Lab Report: Number Adventure & Sudoku Game

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Introduction

The Number Adventure & Sudoku Game is a command-line-based project that combines two distinct games: a number adventure game and a Sudoku puzzle. This project aims to provide an engaging, interactive, and educational experience for users while exploring Linux shell scripting and various game development concepts.

Motivation

The motivation behind this project stems from the desire to create an entertaining and educational command-line game that combines classic number-based puzzles with the interactivity of shell scripting. By merging the Number Adventure and Sudoku games, we aimed to offer users an engaging experience, test their number skills, and challenge them with the classic rules of Sudoku.

Objective

The primary objective of this project is to create a multifaceted command-line game with the following key goals:

1. Develop a single-player number guessing game with multiple difficulty levels to challenge and entertain players.

2. Implement a multiplayer number guessing game that allows users to compete or collaborate with their peers.

3. Create a NumberJack game, which is a fun and educational number-based puzzle for players to enjoy.

4. Incorporate a classic Sudoku puzzle with well-defined rules to test users' logical thinking and problem-solving skills.

5. Design a user profile system to enable players to track their progress and scores.

6. Implement a leaderboard feature to showcase the top-performing players in the game.

7. Offer clear instructions for each game mode to ensure an enjoyable and frustration-free experience for all players.

8. Use shell scripting and Linux-based tools to create a seamless and intuitive user interface.

Tools

The project utilized the following tools and technologies:

- Bash shell scripting: For creating the core logic and gameplay of the command-line games.

- `nc` (netcat) tool: Used for enabling the multiplayer mode, allowing players to communicate and compete in real-time.

- Git: For version control and collaborative development.

- GitHub: To host the project repository and facilitate collaborative contributions.

Methodology

The development process followed these key steps:

1. Game Design: Initial planning and design of the games, including the user interface and game rules.

2. Bash Scripting: Writing Bash scripts for the number adventure game, NumberJack game, Sudoku game, user profiles, and leaderboards.

3. Integration: Merging the individual game scripts into a unified project with a menu-based interface.

4. Testing and Debugging: Extensive testing and debugging to ensure smooth gameplay and eliminate errors.

5. Documentation: Writing code comments and creating a README file to guide users on how to play the games.

6. Version Control: Using Git and GitHub for version control and collaboration with contributors.

Implementation

Source Code:

```
#!/bin/bash

generate_random_number() {
  local min=$1
  local max=$2
  echo $((RANDOM % (max - min + 1) + min))
}

send_message() {
  local message="$1"
  echo "$message" > /dev/tcp/$opponent_ip/$opponent_port
}

receive_message() {
  nc -l -p $player_port
}

declare -A user_profiles

create_user_profile() {
  read -p "Enter a new user ID: " user_id
  read -s -p "Enter a passcode: " passcode
  echo

  echo "$user_id:$passcode:0" >> user_profiles.txt

  echo "User profile created for user ID: $user_id"
}

authenticate_user() {
  read -p "Enter your user ID: " user_id
  read -s -p "Enter your passcode: " passcode
  echo

  if grep -q "^$user_id:$passcode:" user_profiles.txt; then
    echo "Authentication successful. Welcome, $user_id!"
    return 0
  else
    echo "Authentication failed. Invalid user ID or passcode."
    return 1
  fi
}
```

```
update_leaderboard() {
  local user_id="$1"
  local score="$2"

  sed -i "s/^$user_id:[0-9]*$/$user_id:$score/" leaderboard.txt
}

# Function to display the leaderboard
display_leaderboard() {
  clear
  echo "Local Leaderboard:"
  sort -t: -k2,2nr leaderboard.txt | while IFS=: read -r user_id score; do
    echo "Player $user_id Score: $score"
  done
  read -p "Press Enter to continue..."
}

play_game() {
  local min=$1
  local max=$2
  local secret_number=$(generate_random_number $min $max)
  local attempts=0
  local score=0
  local time_limit=60

  echo "You have $time_limit seconds to guess the number between $min and $max."

  local start_time=$(date +%s)

  while true; do
    read -t $time_limit -p "Guess the number between $min and $max: " guess

    local current_time=$(date +%s)
    local elapsed_time=$((current_time - start_time))

    if [ $? -ne 0 ]; then
      echo "Time's up! You didn't guess in time."
      break
    fi

    ((attempts++))

    if [[ $guess -lt $secret_number ]]; then
      echo "Try higher!"
```

```
    elif [[ $guess -gt $secret_number ]]; then
      echo "Try lower!"
    else
      echo "Congratulations! You guessed the number $secret_number in $attempts
attempts."
      score=$((100 - attempts))
      echo "Your score: $score"
      read -p "Press Enter to continue..."
      break
    fi

    if [ $elapsed_time -ge $time_limit ]; then
      echo "Time's up! You didn't guess in time."
      break
    fi
  done
}

play_multiplayer_game() {
  clear
  echo "Multiplayer Mode"
  echo "Waiting for another player to join..."
  echo "Share the following information with the other player:"
  echo "Your IP: $my_ip"
  echo "Your Port: $my_port"

  echo "1. Host a game"
  echo "2. Join a game"
  read -p "Select an option: " mp_option

  case $mp_option in
    1)
      player_number=1
      player_port=$my_port
      opponent_ip=""
      opponent_port=""

      opponent_ip=$(receive_message)
      opponent_port=$(receive_message)
      echo "Player 2 has joined the game."
      ;;
    2)
      player_number=2
      player_port=$my_port
      opponent_ip=$opponent_ip
```

```
      opponent_port=$opponent_port

      send_message "$my_ip"
      send_message "$my_port"
      echo "Connected to Player 1."
      ;;
    *)
      echo "Invalid option. Please choose 1 or 2."
      return
      ;;
  esac

  local min=1
  local max=100
  local secret_number=$(generate_random_number $min $max)
  local attempts=0
  local score=0

  while true; do
    read -p "Player $player_number, guess the number between $min and $max: "
guess
    ((attempts++))

    if [[ $guess -lt $secret_number ]]; then
      echo "Try higher!"
    elif [[ $guess -gt $secret_number ]]; then
      echo "Try lower!"
    else
      echo "Player $player_number, you guessed the number $secret_number in
$attempts attempts."
      score=$((100 - attempts))
      echo "Your score: $score"

      send_message "Player $player_number has guessed the number in $attempts
attempts with a score of $score."

      break
    fi
  done
}

# Function to play the NumberJack game
play_numberjack_game() {
  clear
  echo "Welcome to NumberJack Game!"
```

```
ch=0

while [ $ch -ne 3 ]; do
  echo "NumberJack Menu:"
  echo "1. Play NumberJack"
  echo "2. Instructions"
  echo "3. Return to Main Menu"
  read -p "Enter your choice: " ch

  case $ch in
    1)
      x=0
      c=0
      p=0
      read -p "Enter any number between 0 and 9: " n
      while [ $c -eq 0 ]; do
        x=11
        r=($(shuf -i 0-9 -n 10))
        echo "${r[@]} "
        for i in {1..10}; do
          a[$i]=$i
        done
        echo "${a[@]} "
