DEPARTMENT OF COMPUTER SCIENCE (BS CS PROGRAM)
DATA STRUCTURES AND ALGORITHM LAB(CSL-221)
PROJECT PROPOSAL FORM

SEMESTER Name	Term Name	BS (CS)	Lab Engineer: Engr. Rabia Amjad
TITLE OF PROJECT			
"Snake Game Using Doubly Linked List"			

Group Members		
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EXECUTIVE SUMMARY OF PROJECT PROPOSAL

The proposed project, **"Snake Game Using Doubly Linked Lists,"** is designed as part of the Data Structures & Algorithms course. This project aims to demonstrate the practical implementation of **doubly linked lists** in an interactive and engaging way by recreating the classic Snake Game.

The **background** of this project lies in the need to bridge theoretical knowledge of data structures with practical applications. While arrays or static structures are often used in beginner implementations, using a **doubly linked list** provides better dynamic handling of the snake's body, allowing efficient insertion and deletion operations as the snake moves and grows. This makes the project a strong example of applying course concepts to a real-world simulation.

The **scope** of the project includes implementing snake movement, random food generation, score tracking, collision detection, and game-over conditions, all while managing the snake's body as a linked list. A persistent leader board will be implemented to track and display high scores. The game will be single-player, console-based (with optional simple GUI), and optimized for standard desktop environments. The system excludes advanced features such as multiplayer modes, online play, or artificial intelligence.

In summary, this project will:

- Reinforce the concepts of **linked lists, pointers, and dynamic memory allocation**.
- Deliver a playable Snake Game with real-time data structure operations.
- Provide both educational value (for understanding algorithms) and entertainment value (through gameplay).

This project aligns with the course objectives by demonstrating how abstract data structures can be applied to solve real-world programming problems. It is practical, feasible within the course timeline, and beneficial for showcasing the power of data structures in game development.

PROJECT PURPOSE, SCOPE AND OBJECTIVES

Purpose:
The primary purpose of this project is to design and implement a classic Snake Game using the concept of **Doubly Linked Lists**. The project aims to strengthen the understanding of dynamic data structures in a practical, interactive way while demonstrating how linked lists can efficiently manage sequential data with insertions and deletions.

Scope:
- The system will simulate the traditional Snake Game on a console or GUI interface.
- The snake's body will be dynamically managed using a **doubly linked list**, allowing efficient growth and movement.
- The game will include standard features: snake movement, food generation, score tracking, collision detection (walls and self), leaderboard display,and game over condition.
- The system will **not** include advanced features like multiplayer mode, AI opponents, or online connectivity.

Objectives:
- Demonstrate the practical use of **doubly linked lists** in real-time applications.
- Provide a working Snake Game with dynamic insertion (growing snake) and deletion (movement tail update) operations.
- Offer a user-friendly interface for gameplay.
- Test and validate data structures in action.

Intended Users:
- Students learning data structures.
- Hobbyist programmers interested in games and algorithmic problem-solving.

Value Over Status Quo:
- Unlike traditional array-based implementations, using a **doubly linked list** provides **better memory efficiency and dynamic growth**, especially when the snake length varies frequently.

Hardware & Software Requirements:
- **Hardware:** Standard PC or laptop.
- **Software:** C++ Compiler (e.g., GCC/Visual Studio Code), optional GUI library (like SFML or ncurses), and standard console for gameplay display.

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PROJECT DESCRIPTION

Goal:

To implement a fully functional Snake Game where the snake's body is represented as a **doubly linked list**, demonstrating insertion and deletion operations while maintaining game state in real-time.

Features & Services:

1. **Snake Movement:**
    - Program will dynamically update the snake's position by adding a node at the head and deleting the tail node.
    - Implemented using a **doubly linked list traversal** for efficient updates.
2. **Food Generation:**
    - Randomly place food in the game grid.
    - Increase snake length upon eating by inserting a node at the tail without deletion.
3. **Collision Detection:**
    - Detect if the snake collides with walls or itself.
    - Implemented by iterating the linked list to check if head's position matches any body segment.
4. **Score Tracking:**
    - Score increments each time the snake eats food.
    - Displayed in real-time.
5. **Game Interface:**
    - Simple console or graphical display.
    - Arrow keys or WASD control for snake direction.

Data Processing & Analysis:

- Real-time updating of snake positions requires **constant insertion and deletion operations** on the linked list.
- Collision and boundary checks require **iterative traversal** of the list to ensure game integrity.
- Demonstrates **time and space efficiency** of doubly linked lists compared to static arrays.

Why Accept This Project:

- Combines practical programming, algorithmic thinking, and data structure concepts.
- Offers a clear demonstration of linked list operations in a real-world scenario.
- Provides both educational and entertainment value.

Course Concepts to be Used:

- Doubly Linked Lists (insertion, deletion, traversal)
- Dynamic Memory Management
- Pointers in C++
- Algorithmic problem-solving
- Basic game logic and event handling

TEAM PROFILE

1. **Wardha Khalid:** Strong knowledge of **C++ programming** and data structures.
2. **Maheen Fatima:** in **algorithm design and implementation**.
3. **Ayyan Khan:** Capable of **project documentation and presentation**.

ASSUMPTIONS AND CONSTRAINTS

Assumptions:

- Users have basic keyboard input for controls.
- Standard PC/laptop environment is available for execution.
- Only a single-player mode is required.

Constraints:

- Limited to console-based or simple GUI output.

- Game logic will strictly use **doubly linked lists** for snake management.
- Development to be completed within the course schedule.
- Resource usage optimized for standard desktop specifications.

PROJECT DELIVERABLES NOT CHANGEABLE

1. Software Project Proposal (this document)
2. Project Progress Reports
3. Final Project Report including code, explanation, and testing
4. Team Member Contributions, honestly documented

For Teacher Use Only

REMARKS

Course Teacher Name		Signature		Date	
Lab Engineer Name		Signature		Date	