CSCI 141, Fall 2020

1 Forsyth-Edwards Notation

Forsyth-Edwards Notation (FEN) is a way of describing the location of chess pieces on a chessboard. Part of its popularity comes from the ease with which it can be understood by computers. In this project you will write a function that will take an FEN description of a chessboard and create an ASCII representation of the board and the pieces on it.

2 Background

First, a bit of background for those unfamiliar with chess. In the algebraic notation for describing a chess board, there are 8 rows, or ranks, numbered 1 through 8, and 8 columns, or files, labeled a through h:

```
8
7
6
5
4
3
2
1
  a b c d e f g h
```

Row 8 is the first row for the Black pieces; by tradition it is drawn at the top of the board as seen from above.

FEN uses ASCII characters to represent the pieces on the board:

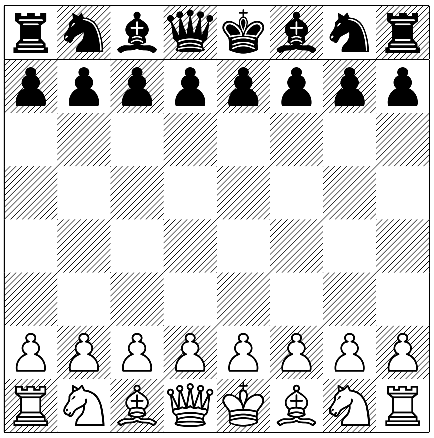
white king	♔	K	black king	♚	k
white queen	♕	Q	black queen	♛	q
white rook	♖	R	black rook	♜	r
white bishop	♗	B	black bishop	♝	b
white knight	♘	N	black knight	♞	n
white pawn	♙	P	black pawn	♟	p

Table 1: Traditional chess symbols and their FEN ASCII representations.

FEN encodes chess boards as follows.

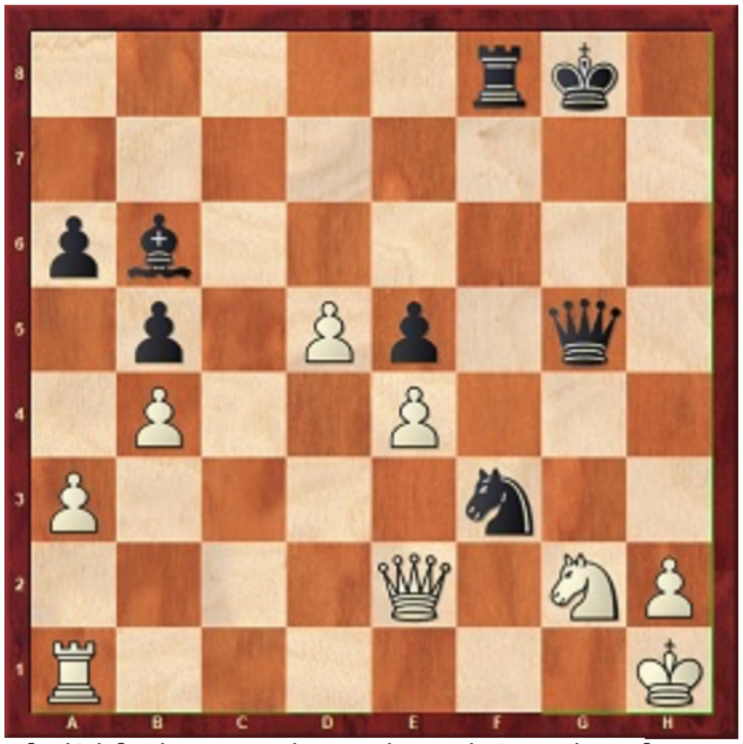
- Each row (rank) is described starting with row 8 and ending with row 1
- The description of the rows are separated by '/'.
- Within each rows, the squares are described from left to right (column a to column h).
- Each piece is identified by a single letter as shown in the table above. White pieces are upper-case ("PNBRQK") and Black pieces are lowercase ("pnbrqk").
- Empty squares are noted using numbers between 1 through 8 that indicate the number of empty squares.