        read -t 5 -p "Enter the index of your number: " x
        if [[ $? -gt 128 ]]; then
          c=1
          break
        fi
        if [ ${r[$(($x))-1]} -eq $n ]; then
          echo "Great"
          ((p=p+1))
        else
          c=1
          break
        fi
      done
      ;;
    2)
      echo "HELP: INSTRUCTIONS TO PLAY THE NUMBERJACK GAME. "
      echo "1. Select any number between 0 and 9 (inclusive) i.e 0 and 9 are
accepted."
      echo "2. Two lists will appear in front of you."
      echo "3. The upper list will have a list of randomly shuffled numbers
between 0 and 9."
```

```
        echo "4. See if you can find your chosen number in that list within 5
seconds."
        echo "5. Then you have to enter the index of that number indicated in the
second list below."
        echo "6. The game will continue until you are correct and enter the
number on time (before 5 sec)."
        ;;
      3)
        break
        ;;
      *)
        echo "Invalid choice. Please select a valid option."
        ;;
    esac

    if [ $c -eq 1 ]; then
      echo -e "\nGAME OVER\n"
      echo "You scored $p points"
    fi
  done
}

my_ip=$(hostname -I | awk '{print $1}')
my_port=$(shuf -i 1024-49151 -n 1)

leaderboard_file="leaderboard.txt"
if [ ! -f "$leaderboard_file" ]; then
  touch "$leaderboard_file"
  echo "1:0" >> "$leaderboard_file"
  echo "2:0" >> "$leaderboard_file"
fi

play_sudoku() {

declare -a board=(
    5 3 0 0 7 0 0 0 0
    6 0 0 1 9 5 0 0 0
    0 9 8 0 0 0 0 6 0
    8 0 0 0 6 0 0 0 3
    4 0 0 8 0 3 0 0 1
    7 0 0 0 2 0 0 0 6
    0 6 0 0 0 0 2 8 0
    0 0 0 4 1 9 0 0 5
    0 0 0 0 8 0 0 7 9
)
```

```
print_board() {
    echo -e "Sudoku Board:"
    for ((row=0; row<9; row++)); do
        for ((col=0; col<9; col++)); do
            echo -n "${board[row*9 + col]} "
            if [ $(((col + 1) % 3)) -eq 0 ] && [ $col -lt 8 ]; then
                echo -n "| "
            fi
        done
        echo
        if [ $(((row + 1) % 3)) -eq 0 ] && [ $row -lt 8 ]; then
            echo "------+-------+------"
        fi
    done
}

is_valid_move() {
    local row=$1
    local col=$2
    local num=$3

    for ((i=0; i<9; i++)); do
        if [ "${board[row*9 + i]}" -eq "$num" ] || [ "${board[i*9 + col]}" -eq
"$num" ]; then
            return 1
        fi
    done

    local box_start_row=$((row - row % 3))
    local box_start_col=$((col - col % 3))

    for ((i=box_start_row; i<box_start_row+3; i++)); do
        for ((j=box_start_col; j<box_start_col+3; j++)); do
            if [ "${board[i*9 + j]}" -eq "$num" ]; then
                return 1
            fi
        done
    done

    return 0
}

is_solved() {
    for ((row=0; row<9; row++)); do
```

```
        for ((col=0; col<9; col++)); do
            if [ "${board[row*9 + col]}" -eq 0 ]; then
                return 1
            fi
        done
    done

    return 0
}

play_sudoku() {
    while true; do
        print_board
        echo -e "Enter row (1-9) and column (1-9) to place a number (0 to quit):"
        read -p "Row: " row
        read -p "Column: " col

        if [ "$row" -eq 0 ] || [ "$col" -eq 0 ]; then
            echo "Exiting Sudoku game."
            break
        fi

        if [ "$row" -ge 1 ] && [ "$row" -le 9 ] && [ "$col" -ge 1 ] && [ "$col" -
le 9 ] && [ "${board[((row-1)*9 + col-1)]}" -eq 0 ]; then
            read -p "Enter a number (1-9): " number
            if is_valid_move $((row-1)) $((col-1)) "$number"; then
                board[((row-1)*9 + col-1)]="$number"
            else
                echo "Invalid move. Try again."
            fi
        else
            echo "Invalid row or column. Try again."
        fi

        if is_solved; then
            print_board
            echo "Congratulations! You've solved the Sudoku puzzle!"
            break
        fi
    done
}

print_menu() {
    while true; do
        echo -e "\nSudoku Game Menu:"
```

```
        echo "1. Play Sudoku"
        echo "2. Return to Main Menu"
        read -p "Enter your choice: " choice

        case "$choice" in
            1)
                play_sudoku
                ;;
            2)
                break
                ;;
            *)
                echo "Invalid choice. Please select a valid option."
                ;;
        esac
    done
}

print_menu

}

play_number_adventure_game() {
    while true; do
        clear
        echo "Number Adventure Game"
        echo "1. Single Player"
        echo "2. Multiplayer"
        echo "3. Instructions"
        echo "4. Leaderboard"
        echo "5. Create User Profile"
        echo "6. Login"
        echo "7. Sudoku"
        echo "8. NumberJack Game"
        echo "9. Quit"
        read -p "Select an option: " choice

        case $choice in
            1)
                clear
                echo "Choose a Difficulty Level:"
                echo "1. Easy (1-50)"
                echo "2. Medium (1-100)"
                echo "3. Hard (1-200)"
                echo "4. Very Hard (1-300)"
```

