**"Guess the Number" Game Project**

Journey to a Network-Based Guess the Number Game

By: Toros Kutlu

**Summary**

This document outlines the development of a simple yet intriguing network-based "Guess the Number" game. The essence of this project lies in its ability to connect two entities, a client and a server, over a network where the client endeavors to guess a number randomly generated by the server. This game not only demonstrates fundamental networking concepts but also encapsulates the joy of interactive programming.

**Development Process**

The journey from conception to the final product can be encapsulated in the following key stages:

1. Idea Conception: The initial stage involved brainstorming ideas that could effectively demonstrate networking capabilities while ensuring engagement and simplicity. The "Guess the Number" concept was chosen for its straightforwardness and potential for network implementation.
2. Design Phase: Sketching out the basic architecture in pseudo-code, including server and client components and their interaction, was crucial. This stage involved outlining the game's flow, from establishing a connection to the gameplay dynamics of guessing numbers.
3. Implementation: Coding began with setting up the server to generate a random number and listen for connections. The client's development followed, enabling it to send guesses and receive feedback. Key Java networking libraries were utilized during this phase.
4. Testing and Refinement: Rigorous testing was conducted to ensure reliability and responsiveness. Feedback loops helped refine the game, improving error handling and user experience.
5. Final Touches and Documentation: The last step involved polishing the code, ensuring consistency in style and comprehensive commenting. The project was then documented, detailing its development process, architecture, and functionality.

**Architecture and Code Structure**

The game's architecture is divided into two main components: the server and the client. The server is responsible for generating a random number and handling incoming guesses, while the client sends guesses and displays feedback. Key code snippets, such as the server's random number generation and client-server communication logic, highlight the program's structure. Pseudocode is provided to offer a high-level understanding of the game's workflow.

* Overview: The project's architecture is a classic client-server model tailored for a network-based "Guess the Number" game. This model enables real-time interaction between a client application, where the user makes guesses, and a server that processes these guesses against a randomly generated number.
* Server Structure:
  + Initialization: The server initiates by binding to a predefined port, setting up a welcoming environment for client connections.
  + Number Generation: Upon a successful client connection, the server generates a random number within a specified range, serving as the target for the guessing game.
  + Client Communication: A loop facilitates continuous communication with the client, receiving guesses and sending back hints or success messages.
  + Concurrency Handling: The server is designed to handle multiple client connections simultaneously, ensuring each session operates independently.
* Client Structure:
  + Connection Setup: The client initiates the interaction by connecting to the server using its IP address and port number, establishing a communication channel.
  + User Interface: While a graphical user interface (GUI) is not mandatory, the client setup includes a simple command-line interface for inputting guesses and receiving feedback.
  + Guess Submission: Users input their guesses, which are then sent to the server for evaluation.
  + Feedback Reception: The client receives hints from the server to adjust their guesses accordingly, enhancing the interactive experience.
* Communication Protocol: The client and server communicate using a simple, custom protocol over TCP/IP. This protocol defines the format of guess submissions and the server's responses, ensuring clarity and consistency in their interaction.
* Error Handling and Validation: Both the client and server include mechanisms to handle potential errors, such as invalid inputs or connection issues, ensuring the game's smooth operation.

**Functionality and Operation**

This section describes the game's operation, from startup to the guessing process. It includes how the server and client establish a connection, the interaction pattern for guesses, and the feedback mechanism. Screenshots and command-line outputs illustrate the game in action, providing a clear view of its functionality.

This structure provides a comprehensive overview of the "Guess the Number" game project, from its conceptualization to its functional state. It captures the essence of the project, the step-by-step development process, the architectural and code details, and the game's operation.

* Game Start:
  + The server is launched first, setting up the listening port and awaiting client connections.
  + Players start the client application, which automatically connects to the server, triggering the game's commencement.
* The Guessing Process:
  + The player is prompted to enter a guess, which is then sent to the server for evaluation.
  + The server compares the guess to the target number and returns feedback: "Higher" if the guess is too low, "Lower" if too high, and "Correct!" if the guess is accurate.
  + This process repeats, with the player adjusting their guesses based on the server's feedback, fostering an engaging game loop.
* Winning the Game:
  + Upon guessing the correct number, the player receives a congratulatory message, and the current game session concludes.
  + The server can then wait for a new connection for another game round, or the session can be terminated based on the player's or server administrator's preference.
* Session Termination:
  + The game session can end in various scenarios: the player successfully guesses the number, the player chooses to exit the game, or an unexpected error occurs.
  + Upon session termination, the client and server gracefully close the connection, ensuring all resources are properly released.
* Scalability and Extensions:
  + The basic game setup allows for scalability, such as adding more sophisticated features like score tracking, time limits, or competitive modes with multiple clients.
  + Extensions could include enhancing the user interface, incorporating secure connections, or adding persistence features like high-score tables.

**Possible expansion / enhancements (Extra):**

Extended Functionality and Creativity:

* Scoring System: Implement a scoring system to track players' performances across games.
* Adjustable Difficulty Levels: Allow players to choose the range of numbers to guess from, making the game easier or harder.
* Multiplayer Support: Enable multiple players to compete against each other, either by taking turns or by playing simultaneously in separate sessions.

Technical Complexity:

* Concurrency Handling: Use multithreading to manage multiple concurrent player sessions, enhancing the scalability and responsiveness of your server.
* Secure Communication: Implement security features such as encryption to protect the data exchanged between the client and server, ensuring privacy and integrity.
* High Score Tracking: Maintain a high score list to record top player scores, providing motivation for players to improve.
* User Customization: Allow users to customize settings, such as the number range for guessing, to personalize their gameplay experience.
* Enhanced User Interface: Improve the user interface for both the server and client, making the game more engaging and user-friendly.
* Game Variants: Introduce different game modes or variants, such as time-limited guesses or penalties for incorrect guesses, to add variety.
* Feedback Mechanism: Provide detailed feedback to users after each guess, such as "much higher" or "slightly lower," to make the game more interactive.
* Session Reconnect: Implement functionality that allows disconnected players to rejoin ongoing game sessions, enhancing user experience.
* Leaderboard: Create a global leaderboard feature to encourage competition among players by displaying top scores and player rankings.

Attachments:

* Please see README.md for instructions, details and credits.
* Pseudo-code in .txt
* Screenshots from the gameplay