Problem Statement: **[*The Queen's Gambit*]**   **Marks: 40**

Chess is a very famous two-player strategic game where the objective of each player is to checkmate other player. The game consists of a squared board divided into 64 square cells (8×8) alternatively shaded as BLACK and WHITE. Each player gets 16 pieces in total comprising of 6 different types as mentioned below:

- $1 \times$ **King (K):** Can move one step at a time in any direction (or twice in right/left during castling).

- $1 \times$ **Queen (Q):** Can move like all other pieces except like that of a knight.

- $2 \times$ **Rooks (R):** Can move in a straight line only either horizontally or vertically.

- $2 \times$ **Knights (N):** Can move two cell straight and then one cell either right or left in any direction.

- $2 \times$ **Bishops (B):** Can move in a straight line only through diagonal cells.

- $8 \times$ **Pawns (P):** Can move one cell forward (or two cells forward in its first move) and can move across one cell along the diagonal only to capture.

Now, the board configuration of 64 cells (8×8) is marked using $[a, b, c, d, e, f, g, h]$ in the horizontal direction (left-to-right) and $[1, 2, 3, 4, 5, 6, 7, 8]$ in the vertical direction (bottom-to-top) – while facing the board from white's side. Hence, the bottom-left, bottom-right, top-left and top-right cells are denoted as $a1, h1, a8, h8$, respectively. Moreover, various types of moves are indicated using the board configuration *notations* as follows:

Normal Piece Movement: [piece] [location (FROM)] − [location (TO)]

As an example, to indicate "Knight (N) moves from cell g1 to cell f3", we use Ng1-f3.

Piece Capturing Opponent's Piece during Movement: [piece] [location (FROM)] x [location (TO)]

As an example, to indicate "Pawn (P) moves from cell e4 to cell d5" and captures opponent's existing pawn there", we use Pe4xd5.

Indication of 'check' after Movement:
[piece] [location (FROM)] − [location (TO)] +   OR   [piece] [location (FROM)] x [location (TO)] +

As an example, to indicate "Rook (R) moves from cell f8 to cell e8 and giving the opponent's king a check threat", we use Rf8-e8+. If 'check' results after a capture, then we place 'x' in between moves instead of '-' (Ex: Rf8xe8+).

Indication of 'checkmate' after Movement:
[piece] [location (FROM)] − [location (TO)] #   OR   [piece] [location (FROM)] x [location (TO)] #

As an example, to indicate "Queen (Q) moves from cell d1 to cell h5 forcing checkmate", we use Qd1-h5#. If 'checkmate' results after a capture, then we place 'x' in between moves instead of '-' (Ex: Qd1xh5#). Incidentally, the game gets over after this move.

Castling: 0-0 [King-side]   OR   0-0-0 [Queen-side]

For King-side castling, the King moves two cells to right and the Rook on the right-side move two places on the left taking the immediate left position next to King. For Queen-side castling, the King moves two cells to left and the Rook on the left-side move three places on the right taking the immediate right position next to King. It can be usually played when King is not under 'check' threat and the participating Rook and King positions have not been altered previously in any game move.

Indication of Draw or Resignation: DRAW / draw   OR   RESIGN / resign

The game being drawn or any player wish to resign from an intermediate position of the game can be indicated (respectively) using such move-notations. Incidentally, the game ends with this declaration.

However, in order to *draw the overall chess-board configuration* (initially or at any intermediate game phase), you should consider the following (also refer to the sample executions):

- Indicate BLACK player's pieces present in a cell using *small letters*, i.e. [k], [q], [r], [n], [b], [p] and WHITE player's pieces present in a cell using *capital letters*, i.e. [K], [Q], [R], [N], [B], [P].

- Print each cell in a 3×3 matrix-like structure, where the piece information will be printed in the center location, the rest 8 locations will contain nothing (SPACE for WHITE cells, DOT for BLACK cells).

- Draw alternative BLACK and WHITE cells to complete the chess board configuration. The separator between two cells will be appropriately marked too (as shown in execution details).