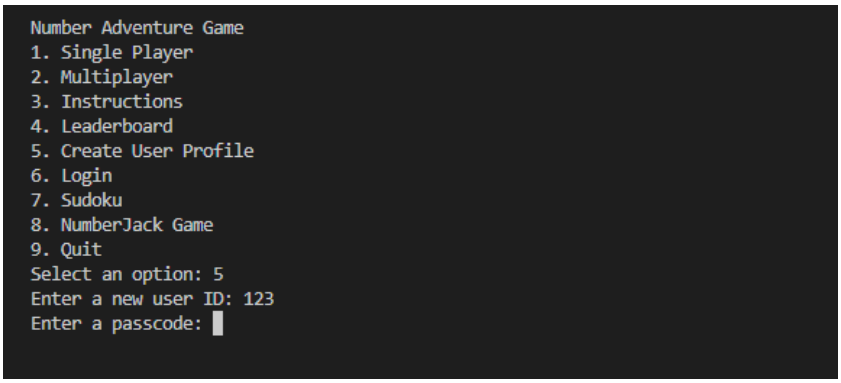
```
                echo "5. Insane (1-500)"
                read -p "Select a difficulty level: " difficulty_choice

                case $difficulty_choice in
                    1)
                        play_game 1 50
                        ;;
                    2)
                        play_game 1 100
                        ;;
                    3)
                        play_game 1 200
                        ;;
                    4)
                        play_game 1 300
                        ;;
                    5)
                        play_game 1 500
                        ;;
                    *)
                        echo "Invalid difficulty level. Please choose 1, 2, 3, 4,
or 5."
                        ;;
                esac
                ;;
            2)
                play_multiplayer_game
                ;;
            3)
                clear
                echo "Instructions:"
                echo "- This is a number guessing game combined with Linux shell
commands."
                echo "- In single-player mode, guess the number to earn points."
                echo "- In multiplayer mode, compete or collaborate with others."
                echo "- Use Linux commands to solve puzzles and advance in the
game."
                echo "- Check leaderboards for your ranking."
                echo "- Have fun and learn Linux commands!"
                read -p "Press Enter to go back to the menu..."
                ;;
            4)
                display_leaderboard
                ;;
            5)
```

```
                create_user_profile
                ;;
            6)
                authenticate_user
                if [ $? -eq 0 ]; then
                    echo "Press Enter to continue..."
                    read

                    play_game 1 100

                    update_leaderboard "$user_id" "$score"
                else
                    echo "Press Enter to go back to the menu..."
                    read
                fi
                ;;
            7)
                play_sudoku
                ;;
            8)
                play_numberjack_game
                ;;
            9)
                echo "Thanks for playing! Goodbye."
                exit
                ;;
            *)
                echo "Invalid option. Please choose a valid option."
                ;;
        esac
    done
}

play_number_adventure_game
```

