# High-Quality Code Construction – “Bulls and Cows” Game

Your task is to write an interactive **console-based implementation of the game “Cows and Bulls”** in which the **player tries to guess a secret number**. At the start of the game the computer generates a random secret number of 4 decimal digits (e.g. 7725). At each step the player makes a guess to the computer (e.g. 2375) and the computer answers how many digits are **correct** (**bulls**) and how many digits are present in the secret number but are **misplaced** (**cows**). For example, if the secret number is 7725 and the guess number is 2375, this means 1 bull (the last digit ‘5’) and 2 cows (the digits ‘2’ and ‘7’). Note that a single digit can either represent a bull, or a cow, but not two bulls, two cows or bull and cow in the same time. For example, if the secret number is 2424 and the guess number is 4144, the result is 1 bull and 1 cow. The game ends when the player’s guess is correct. Otherwise the computer prints the number of bulls and cows of the last guess and invites the player to try another guess. When the game is finished, a new game automatically starts.

If the player is bored, he or she can enter the command **'help'** instead of a guess number and as a response the computer should reveal a bull at a random position (different position every time). The player can request starting a new game by entering the command **'restart'**.

Your program should implement a local top scoreboard to keep the best results and the names of their authors. Initially, at the program start, the top scoreboard is empty. It **keeps the top 5 results** sorted in ascending order by the number of guesses. When a game is finished by correct guess of the secret number and without using the **'help'** command, the player’s result can enter in the top scoreboard if his or her number of guesses is less than some of the other achievements staying in the top scoreboard. When the player’s result enters the scoreboard, the player should enter his or her name or nickname.

The player can request printing the top scoreboard during the game by entering the command **'top'**. The player can request stopping the game and exiting from the program the command **'exit'**.

## Example Game Session

At the start of this game session the computer’s secret random number is 7725. The player’s input is shown in *italic*:

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| --- |
| **Welcome to “Bulls and Cows” game. Please try to guess my secret 4-digit number.**  **Use 'top' to view the top scoreboard, 'restart' to start a new game and 'help' to cheat and 'exit' to quit the game.**  **Enter your guess or command: *2375***  **Wrong number! Bulls: 1, Cows: 2**  Assume the computer’s secret number is 7725.  **Enter your guess or command: *8946***  **Wrong number! Bulls: 0, Cows: 0**  **Enter your guess or command: *top***  **Top scoreboard is empty.**  **Enter your guess or command: *1055***  **Wrong number! Bulls: 1, Cows: 0**  **Enter your guess or command: *2253***  **Wrong number! Bulls: 0, Cows: 2**  **Enter your guess or command: *7375***  **Wrong number! Bulls: 2, Cows: 1**  **Enter your guess or command: *2775***  **Wrong number! Bulls: 2, Cows: 2**  **Enter your guess or command: *7725***  **Congratulations! You guessed the secret number in 7 attempts.**  **Please enter your name for the top scoreboard: *Bay Ivan***  **Scoreboard:**  **1. Bay Ivan --> 7 guesses**  **Welcome to “Bulls and Cows” game. Please try to guess my secret 4-digit number.**  **Use 'top' to view the top scoreboard, 'restart' to start a new game and 'help' to cheat and 'exit' to quit the game.**  **Enter your guess or command: *1234***  **Wrong number! Bulls: 1, Cows: 1**  Assume the computer’s secret number is 8130.  **Enter your guess or command: *4567***  **Wrong number! Bulls: 0, Cows: 0**  **Enter your guess or command: *8901***  **Wrong number! Bulls: 1, Cows: 2**  **Enter your guess or command: *top***  **Scoreboard:**  **1. Bay Ivan --> 7 guesses**  **Enter your guess or command: *restart***  **Welcome to “Bulls and Cows” game. Please try to guess my secret 4-digit number.**  **Use 'top' to view the top scoreboard, 'restart' to start a new game and 'help' to cheat and 'exit' to quit the game.**  **Enter your guess or command: *1234***  **Wrong number! Bulls: 0, Cows: 2**  Assume the computer’s secret number is 0347.  **Enter your guess or command: *5678***  **Wrong number! Bulls: 0, Cows: 1**  **Enter your guess or command: *help***  **The number looks like XX4X.**  **Enter your guess or command: *9043***  **Wrong number! Bulls: 1, Cows: 2**  **Enter your guess or command: *help***  **The number looks like 0X4X.**  **Enter your guess or command: *0642***  **Wrong number! Bulls: 2, Cows: 0**  **Enter your guess or command: *0348***  **Wrong number! Bulls: 8, Cows: 0**  **Enter your guess or command: *0347***  **Congratulations! You guessed the secret number in 6 attempts and 2 cheats.**  **You are not allowed to enter the top scoreboard.**  **Scoreboard:**  **1. Bay Ivan --> 7 guesses**  **Welcome to “Bulls and Cows” game. Please try to guess my secret 4-digit number.**  **Use 'top' to view the top scoreboard, 'restart' to start a new game and 'help' to cheat and 'exit' to quit the game.**  **Enter your guess or command: *1234***  **Wrong number! Bulls: 1, Cows: 2**  Assume the computer’s secret number is 2133.  **Enter your guess or command: *5678***  **Wrong number! Bulls: 0, Cows: 0**  **Enter your guess or command: *9012***  **Wrong number! Bulls: 0, Cows: 2**  **Enter your guess or command: *win***  **Incorrect guess or command!**  **Enter your guess or command: *exit***  **Good bye!** |

Some players could try to cheat by entering illegal moves, so be cautious and **prevent illegal input**.