A sample 8×8 board (with cell number markers, but without any pieces being placed) is given below and two 3×3 cells containing a piece in it (as an example, white cell contains black-player's Queen [q] and black cell contains white-player's Pawn [P]) are detailed out in the right side.

```
           a       b       c       d       e       f       g       h
        +-------+-------+-------+-------+-------+-------+-------+-------+      <-- BLACK SIDE
        |       | . . . |       | . . . |       | . . . |       | . . . |
      8 |       | . . . |       | . . . |       | . . . |       | . . . | 8
        |       | . . . |       | . . . |       | . . . |       | . . . |
        +-------+-------+-------+-------+-------+-------+-------+-------+
        | . . . |       | . . . |       | . . . |       | . . . |       |
      7 | . . . |       | . . . |       | . . . |       | . . . |       | 7
        | . . . |       | . . . |       | . . . |       | . . . |       |
        +-------+-------+-------+-------+-------+-------+-------+-------+                  +-------+
        |       | . . . |       | . . . |       | . . . |       | . . . |                  |       |
      6 |       | . . . |       | . . . |       | . . . |       | . . . | 6                |  [q]  |
        |       | . . . |       | . . . |       | . . . |       | . . . |                  |       |
        +-------+-------+-------+-------+-------+-------+-------+-------+                  +-------+
        | . . . |       | . . . |       | . . . |       | . . . |       |
      5 | . . . |       | . . . |       | . . . |       | . . . |       | 5
        | . . . |       | . . . |       | . . . |       | . . . |       |
        +-------+-------+-------+-------+-------+-------+-------+-------+                  +-------+
        |       | . . . |       | . . . |       | . . . |       | . . . |                  | . . . |
      4 |       | . . . |       | . . . |       | . . . |       | . . . | 4                | .[P]. |
        |       | . . . |       | . . . |       | . . . |       | . . . |                  | . . . |
        +-------+-------+-------+-------+-------+-------+-------+-------+                  +-------+
        | . . . |       | . . . |       | . . . |       | . . . |       |
      3 | . . . |       | . . . |       | . . . |       | . . . |       | 3
        | . . . |       | . . . |       | . . . |       | . . . |       |
        +-------+-------+-------+-------+-------+-------+-------+-------+
        |       | . . . |       | . . . |       | . . . |       | . . . |
      2 |       | . . . |       | . . . |       | . . . |       | . . . | 2
        |       | . . . |       | . . . |       | . . . |       | . . . |
        +-------+-------+-------+-------+-------+-------+-------+-------+
        | . . . |       | . . . |       | . . . |       | . . . |       |
      1 | . . . |       | . . . |       | . . . |       | . . . |       | 1
        | . . . |       | . . . |       | . . . |       | . . . |       |
        +-------+-------+-------+-------+-------+-------+-------+-------+      <-- WHITE SIDE
           a       b       c       d       e       f       g       h
```
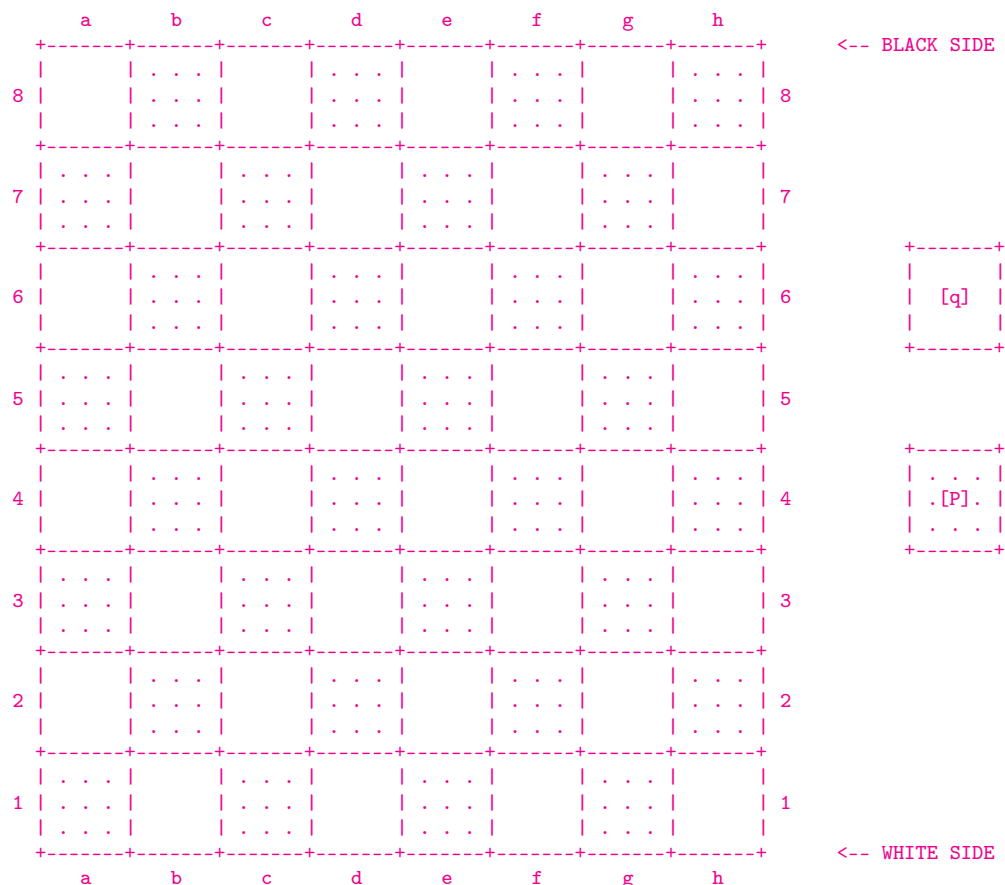
Note that, the initial configuration of a chess board before the game starts is also shown under the sample execution details part (refer to Sample-1 and Sample-2 both).

