

REPORT

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How to run the code:

The Morris Variant Game has been developed in C++ Clang Version 11.2.0. In order to run any file, simply navigate to the file location through the command prompt and then run the following command to compile the program.

```
g++ program_filename.cpp -o program_filename.exe
```

Once the program has been compiled and there are no errors, run the executable file with the input/output file and the depth required.

```
.\program_filename input_filename output_filename depth
```

Result:

The compiled results are kept in a tabular form in an excel file named 'CompiledResult.xlsx' for ease of comparison.

In the compiled results, we can see that except for depth 1, alpha-beta produces savings over MINIMAX in all cases.

In the below table and in the excel file containing the compiled results, we see two examples where my evaluation function produces different moves than the standard function.

Input Board Position	MiniMax	MiniMaxImproved
Opening Scenario		
xxWxxxxxxxxxBxx	WxWxxxxxxxxxBxx	xWWxxxxxxxxxBxx
xWxWxxxxBxxxxBxxx	xWxWxWxxxxxxxxBxxx	WWxWxxxxBxxxxBxxx
Mid-End Game Scenario		
xBBWxxWxxxxxBxBxxW	WBBWxxxxxxxxBxBxxW	xBBWxxxxxxxxBxBWxW
WWBBBBxWxxxxWBWxWx	WWBBBBWxxxxWBWxWx	xWBBBBxWxxxxWBWWWx

Improved Static Estimation:

In the opening scenario, the static estimation function given by the instructor returns the difference of the number of white pieces and the number of black pieces, but the new static estimation function tries to improve upon this result by taking the possibility of formation of mills in the next few steps. This process is also given higher importance by placing higher weights on this function.

The algorithm finds all empty places and checks for mill formation by placing white pieces in these spots.

The new estimation function builds on the static estimation function provided by the instructor by adding the weighted sum of mill formation to the difference of the white and black pieces in both the opening and mid-end game scenario.