

**digital**  
**INTEROFFICE**  
**MEMORANDUM**

M-1098

SUBJECT    The "Kalah" Game Playing Program  
 TO            PDP Distribution List  
 DATE        March 31, 1961  
 FROM        Roland Silver

The Board and Pieces

Kalah is played by two opponents seated opposite one another across a wooden board (Figure 1)

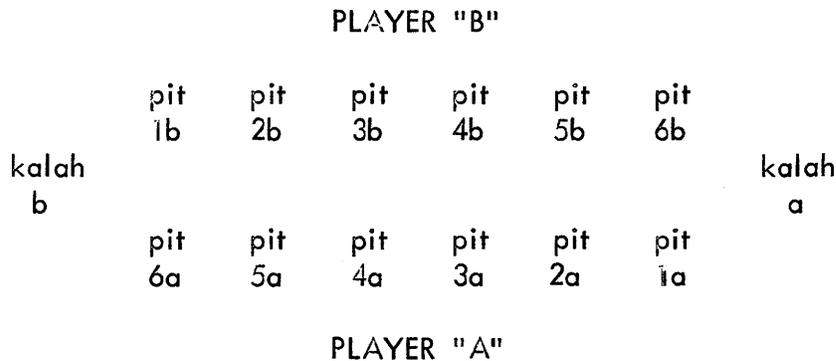


Figure 1. Kalah Board

Each player has before him six circular holes called his pits. At the end of the board to his right is an oval hole called his kalah. At the beginning of the game, each pit has three pieces or stones in it. The two kalahs are empty. As the game proceeds, these stones are moved from hole to hole, but are never removed from the board.

Object of the Game

In the course of the game, stones are cast into the kalahs but are never removed from them. The game ends when one player finds all of his pits empty. The other player then casts the stones remaining in his pits into his kalah. At this point, the player with the more stones in his kalah wins.

Rules

The players move alternately. The player whose turn it is to move proceeds as follows:

1. He selects one of his non-empty pits.

2. He removes all the stones from the selected pit and casts them, one per hole, into the succession of holes located counterclockwise from the selected pit, but skipping opponent's kalah. Thus for player A (Figure 1) the cyclic hole-order is 6a, 5a, 4a, 3a, 2a, 1a, kalah-a, 6b, 5b, 4b, 3b, 2b, 1b, 6a, ..., while for player B the order is 6b, 5b, 4b, 3b, 2b, 1b, kalah-b, 6a, 5a, 4a, 3a, 2a, 1a, 6b, ...
3. What happens next depends on the results of the play:
  - (a) If, as a result of the play, all of the player's pits are empty, then the game is over.
  - (b) If the last stone distributed in the play was cast into the player's kalah (repeat play), then the player must move again.
  - (c) If the last stone was cast into an empty pit on the player's side of the board, opposite a non-empty pit, then a capture results: The single stone in the previously empty pit, together with all the stones in the opposite pit, are taken up and cast into the player's kalah.
  - (d) If neither (a) nor (b) occurs, the move passes to the opponent.

### Operation of the Kalah Program

The Kalah program communicates with you via the typewriter and the scope. The typewriter is the input medium through which you communicate moves to be made, and other information. The scope is the program's output medium, on the face of which it displays the board, and other information. Figure 2 shows the display presented by the program at the beginning of the game.

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      3   3   3   3   3   3
0
+
      3   3   3   3   3   3
0
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Figure 2. Kalah Board at Start of Game

Each of the twelve pits has three stones in it, while the two kalahs at the ends have no stones in them. The "+" appearing below the left-hand kalah indicates that it is the lower player's turn to move. Considering the displayed board, you may select any legal move (in this case, any of 1a, 2a, 3a, 4a, 5a, 6a) and indicate your choice to the machine by typing the

appropriate numeral key on the typewriter. You have two other options. You may type a space, indicating that the machine is to select the next move, or you may type a carriage return, indicating that you wish to restart the game. If you type a numeral corresponding to an illegal move, or any other character not significant to the program, the program will reject the move by crossing out the offending character.

When a legal move has been decided upon, the machine will update its internal model of the board by making that move, and then it will display the new position of the board and wait for you to make another choice.

The position of the "+" at all times indicates which side is to move: if it is below the left-hand kalah, it is the lower player's turn to move: if it is above the left-hand kalah, it is the upper player's turn. At the end of the game the board is displayed without a "+", indicating that no further moves are to be made.

The machine will now display the board, as shown in Figure 2, and wait for you either to choose a move or to let it choose a move.

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Acknowledgment - The Kalah Program was supplied to DEC by Mr. Roland Silver, of Bolt Beranek and Newman, Cambridge, Massachusetts.