In this exercise, you need to simulate the given sequence of moves between two chess players and print all the intermediate board configurations using a C program. In particular, you have to carry out the following steps:

- Print the initial board configuration with the initial position of pieces placed in the board in structured format (refer to the execution details and the above discussion).

- Scan/Load from user a sequence of chess moves (you may assume that all the chess moves given are legal and notation-wise perfect).

- Simulate the moves one-after-another and subsequently print all the board configurations (in structured format) after every intermediate move made by a player.

- In between the play, indicate whenever the CHECK being shown by any player to the opponent.

- Finally (upon CHECKMATE, DRAW or RESIGN), prompt the corresponding message including the winner/loser.

Hint: Define the board as a two-dimensional array – this array will portray the running board configuration. You may try to write the functions like, printBoard (to print board configuration), initBoard (to initialize board before play starts), updateBoard (to update the board configurations after every move) and finally autoGamePlay (to simulate all the moves in a sequence).

Example Inputs/Outputs:

Sample-1:   (Fool's Mate)

```
** Initial Board Configuration:
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 | [r]   | .[n]. | [b]   | .[q]. | [k]   | .[b]. | [n]   | .[r]. |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | .[p]. | [p]   | .[p]. | [p]   | .[p]. | [p]   | .[p]. | [p]   |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 | [P]   | .[P]. | [P]   | .[P]. | [P]   | .[P]. | [P]   | .[P]. |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | .[R]. | [N]   | .[B]. | [Q]   | .[K]. | [B]   | .[N]. | [R]   |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+

++ Load Game Data:
Pd2-d4  Pf7-f5
Bc1-g5  Ph7-h6
Bg5-h4  Pg7-g5
Pe2-e4  Pg5xh4
Qd1-h5#


================================================================================
** FULL DETAILS OF SAMPLE-1 EXECUTION/OUTPUT :: ATTACHED IN "sample1.txt" FILE **
================================================================================
```

3

Sample-2:   (Viswanathan Anand vs. Boris Gelfand [1 − 0] : Game-8 of World Championship 2012)

** Initial Board Configuration:
```
+-------+-------+-------+-------+-------+-------+-------+-------+
|       | . . . |       | . . . |       | . . . |       | . . . |
|  [r]  | .[n]. |  [b]  | .[q]. |  [k]  | .[b]. |  [n]  | .[r]. |
|       | . . . |       | . . . |       | . . . |       | . . . |
+-------+-------+-------+-------+-------+-------+-------+-------+
| . . . |       | . . . |       | . . . |       | . . . |       |
| .[p]. |  [p]  | .[p]. |  [p]  | .[p]. |  [p]  | .[p]. |  [p]  |
| . . . |       | . . . |       | . . . |       | . . . |       |
+-------+-------+-------+-------+-------+-------+-------+-------+
|       | . . . |       | . . . |       | . . . |       | . . . |
|       | . . . |       | . . . |       | . . . |       | . . . |
|       | . . . |       | . . . |       | . . . |       | . . . |
+-------+-------+-------+-------+-------+-------+-------+-------+
| . . . |       | . . . |       | . . . |       | . . . |       |
| . . . |       | . . . |       | . . . |       | . . . |       |
| . . . |       | . . . |       | . . . |       | . . . |       |
+-------+-------+-------+-------+-------+-------+-------+-------+
|       | . . . |       | . . . |       | . . . |       | . . . |
|       | . . . |       | . . . |       | . . . |       | . . . |
|       | . . . |       | . . . |       | . . . |       | . . . |
+-------+-------+-------+-------+-------+-------+-------+-------+
| . . . |       | . . . |       | . . . |       | . . . |       |
| . . . |       | . . . |       | . . . |       | . . . |       |
| . . . |       | . . . |       | . . . |       | . . . |       |
+-------+-------+-------+-------+-------+-------+-------+-------+
|       | . . . |       | . . . |       | . . . |       | . . . |
|  [P]  | .[P]. |  [P]  | .[P]. |  [P]  | .[P]. |  [P]  | .[P]. |
|       | . . . |       | . . . |       | . . . |       | . . . |
+-------+-------+-------+-------+-------+-------+-------+-------+
| . . . |       | . . . |       | . . . |       | . . . |       |
| .[R]. |  [N]  | .[B]. |  [Q]  | .[K]. |  [B]  | .[N]. |  [R]  |
| . . . |       | . . . |       | . . . |       | . . . |       |
+-------+-------+-------+-------+-------+-------+-------+-------+
```

++ Load Game Data:
```
Pd2-d4   Ng8-f6
Pc2-c4   Pg7-g6
Pf2-f3   Pc7-c5
Pd4-d5   Pd7-d6
Pe2-e4   Bf8-g7
Ng1-e2   O-O
Ne2-c3   Nf6-h5
Bc1-g5   Bg7-f6
Bg5xf6   Pe7xf6
Qd1-d2   Pf6-f5
Pe4xf5   Bc8xf5
Pg2-g4   Rf8-e8+
Ke1-d1   Bf5xb1
Ra1xb1   Qd8-f6
Pg4xh5   Qf6xf3+
Kd1-c2   Qf3xh1
Qd2-f2   RESIGN
```

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** FULL DETAILS OF SAMPLE-2 EXECUTION/OUTPUT :: ATTACHED IN "sample2.txt" FILE **
===

```
** Initial Board Configuration:
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |  [r]  | .[n]. |  [b]  | .[q]. |  [k]  | .[b]. |  [n]  | .[r]. |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | .[p]. |  [p]  | .[p]. |  [p]  | .[p]. |  [p]  | .[p]. |  [p]  |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 |       | . . . |       | . . . |       | . . . |       | . . . |
 |  [P]  | .[P]. |  [P]  | .[P]. |  [P]  | .[P]. |  [P]  | .[P]. |
 |       | . . . |       | . . . |       | . . . |       | . . . |
 +-------+-------+-------+-------+-------+-------+-------+-------+
 | . . . |       | . . . |       | . . . |       | . . . |       |
 | .[R]. |  [N]  | .[B]. |  [Q]  | .[K]. |  [B]  | .[N]. |  [R]  |
 | . . . |       | . . . |       | . . . |       | . . . |       |
 +-------+-------+-------+-------+-------+-------+-------+-------+
```

```
++ Load Game Data:
Pe2-e4  Pe7-e5
Ng1-f3  Nb8-c6
Bf1-b5  Ng8-f6
O-O     Nf6xe4
Pd2-d4  Ne4-d6
Bb5xc6  Pd7xc6
Pd4xe5  Nd6-f5
Qd1xd8  Ke8xd8
Ph2-h3  Kd8-e8
Nb1-c3  Ph7-h5
Nc3-e2  Pb7-b6
Rf1-d1  Bc8-a6
Ne2-f4  Ba6-b7
Pe5-e6  Bf8-d6
Pe6xf7  Ke8xf7
Nf3-g5+ Kf7-f6
Ng5-e4+ Kf6-f7
Ne4-g5+ Kf7-f6
Ng5-e4+ Kf6-f7
Ne4-g5+ Kf7-f6
DRAW
```

```
================================================================================
** FULL DETAILS OF SAMPLE-3 EXECUTION/OUTPUT :: ATTACHED IN "sample3.txt" FILE **
================================================================================
```

Submit a single C source file. Do not use global/static variables.