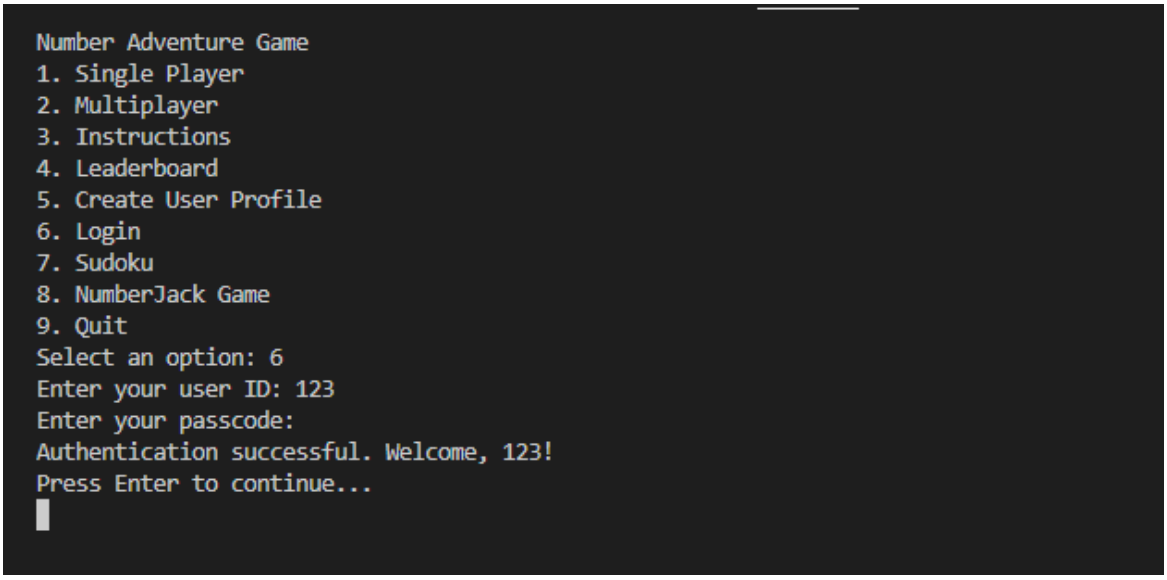
Output

Main Menu:

Creating User:



User Login:



Number Guessing:

```
You have 60 seconds to guess the number between 1 and 100.
Guess the number between 1 and 100: 1
Try higher!
Guess the number between 1 and 100: 4
Try higher!
Guess the number between 1 and 100: 5
Try higher!
Guess the number between 1 and 100: 99
Try lower!
Guess the number between 1 and 100: 90
Try lower!
Guess the number between 1 and 100: 80
Try lower!
Guess the number between 1 and 100: 70
Try lower!
Guess the number between 1 and 100: 60
Try lower!
Guess the number between 1 and 100: 50
Try lower!
Guess the number between 1 and 100: 40
Try higher!
Guess the number between 1 and 100: 45
Try lower!
Guess the number between 1 and 100: 44
Try lower!
Guess the number between 1 and 100: 43
Try lower!
Guess the number between 1 and 100: 42
Congratulations! You guessed the number 42 in 14 attempts.
Your score: 86
Press Enter to continue...
```

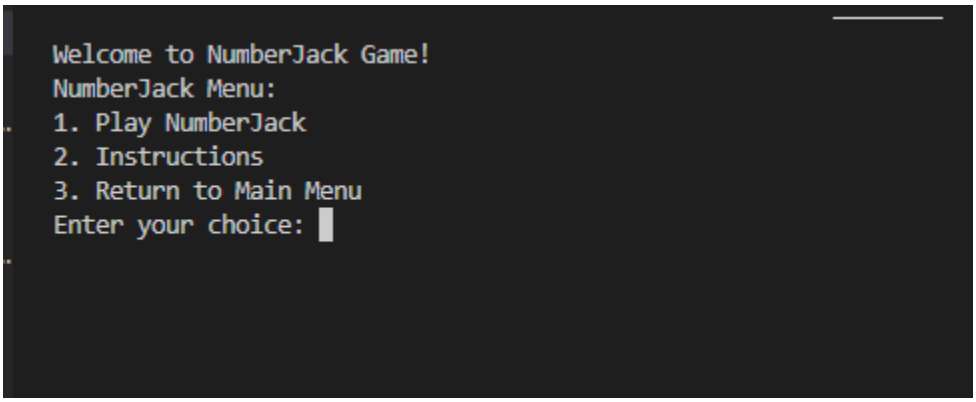
Leaderboard:

```
Local Leaderboard:
Player 1 Score: 0
Player 2 Score: 0
Press Enter to continue...
```

Sudoku:

```
Select an option: 7

Sudoku Game Menu:
1. Play Sudoku
2. Return to Main Menu
Enter your choice: 1
Sudoku Board:
5 3 0 | 0 7 0 | 0 0 0
6 0 0 | 1 9 5 | 0 0 0
0 9 8 | 0 0 0 | 0 6 0
------+-------+------
8 0 0 | 0 6 0 | 0 0 3
4 0 0 | 8 0 3 | 0 0 1
7 0 0 | 0 2 0 | 0 0 6
------+-------+------
0 6 0 | 0 0 0 | 2 8 0
0 0 0 | 4 1 9 | 0 0 5
0 0 0 | 0 8 0 | 0 7 9
Enter row (1-9) and column (1-9) to place a number (0 to quit):
Row: 1
Column: 3
Enter a number (1-9): 1
Sudoku Board:
5 3 1 | 0 7 0 | 0 0 0
6 0 0 | 1 9 5 | 0 0 0
0 9 8 | 0 0 0 | 0 6 0
------+-------+------
8 0 0 | 0 6 0 | 0 0 3
4 0 0 | 8 0 3 | 0 0 1
7 0 0 | 0 2 0 | 0 0 6
------+-------+------
0 6 0 | 0 0 0 | 2 8 0
0 0 0 | 4 1 9 | 0 0 5
0 0 0 | 0 8 0 | 0 7 9
Enter row (1-9) and column (1-9) to place a number (0 to quit):
Row:
```

NumberJack:




```
NumberJack Menu:
1. Play NumberJack
2. Instructions
3. Return to Main Menu
Enter your choice: 1
Enter any number between 0 and 9: 6
5 3 0 7 6 1 8 2 9 4
1 2 3 4 5 6 7 8 9 10
Enter the index of your number: 5
Great
7 3 8 4 2 5 1 9 0 6
1 2 3 4 5 6 7 8 9 10
Enter the index of your number: 10
Great
3 8 1 7 5 4 6 0 2 9
1 2 3 4 5 6 7 8 9 10
Enter the index of your number: 9

GAME OVER

You scored 2 points
NumberJack Menu:
1. Play NumberJack
2. Instructions
3. Return to Main Menu
Enter your choice:
```

Conclusion

The Number Adventure & Sudoku Game project successfully combines multiple entertaining and educational command-line games into one cohesive experience. By offering users a choice of single-player and multiplayer modes, classic number puzzles, and a Sudoku challenge, the project achieves its goal of providing an enjoyable and interactive environment.

Additionally, the user profile system and leaderboard allow players to track their progress and compete for top positions. The project demonstrates the capabilities of Bash scripting and Linux-based tools for creating a seamless and intuitive user interface.

In conclusion, the Number Adventure & Sudoku Game project represents a successful fusion of classic games with modern command-line scripting, offering users a fun and educational way to explore the world of numbers and puzzles while enhancing their Linux command-line skills.

GitHub Link: https://github.com/motiullahsajit/Number-Adventure