SPL1 Project Proposal Form, 2025
Institute of Information Technology (IIT)
University of Dhaka

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Project Description:

This project focuses on implementing the **Column Generation Algorithm**, a powerful technique for solving large-scale **Linear Programming (LP)** and **Integer Programming (IP)** problems, particularly in **Crew Scheduling** and **Vehicle Routing Problems (VRP)**.

The Column Generation approach decomposes a large optimization problem into two parts:

1. **Master Problem (MP)** – formulated using a subset of variables.
2. **Subproblem (SP)** – generates new columns (variables) with negative reduced cost to improve the MP.

The project will start with learning and implementing foundational **Linear Programming** concepts including **Simplex method**, **Dual problem**, and **Branch-and-bound** integration for integer constraints. The system will then model real-world cases:

- **Crew Scheduling Problem (CSP)** – minimizing crew cost while ensuring coverage of all scheduled trips.
- **Vehicle Routing Problem (VRP)** – optimizing delivery routes to minimize total distance or cost.

The final implementation will include:

- LP model formulation
- Solving the master problem.
- Column generation subproblem that uses shortest path with resource constraints.
- Simulation of sample data for performance testing.

This project combines algorithmic research with practical optimization applications in operations research and logistics.

Languages or Tools to be used:

- Programming Language: C/C++/JAVA
- Libraries: **IBM ILOG CPLEX** Optimization Studio
- Tools: Git, VS Code / Neovim
- Platform: macOS

Supervisor's Name: **Shah Mostafa Khaled, Ph.D.**

Signature of the supervisor:_____

Date: _____

Before the Midterm Presentation:

I confirm that the progress is satisfactory and I am forwarding it for midterm presentation.

Signature of the supervisor:_____

Date: _____

Midterm Presentation Feedback: