Title Page Project Title: AI-Based Number Guessing Game
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Course: Introduction to AI
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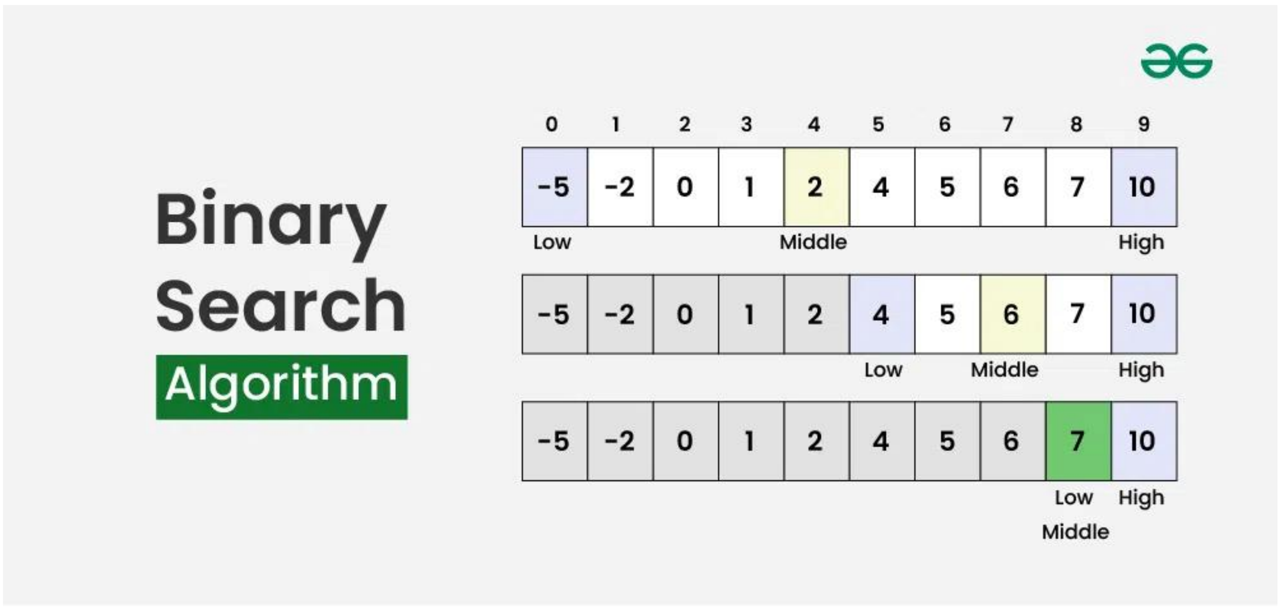
Introduction- The AI-Based Number Guessing Game is an interactive program where the computer attempts to guess a number that the user is thinking of, using an optimized approach called the **Binary Search Algorithm**. Instead of randomly guessing numbers, the AI intelligently narrows down the range based on user feedback. This approach ensures that the game finds the correct number in the shortest possible time.



Methodology-

1. The user is asked to think of a number between 1 and 100.
2. The AI starts by guessing the middle number of the given range.
3. The user provides feedback:

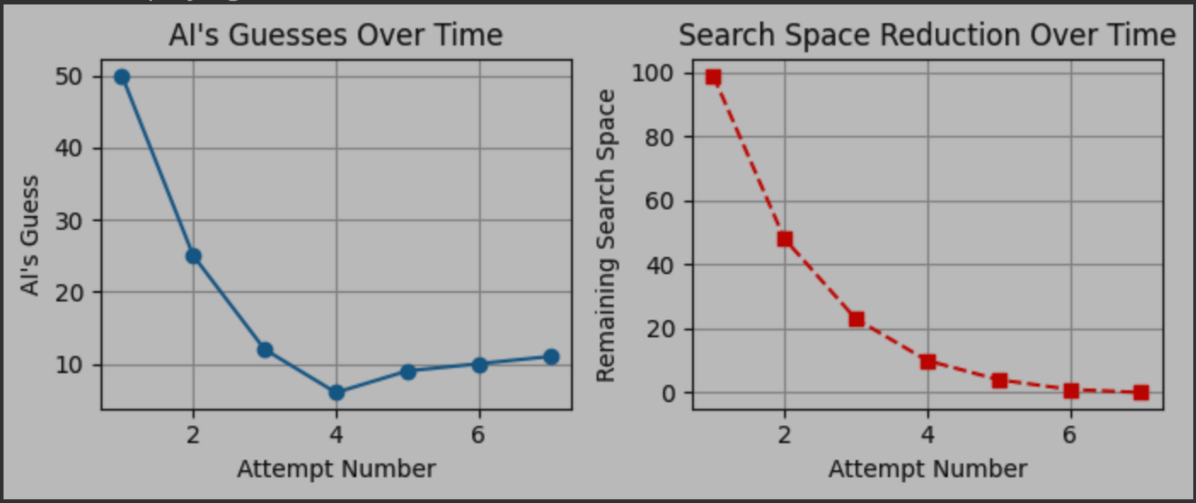
    - If the guessed number is **too high**, the upper bound is reduced.
    - If the guessed number is **too low**, the lower bound is increased.
    - If the guessed number is **correct**, the game ends.
4. The AI repeats this process, halving the search space each time, ensuring that the number is found in at most **7 attempts** ($\log_2(100) \approx 7$).