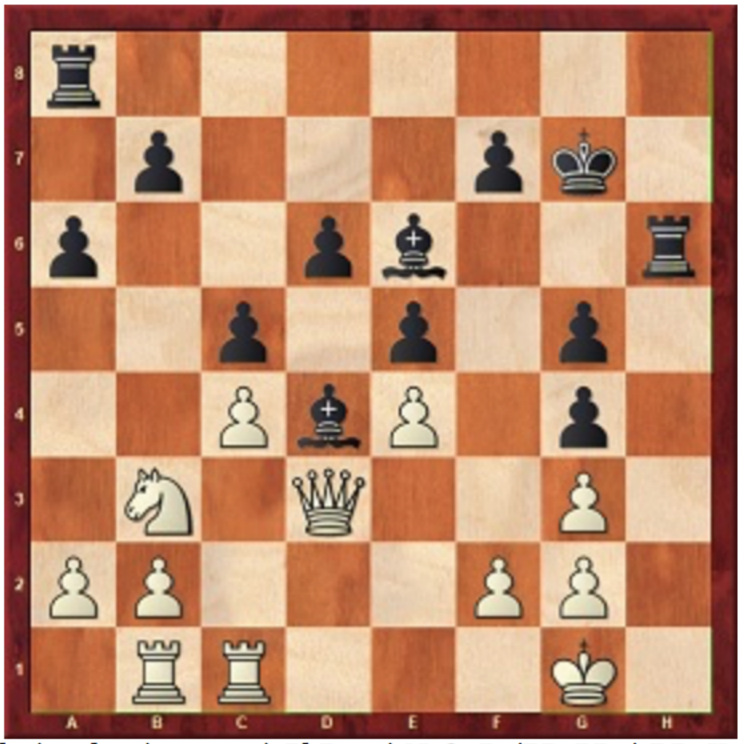
For the board at the start of a game,

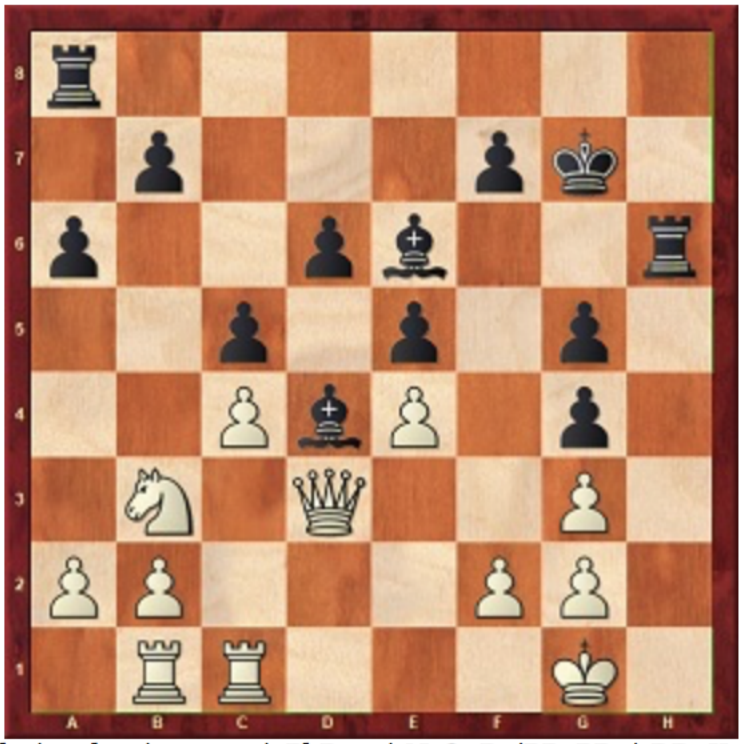


the FEN encoding is rnbqkbnr/pppppppp/8/8/8/8/PPPPPPPP/RNBQKBNR.

