matrix[pos[0]][pos[1]] = temp;
}

void moveright(int matrix[m][n])
{
    int temp;
    int pos[2];
```

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```
    checkblank(matrix, pos);
    temp = matrix[pos[0]][pos[1]+1];
    matrix[pos[0]][pos[1]+1] = -1;
    matrix[pos[0]][pos[1]] = temp;
}

void copy( int newcopy[m][n],int matrix[m][n])
{
    for (int i = 0; i < 2; i++)
    {
        for (int j = 0; j < 3; j++)
        {
            newcopy[i][j] = matrix[i][j];
        }
    }
}

int solvematrix(int matrix[m][n], int goal[m][n])
{
    int u=0,l=0,r=0,d=0;
    level = level + 1;
    int prev[m][n];
    copy(prev,matrix);

    int pos[2];
    int result;
    checkblank(matrix, pos);
    printf("level %d", level);


    if (pos[0] == 1)
    {
        moveup(matrix);
        if(prevstate(matrix,preprematrix)!=1)
        {
            u=1;
        }
        copy(upmatrix,matrix);
        matrixprint(matrix);
    }

    if (goalstate(matrix, goal) == 1)
    {
        printf("\n End Of The Tree\n");
        return 1;
    }
    copy(matrix,prev);
```

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```
if(pos[0]==0)
{

    if(prevstate(matrix,preprematrix)!=1)
    {
           d=1;
    }
    movedown(matrix);
    copy(downmatrix,matrix);
    matrixprint(matrix);

}
if (goalstate(matrix, goal) == 1)
{
    printf("\n End Of The Tree\n");
    return 1;
}

copy(matrix,prev);

if(pos[1]==0 || pos[1]==1 )
{

    if(prevstate(matrix,preprematrix)!=1)
    {
           r=1;
    }
    moveright(matrix);
    copy(rightmatrix,matrix);
    matrixprint(matrix);

}

if (goalstate(matrix, goal) == 1)
{
    printf("\n End Of The Tree\n");
    return 1;
}

copy(matrix,prev);

if(pos[1]==1 || pos[1]==2)
{
    if(prevstate(matrix,preprematrix)!=1)
    {
           l=1;
    }
     moveleft(matrix);
```

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```
         copy(leftmatrix,matrix);
         matrixprint(matrix);

    }
    if (goalstate(matrix, goal) == 1)
    {
        printf("\n End Of The Tree\n");
        return 1;
    }

    copy(preprematrix,prev);

     if(u!=0)
    {
        solvematrix(upmatrix,goal);
    }
     if(d!=0)
    {
        solvematrix(downmatrix,goal);
    }
     if(l!=0)
    {
        solvematrix(leftmatrix,goal);
    }
     if(r!=0)
    {
        solvematrix(rightmatrix,goal);
    }
    return 0;
}

int main()
{

    int matrix[2][3] = {{-1, 2, 3}, {1, 4, 5}};
    int goal[2][3] = {{1, 2, 3}, {4, 5, -1}};
    int temp[2];


    solvematrix(matrix, goal);

    checkblank(matrix, temp);

    // matrixprint(matrix);
    // matrixprint(goal);
    return 0;
}
```

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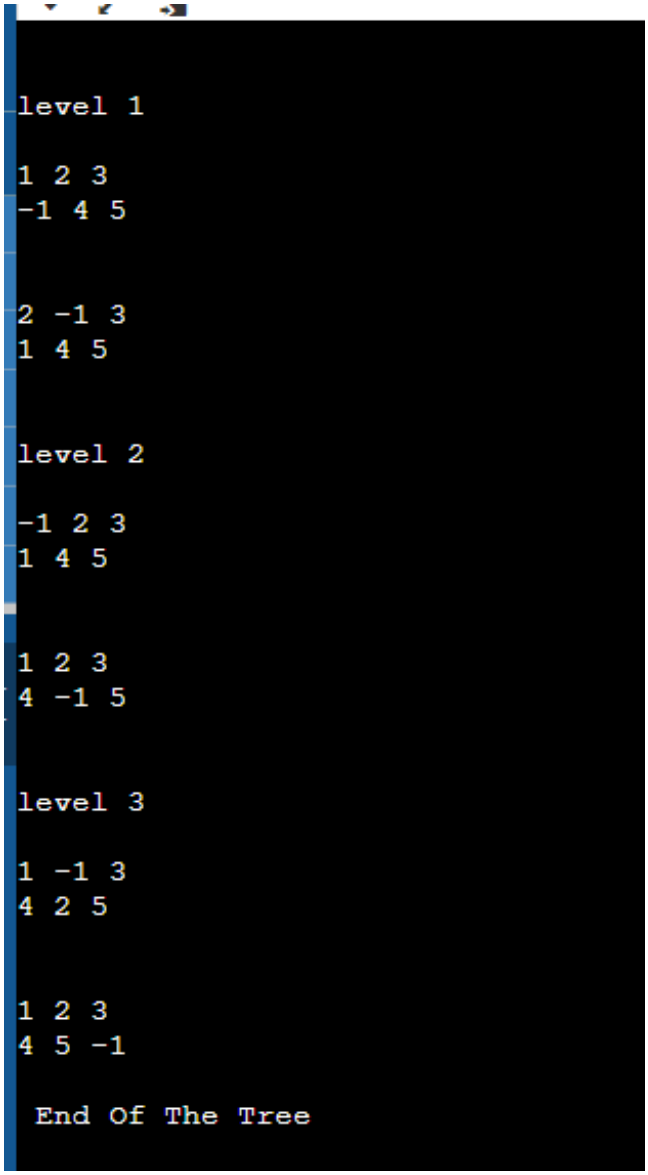
Output:



CONCLUSION:

Thus the task environment of agents can be described for their performance measure, environment , actuators ,sensors using PEAS and 5 puzzle problem can be represented in its state space tree form using a bounding function/ heuristic.