CIA – 3

Topic: COMBINATORICS

***Combinatorics*** is an area of mathematics primarily concerned with counting, both as a means and an end in obtaining results, and certain properties of finite structures. It is closely related to many other areas of mathematics and has many applications ranging from logic to statistical physics, from evolutionary biology to computer science, etc.

Since Combinatorics is a vast branch of mathematics, we decided to focus on Combinatorics used in Game Theory.

***Combinatorial game theory*** (CGT) is a branch of mathematics and theoretical computer science that typically studies *sequential games* (a game where one player chooses their action before the others choose theirs) with *perfect information* (where all players are perfectly informed of all the events that have previously occurred, including the "initialization event" of the game).

Study has been largely confined to two-player games that have a position in which the players take turns changing in defined ways or moves to achieve a defined winning condition. CGT has not traditionally studied games of chance or those that use imperfect or incomplete information, favouring games that offer perfect information in which the state of the game and the set of available moves are always known by both players.

Combinatorial games include well-known games such as chess, checkers, and Go, which are regarded as non-trivial, and tic-tac-toe, which is considered as trivial in the sense of being "easy to solve". Some combinatorial games may also have an unbounded playing area, such as infinite chess. In CGT, the moves in these and other games are represented as a game tree.

We have decided to present the use of combinatorial game theory in ‘Tic-Tac-Toe’ to explain the basic mechanism of its use in a game with perfect information.