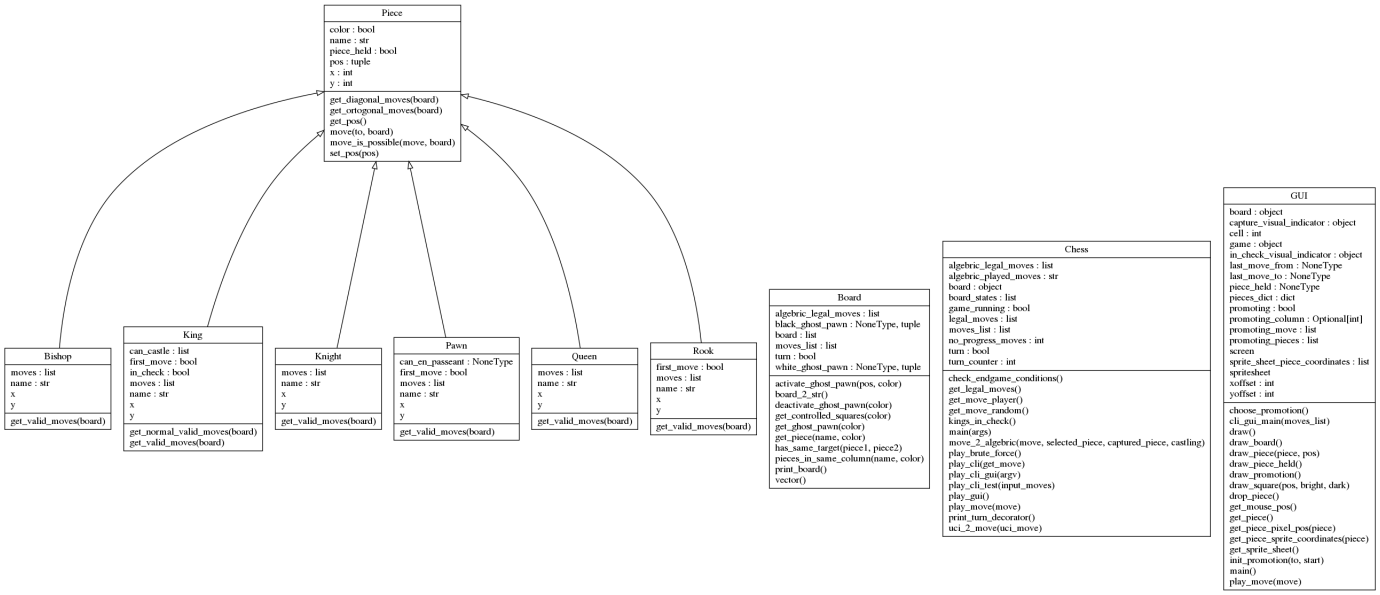
1 Program Scope

The program should be able to receive as input a chess move in UCI(Universal Chess Interface) format i.e e2e4, and if the movement is valid, output the board state to the user or inform the user the input isn't valid. For this matter, the standard python library is enough address the problem. For debugging purposes, a graphical interface was also required and implemented in pygame, a graphical framework for games.

2 Program project



3 Testing

Number of plies (half-moves)	Number of possible games
1	20
2	400
3	8092
4	197,281
5	4,865,609
6	119,060,324
...	...
10	69,352,859,712,417

Tabela 1: Shannon's Calculation. Obs: A turn is composed by a white move and a black move. Five plies therefore stands for white playing three times and black two.

For testing the general accuracy of the game, it was used the Shannon Number, which stands for all the possible moves that can be played until a certain ply(half-move). By the limitation of the computer power avaible for our

disposal, and considering that the game was not written in a language nor written in a way for fast computation, we could only check the precision of the game until 5 ply, which consists in 4,865,609 games. And which our game calculated 4,865,824. For 1,2,3 and 4 plies, the test generated the correct amount of games.

Specific tests were also made when debugging certain problems in code. So it was possible to replay a certain game until a specific move and debug it from there, without manually giving the moves as input.

For example, at 5 ply, there can't be a game with a promoted pawn case, therefore we need to make a specific test case for that matter.

```
python3 tests/promotionTest.py
python3 chess.py -guitest g2g4 h7h5 g4h5 g7g6 h5h6 h8h7 f2f3 h7g7 h6h7 f7f6
...
PlayedMoves: 1. g4 h5 2. gxh5 g6 3. h6 Rh7 4. f3 Rg7 5. h7 f6
```

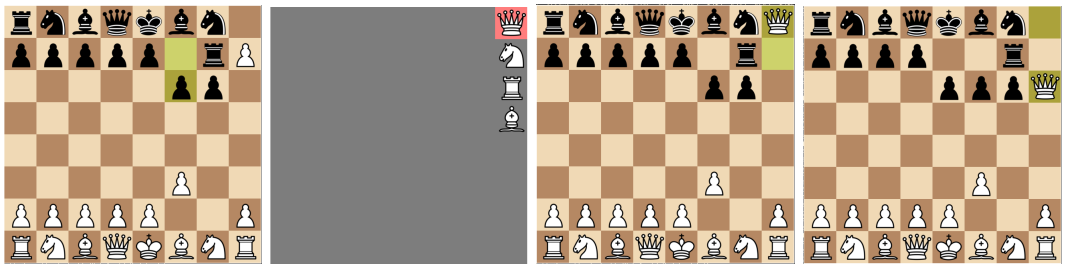


Figura 1: The most left screenshot is the result of the test, and then it was a sequence of screenshots of the user playing and doing the promotion manually.

While developing, the GUI and CLI interface could be behaving differently, having that in mind, we can also do the same test with the CLI if we are in doubt:

```
 >> $ python3 tests/promotionTest_cli.py
python3 chess.py -clitest g2g4 h7h5 g4h5 g7g6 h5h6 h8h7 f2f3 h7g7 h6h7 f7f6 h7h8q
e7e6 h8h6
(...)
Black's turn to move!
********************************
8| r | n | b | q | k | b | n |   |
7| p | p | p | p |   |   | r |   |
6|   |   |   |   | p | p | p | Q |
5|   |   |   |   |   |   |   |   |
4|   |   |   |   |   |   |   |   |
3|   |   |   |   |   | P |   |   |
2| P | P | P | P | P |   |   | P |
1| R | N | B | Q | K | B | N | R |
   a   b   c   d   e   f   g   h
********************************


2022-01-16 18:11:02,057 Result of possible games with 1 ply: 20/20 - OK
2022-01-16 18:11:02,057 Elapsed time in 1 ply: 00h00m00s seconds
2022-01-16 18:11:03,073 Result of possible games with 2 ply: 400/400 - OK
2022-01-16 18:11:03,073 Elapsed time in 2 ply: 00h00m01s seconds
2022-01-16 18:11:28,139 Result of possible games with 3 ply: 8902/8902 - OK
2022-01-16 18:11:28,140 Elapsed time in 3 ply: 00h00m25s seconds
2022-01-16 18:20:02,978 Result of possible games with 4 ply: 197281/197281 - OK
2022-01-16 18:20:02,978 Elapsed time in 4 ply: 00h08m34s seconds
2022-01-16 22:00:48,487 Result of possible games with 5 ply: 4865824/4865609 - ERROR
2022-01-16 22:00:48,487 Elapsed time in 5 ply: 03h40m45s seconds
2022-01-16 22:00:48,487 Total Elapsed time: (03h49m46s)
```