Intermediate Assignment Report

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Search Algorithm(s):
1) We will use iterative deepening minimax algorithm with alpha beta pruning to find the best move at each turn.
2) After each iteration we will increase search depth by 1 and update the best move. This shall be aborted after 24 seconds.
3) We are also planning to use Zobrist hashing to store board state and block state, so that heuristic for state that has already occured need not be recalculated.

Advantages
a) Since we more or less have complete information about the state of the game, minimax turns out to best available option.
b) Since we are using Zobrist hashing, if the same block or board is seen again in the future, its heuristic need not be calculated all over again thus saving a lot of computation time.
c) Iterative deepening ensures that if we somehow enter a wrong path, then search does not go on in the wrong path for large depth, instead it will backtrack after it has reach the max depth and then will go along the path of best solution.
d) Since we are using alpha beta pruning, some branches of the search tree can be eliminated as they do not yield better solution than already known solution and thus saving computation time.

Heuristic
Terminologies
Large board – Two large 3x3 game board
Small board – Smaller board inside large board.
Cell – The cell inside the small board
Winning Pattern – Each winning parttern viz. Horizontal line, vertical line and diagonal line.
Thus our aim is to calculate the heuristic of each small board and then combine them to get the entire heuristic.

Position Weightage Table
Each cell of the small board is given weightage based on the number of winning patter it contributes to, for example cell (2,3), contributes to 2 winning patter, one horizontal on 2nd row and one vertical on 3rd column

3	2	3
2	4	2
3	2	3

Small Board Heuristic
1) If a small board is already won then it is given a score of 200.
2) For a small board that is won by opponent or has been drawn we give it score of 0.
3) For a small block that still under consideration:
    1) If there are two crosses(assuming that we are playing with cross) in a pattern and no opponent player in the 3rd cell then we add a score of 40 to our score.

2) For every cross add its position weightage to the final score.

3) Other cases can be ignored.

Large Board Heuristic:

1) Large board heuristic is calculated based on the small board score.

2) If any small board that has been won by opponent or is drawn then it is ignored.

3) If in any pattern there are two our marker and 3rd small board is still under consideration then we add 800 score to our heuristic.

4) For every other small board we add (small board score * position wieghtage) to the heuristic.

This is a tentative heuristic which may change when we actually implement the bot.