Let,

*Player_1 moves are **(0,0) , (2,0) , (2,1) , (0,2)** and **(1,2).***

*Player_2 moves are **(0,1) , (1,0) , (1,2)** and **(2,2).***

Then, Centroid (g,f) $= \left(\frac{0+2+2+0+1}{5} \;,\; \frac{0+0+1+2+2}{5} \right)$

∴ G(g, f) = (1, 1)

X	X	O
O	O	X
X	O	X

Fig(i) : Player_1 = X , Player_2 = O

Again,

Reference Vector from G to each Point,

$\vec{V}_0$ = (0,0) – (1,1) = (0 – 1, 1 – 1) = (–1 , –1)

$\vec{V}_1$ = (2,0) – (1,1) = (2 – 1, 0 – 1) = (1 , –1)

$\vec{V}_2$ = (2,1) – (1,1) = (2 – 1, 1 – 1) = (1 , 0)

$\vec{V}_3$ = (0,2) – (1,1) = (0 – 1, 2 – 1) = (–1 , 1)

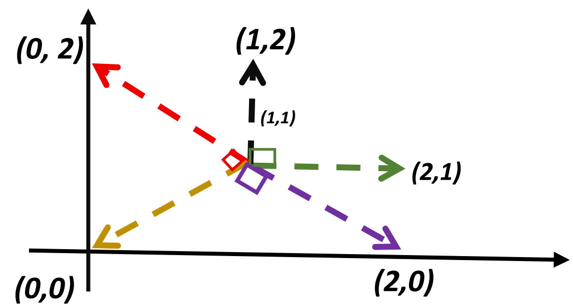
$\vec{V}_4$ = (1,2) – (1,1) = (1 – 1, 2 – 1) = (0 , 1)

Then,

Norms of all of these Norms Vector,

$|\vec{V}_0| = |\vec{V}_1| = |\vec{V}_3| = \sqrt{2} = 1.414$

$|\vec{V}_2| = |\vec{V}_4| = \sqrt{1} = 1$



Fig(ii) : Player_1 moves plotted in Graph

Now,

All the possible Pairs of all the Reference Vectors are ,

$\vec{V}_0\vec{V}_1$, $\vec{V}_0\vec{V}_2$, $\vec{V}_0\vec{V}_3$, $\vec{V}_0\vec{V}_4$, $\vec{V}_1\vec{V}_2$, $\vec{V}_1\vec{V}_3$, $\vec{V}_1\vec{V}_4$, $\vec{V}_2\vec{V}_3$, $\vec{V}_2\vec{V}_4$ and $\vec{V}_3\vec{V}_4$.

Cosines between $\vec{V}_0$ and $\vec{V}_1$ = $\vec{V}_0.\vec{V}_1$ / ($|\vec{V}_0||\vec{V}_1|$) = 1 (-1) + (-1)(-1) / (2) = 0 = 90

Cosines between $\vec{V}_0$ and $\vec{V}_2$ = $\vec{V}_0.\vec{V}_2$ / ($|\vec{V}_0||\vec{V}_2|$) = 1 (-1) + (0)(-1) / (1.1414) = –0.7071 = 135

Cosines between $\vec{V}_0$ and $\vec{V}_3$ = $\vec{V}_0.\vec{V}_3$ / ($|\vec{V}_0||\vec{V}_3|$) = (-1) (-1) + 1 (-1) / (2) = 0 = 90

Cosines between $\vec{V}_0$ and $\vec{V}_4$ = $\vec{V}_0.\vec{V}_4$ / ($|\vec{V}_0||\vec{V}_4|$) = 0(-1) + 1(-1) / (1.1414) = –0.7071 = 135

Cosines between $\vec{V}_1$ and $\vec{V}_2$ = $\vec{V}_1.\vec{V}_2$ / ($|\vec{V}_1||\vec{V}_2|$) = 1 (1) + (0)(-1) / (1.1414) = 0.7071 = 45

Cosines between $\vec{V}_1$ and $\vec{V}_3$ = $\vec{V}_1.\vec{V}_3$ / ($|\vec{V}_1||\vec{V}_3|$) = 1 (-1) + 1(-1) / (2) = –1 = 180 (Ignore)

Cosines between $\vec{V}_1$ and $\vec{V}_4$ = $\vec{V}_1.\vec{V}_4$ / ($|\vec{V}_1||\vec{V}_4|$) = 1 (0) + 1(-1) / (1.1414) = –0.7071 = 135

Cosines between $\vec{V}_2$ and $\vec{V}_3$ = $\vec{V}_0.\vec{V}_2$ / ($|\vec{V}_2||\vec{V}_3|$) = 1 (-1) + 0(1) / (1.1414) = –0.7071 = 135

Cosines between $\vec{V}_2$ and $\vec{V}_4$ = $\vec{V}_2.\vec{V}_4$ / ($|\vec{V}_2||\vec{V}_4|$) = 1 (0) + 1(0) / (1.1414) = 0 = 90

Cosines between $\vec{V}_3$ and $\vec{V}_4$ = $\vec{V}_3.\vec{V}_4$ / ($|\vec{V}_3||\vec{V}_4|$) = 0 (-1) + 1 (1) / (1.1414) = 0.7071 = 45

Now ,

Score (Avg Cosines) of Player_1 = (3 * 90 + 4 * 135 + 2 * 45) / 9 = **100**

Similarly, For Player 2 :

Score (Avg Cosines) of Player_2 = (76 + 104 + 157 + + 53 + 127) / 5 = **116**

Since, Avg Cosines Score of (Player_1 < Player_2) :

∴ Player_1 is the Winner .

// Higher the Avg Cosines Angle, more Player moves are Scarttered and less of Straight lines (Win Chance).