

## CSD311-AI

**Assignment 1 (Marks <15>):** Group of 2-3 students from the same lab group.

- Posting Date: <28<sup>th</sup> Aug 2021>;
- Due date of submission <9<sup>th</sup> Sept 2021>

### Instructions:

- Serious penalty for plagiarism and cheating.
- Demo: TA will announce demo Schedule during Lab timings on <TBD>
- Student doing assignment alone will be given extra 2 marks if marks obtained in the assignment are >80%. This situation will be entertained if there is no partner left in the lab group. Inform in advance.

Develop and implement the following in C/C++

- (<3> marks) Write a program to generate a 3-D magic cube (Description available in lecture notes OR find at [https://en.wikipedia.org/wiki/Magic\\_cube](https://en.wikipedia.org/wiki/Magic_cube)).
- (<8> marks) Write program for 3-D Tic Tac Toe using magic square concept approach discussed in the class.
  - Winner is the one who makes first 10 collinear lines which satisfy magic square condition.
- (<2> marks) Display the board position (you can display 3 separate boards) after each turn along with a list of contents for both the players.
- (<2> marks) For well documented program.
  - Write all algorithms used should in a doc file and put comments explaining each module in the program

Questions at the time of evaluation:

1. Magic square – generalization (start from any cell and generate magic square; Using some formula, using backtracking, ..)
2. Tic-Tac –toe (Updation of both the lists after each play, display of board position)
3. Will be asked to change a code of specific activity.

### Winning Strategy:

A winning line is formed when the sum of the three numbers is 42 on the magic square, **and** the three points are collinear i.e each row, column, pillar, four main space diagonals.

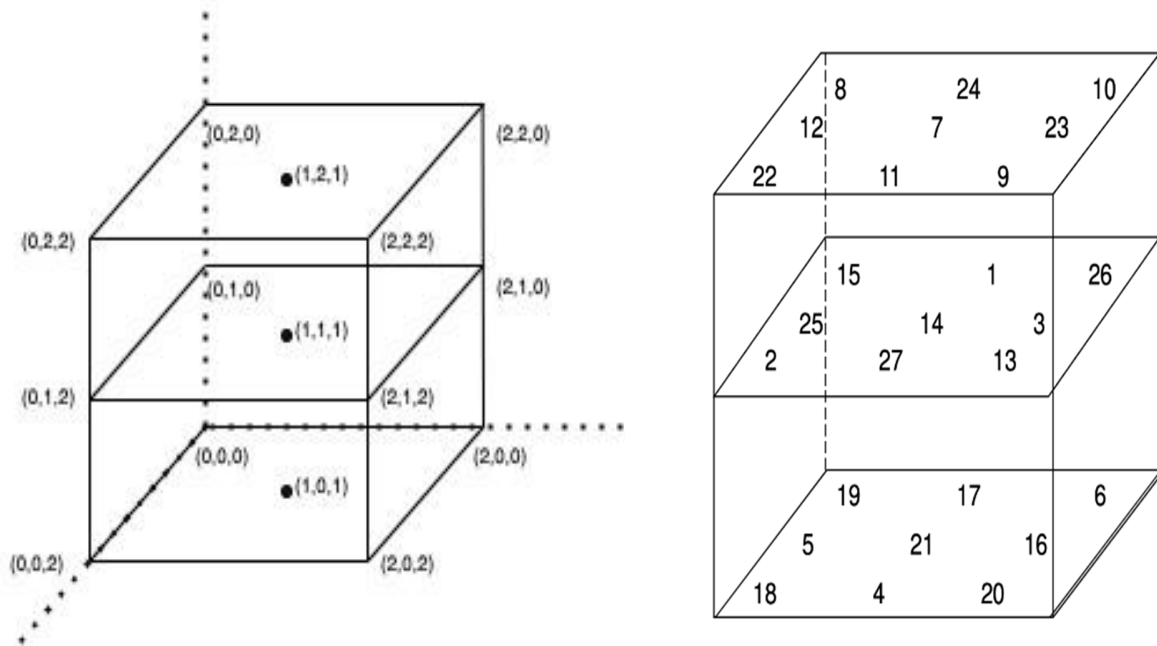
Hint: One of the working solutions would be to test if the three points in 3-D space have the sum as 42 **and** the three points are collinear.

Formula for showing 3 points are collinear:

Let us consider three points A (x<sub>1</sub>,y<sub>1</sub>,z<sub>1</sub>) , B(x<sub>2</sub>,y<sub>2</sub>,z<sub>2</sub>) and C(x<sub>3</sub>,y<sub>3</sub>,z<sub>3</sub>) as 3-D co-ordinates. In order to prove that the three points are collinear we need to show:

$$\overrightarrow{AB} = \lambda \overrightarrow{AC}$$

$$(x_2 - x_1, y_2 - y_1, z_2 - z_1) = \lambda (x_3 - x_1, y_3 - y_1, z_3 - z_1)$$



### Sample Explanation:

#### Winning Lines:

1. **Row:** Taking the points on the top surface (0,2,0) - (1,2,0) - (2,2,0), the slope is the same between the three points and the sum of the three points is 42.
2. **Column:** Take the points on the middle surface (2,1,2) - (2,1,1) - (2,1,0), the slope is the same between the three points and the sum of the three points is 42.
3. **Pillar:** Take the points on the right surface (2,2,0) - (2,1,0) - (2,0,0), the slope is the same between the three points and the sum of the three points is 42.
4. **Major Diagonal:** Take the points on the right surface (0,2,0) - (1,1,1) - (2,0,2), the slope is the same between the three points and the sum of the three points is 42.

#### Incorrect Lines:

1. Diagonal on Top Surface: The points are collinear but the sum is not 42.
2. Three random points with sum 42: Eg - (0,2,0) - (1,2,1) - (1,1,2), the sum is 42 but the slope is different i.e they are non collinear.