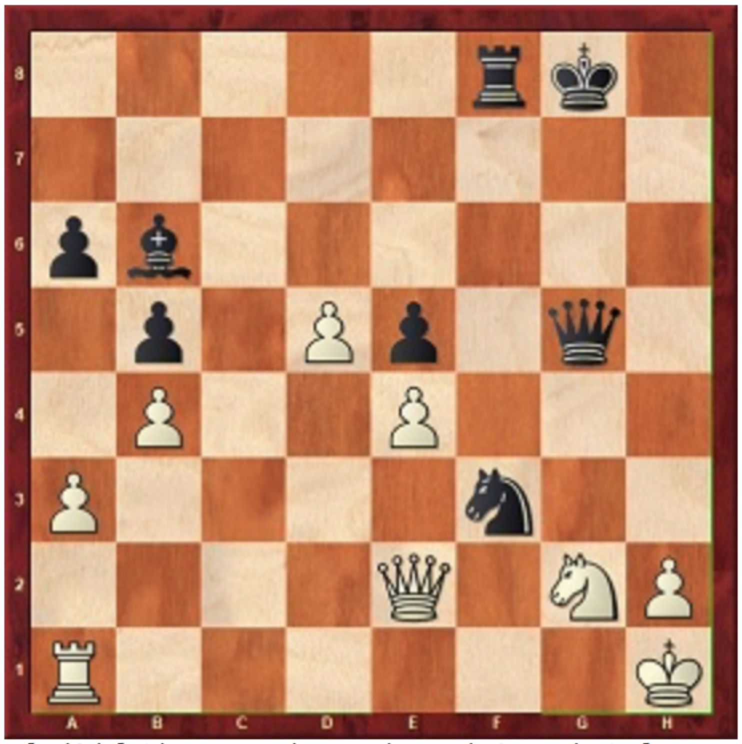
Here are some more FEN encodings you can examine to make sure you understand how it works. They also give you some more test cases. Ignore the last part of the string (e.g., `b - - 0 1`)—this is extra information about whose turn it is and possible legal moves.


5rk1/8/pb6/1p1Pp1q1/1P2P3/P4n2/4Q1NP/R6K b - - 0 1


r7/1p3pk1/p2pb2r/2p1p1p1/2PbP1p1/1N1Q2P1/PP3PP1/1RR3K1 b - - 0 1



r7/1p3pk1/p2pb2r/2p1p1p1/2PbP1p1/1N1Q2P1/PP3PP1/1RR3K1 b - - 0 1



5rk1/8/pb6/1p1Pp1q1/1P2P3/P4n2/4Q1NP/R6K b - - 0 1

2.1 Your task

Important! Your code should be in a file named `fen.py`.

In this project you are to write a function `fen(s)` that deciphers FEN descriptions of a chessboard and creates ASCII representations of the board. This function takes as its input a string `s` which is a FEN encoding of the location of pieces on a chess board. The function is to return a string which, when printed, will display the board. This means your string will need to include newlines. The board should also have the rows and columns labeled as in algebraic chess notation.

For instance, if

```
s = rnbqkbnr/pppppppp/8/8/8/8/PPPPPPPP/RNBQKBNR
```

then

```
board = fen(s)
print(board)
```

will result in

```
8  r  n  b  q  k  b  n  r
7  p  p  p  p  p  p  p  p
6  .  .  .  .  .  .  .  .
5  .  .  .  .  .  .  .  .
4  .  .  .  .  .  .  .  .
3  .  .  .  .  .  .  .  .
2  P  P  P  P  P  P  P  P
1  R  N  B  Q  K  B  N  R
   a  b  c  d  e  f  g  h
```

Important points:

- There should be two spaces between each character in a row but no spaces after the end of the row.
- Your function must contain a meaningful docstring.
- For now you do not need to check for bogus input.

You can view the raw characters in a string (including characters such as newlines and tabs) with the `repr()` function (hyperlink), which yields a printable representation of its input. For example,

```python
s = '**\n**\n'
print(repr(s))
```

yields

```
'**\n**\n'
```

By contrast,

```
print(s)
```

yields

```
**
**
```

3 Thinking about the problem

This problem is a tad more difficult than the ones you have faced so far. It is crucial you write out a plan for the solution before you start programming (and don't expect any help from us until you do!). Imagine trying to build a cathedral without scaffolding.

You can write such an outline as comments in your code. The outline is the "what"; the code is the "how". If you just start writing code without outlining the solution you're trying to figure out "how" without understanding "what" you're trying to do. This is a recipe for failure.

Talk through what you need to do out loud:

- I need to build a string that, when printed, represents a chessboard. This sounds like a variant of the "start with nothing and accumulate" pattern we have seen before.
- I need to read the FEN string character-by-character. This sounds like iteration.
- If I see a '/', that indicates a new row (rank), starting at the top. Before each row I need to place a number indicating which row it is. After the first row, before I begin the new row I need to insert a newline character '
  n' so I'll have a line break when printed.
- If I see a number, I need to insert the requisite number of spaces.
- If I see an alphabetic character, I need to insert this character with the requisite spacing.
- At the bottom of the diagram I need to label the columns (files).
- Everything needs to line up.

4 What to upload

Upload `fen.py` via the Blackboard site. Be sure that your file does not contain any active statements that will be executed when we import your code for testing.