

Assignment 3

- The primary purpose of this assignment is to evaluate the performance of serial and parallel version of TicTacToe game. MinMax Tree algorithm has been implemented to find the next possible move for computer.
- This assignment is solved using the concept of parallel programming in Java. I have used the RecursiveTask<T> to implement the parallel version of TicTacToe game.
- Time to find out the next suitable place for computer has been printed in milliseconds.
- According to the test cases listed below, the parallel version of the programs seems comparatively slower than the serial version to find out the next suitable move. The reason behind this is the communication overhead between the created threads. Usually, creation of threads takes time which is also causing the parallel program to take more time to produce the next move.

To compile this program:

```
javac MainGameTicTacToe.java
```

To run serial version of the program:

```
java MainGameTicTacToe serial
```

To run parallel version of the program:

```
java MainGameTicTacToe parallel
```

Serial Version

Test Case 1:

Enter your choice

1 - To play first with notation 'X'

2 - To play after computer with notation 'O'

1

Game Board:

1 2 3

4 5 6

7 8 9

Enter desired move:

1

Game Board:

X 2 3

4 5 6

7 8 9

Time taken by Computer to find the next position: 54.739168 ms

Game Board:

X O 3

4 5 6

7 8 9

Enter desired move:

4

Game Board:

X O 3

X 5 6

7 8 9

Time taken by Computer to find the next position: 0.235359 ms

Game Board:

X O 3

X 5 6

O 8 9

Enter desired move:

5

Game Board:

X O 3

X X 6

O 8 9

Time taken by Computer to find the next position: 0.028992 ms

Game Board:

X O 3

X X O

O 8 9

Enter desired move:

9

Game Board:

X O 3

X X O

O 8 X

Game Over !!!

Test Case 2:

Enter your choice

1 - To play first with notation 'X'

2 - To play after computer with notation 'O'

2

Game Board:

1 2 3

4 5 6

7 8 9

Time taken by Computer to find the next position: 152.953972 ms

Game Board:

X 2 3

4 5 6

7 8 9

Enter desired move:

5

Game Board:

X 2 3

4 O 6

7 8 9

Time taken by Computer to find the next position: 1.372502 ms

Game Board:

X X 3

4 O 6

7 8 9

Enter desired move:

3

Game Board:

X X O

4 O 6

7 8 9

Time taken by Computer to find the next position: 0.064764 ms

Game Board:

X X O

4 O 6

X 8 9

Enter desired move:

6

Game Board:

X X O

4 O O

X 8 9

Time taken by Computer to find the next position: 0.020961 ms

Game Board:

X X O

X O O

X 8 9

Game Over !!!

Parallel Version

Test Case 1:

Enter your choice

1 - To play first with notation 'X'

2 - To play after computer with notation 'O'

1

Game Board:

1 2 3

4 5 6

7 8 9

Enter desired move:

2

Game Board:

1 X 3

4 5 6

7 8 9

Time taken by Computer to find the next position: 87.670092 ms

Game Board:

O X 3

4 5 6

7 8 9

Enter desired move:

4

Game Board:

O X 3

X 5 6

7 8 9

Time taken by Computer to find the next position: 9.789713 ms

Game Board:

O X O

X 5 6

7 8 9

Enter desired move:

5

Game Board:

O X O

X X 6

7 8 9

Time taken by Computer to find the next position: 4.475945 ms

Game Board:

O X O

X X O

7 8 9

Enter desired move:

8

Game Board:

O X O

X X O

7 X 9

Game Over !!!

Test Case 2:

Enter your choice

1 - To play first with notation 'X'

2 - To play after computer with notation 'O'

2

Game Board:

1 2 3

4 5 6

7 8 9

Time taken by Computer to find the next position: 151.922421 ms

Game Board:

X 2 3

4 5 6

7 8 9

Enter desired move:

4

Game Board:

X 2 3

O 5 6

7 8 9

Time taken by Computer to find the next position: 16.531939 ms

Game Board:

X X 3

O 5 6

7 8 9

Enter desired move:

8

Game Board:

X X 3

O 5 6

7 O 9

Time taken by Computer to find the next position: 2.233002 ms

Game Board:

X X X

O 5 6

7 O 9

Game Over !!!

Note: I have taken guidelines from this website to implement the game logic.

<http://www.csc.tntech.edu/pdcincs/resources/CS2/minimax/Java/MiniMax.html>