Research Assignment: Genetic Algorithm

Objective:

This assignment aims to introduce students to **Genetic Algorithms (GA)**, a powerful optimization technique inspired by natural selection, and explore how it can be applied to solve real-world problems across various fields. Students will learn the basics of GA and understand its practical applications in diverse industries.

Research Guidelines:

1. **Understanding Genetic Algorithms:**
    - What is a **Genetic Algorithm**, and how does it work?
    - Describe the main components of a GA: **selection**, **crossover**, **mutation**, and **fitness function**.
    - How does GA compare to other optimization techniques like **Simulated Annealing (SA)** and **Particle Swarm Optimization (PSO)**?

2. **Real-World Applications of Genetic Algorithms:**
    - Discuss how **Genetic Algorithms** can be applied to solve optimization problems in real-world scenarios.
    - **Example Applications:**
        - **Machine Learning and AI:** How GA can be used to tune hyperparameters in machine learning models.
        - **Optimization Problems in Industry:** How GA is applied in areas like **supply chain optimization**, **scheduling problems**, and **route planning**.
        - **Electronics and Chip Design (VLSI) [Bonus Application]:** How GA can be used to optimize power consumption and chip area in electronics design.