Code-

```
import random
import matplotlib.pyplot as plt

def ai_guess(low, high):
    """AI guesses a number intelligently using a binary search approach"""
    return (low + high) // 2  # Middle of the current range

def main():
    """Main function to play the AI-based Number Guessing Game"""
    print("Think of a number between 1 and 100, and I'll try to guess it!")
    input("Press Enter when you're ready...")  # Wait for user to start the game

    low, high = 1, 100  # Initial range
    attempts = 0  # Count the number of attempts made by AI
    guess_history = []  # Stores the guesses made by AI
    range_history = []  # Stores the remaining search space size

    while low <= high:
        guess = ai_guess(low, high)  # AI makes a guess based on the current range
        guess_history.append(guess)
        range_history.append(high - low)

        print(f"Is your number {guess}? (Enter 'h' if higher, 'l' if lower, 'c' if correct)")
        response = input().strip().lower()  # Get user feedback and normalize input
        attempts += 1  # Increase attempt count
        if response == 'c':
            print(f"Yay! I guessed your number in {attempts} attempts.")
            break
        elif response == 'h':
            low = guess + 1  # Narrow the range upwards
        elif response == 'l':
            high = guess - 1  # Narrow the range downwards
        else:
            print("Invalid input. Please enter 'h', 'l', or 'c'.")
    print("Thanks for playing!")  # End of the game message
    # Plot the graphs
    plt.figure(figsize=(7, 3))
    # First graph: AI's guesses over attempts
    plt.subplot(1, 2, 1)
    plt.plot(range(1, len(guess_history) + 1), guess_history, marker='o', linestyle='-')
    plt.xlabel("Attempt Number")
    plt.ylabel("AI's Guess")
    plt.title("AI's Guesses Over Time")
    plt.grid(True)
    # Second graph: Remaining search space size over attempts
    plt.subplot(1, 2, 2)
    plt.plot(range(1, len(range_history) + 1), range_history, marker='s', linestyle='--', color='r')
    plt.xlabel("Attempt Number")
    plt.ylabel("Remaining Search Space")
    plt.title("Search Space Reduction Over Time")
    plt.grid(True)
    plt.tight_layout()
    plt.show()
if __name__ == "__main__":
    main()  # Start the game when the script is run
```

Output/Result-

```
Think of a number between 1 and 100, and I'll try to guess it!
Press Enter when you're ready...
Is your number 50? (Enter 'h' if higher, 'l' if lower, 'c' if correct)
l
Is your number 25? (Enter 'h' if higher, 'l' if lower, 'c' if correct)
l
Is your number 12? (Enter 'h' if higher, 'l' if lower, 'c' if correct)
l
Is your number 6? (Enter 'h' if higher, 'l' if lower, 'c' if correct)
h
Is your number 9? (Enter 'h' if higher, 'l' if lower, 'c' if correct)
h
Is your number 10? (Enter 'h' if higher, 'l' if lower, 'c' if correct)
h
Is your number 11? (Enter 'h' if higher, 'l' if lower, 'c' if correct)
c
Yay! I guessed your number in 7 attempts.
Thanks for playing!
```



References/Credits-

- Concept of Binary Search Algorithm: Learned in C programming.
- Code developed by: Aanjneya Nayak.

Submitted to- Mr. Bikki Gupta