BAHRIA UNIVERSITY, (Karachi Campus)

Department of Software Engineering

PROJECT PROPOSAL

Course Title: Data Structure and Algorithm Lab **Course Code**: **CSC-221**
Course Instructor: Engr. Raazi/Majid Kalim **Class**: BSE-3(C)
Lab Instructor: Engr.Saniya Sarim **Name:** Muhammad Affan bin Aamir
Date: 18/11/2025

PROJECT PROPOSAL

PROJECT TITLE:

File Compression and Decompression System using Huffman Coding

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GROUP MEMBERS LIST:

Name	Registration No.	Role
Muhammad Hammad Asher(Team Lead)	02-131242-066	Decompression Module Developer
Muhammad Affan Bin Aamir	02-131242-064	Huffman Tree & Frequency Analysis Developer
Samiullah Baig	02-131242-012	Compression Module Developer
Syed Shayan Agha	02-131242-093	UI/Frontend Developer

PROJECT SCOPE:

The purpose of this project is to design and implement a C# based application capable of compressing and decompressing text files using the Huffman Coding algorithm. The system will allow users to minimize file size for efficient storage and later restore the compressed file to its original form.

The project focuses on core Data Structures and Algorithms concepts including priority queues, binary trees, hashing, frequency analysis, and encoding/decoding mechanisms.

The application will feature file selection, compression, decompression, statistics display, and optional visualization of the Huffman tree and code table. It is designed to be completed within one month by a team of four members, with clear distribution of responsibilities.

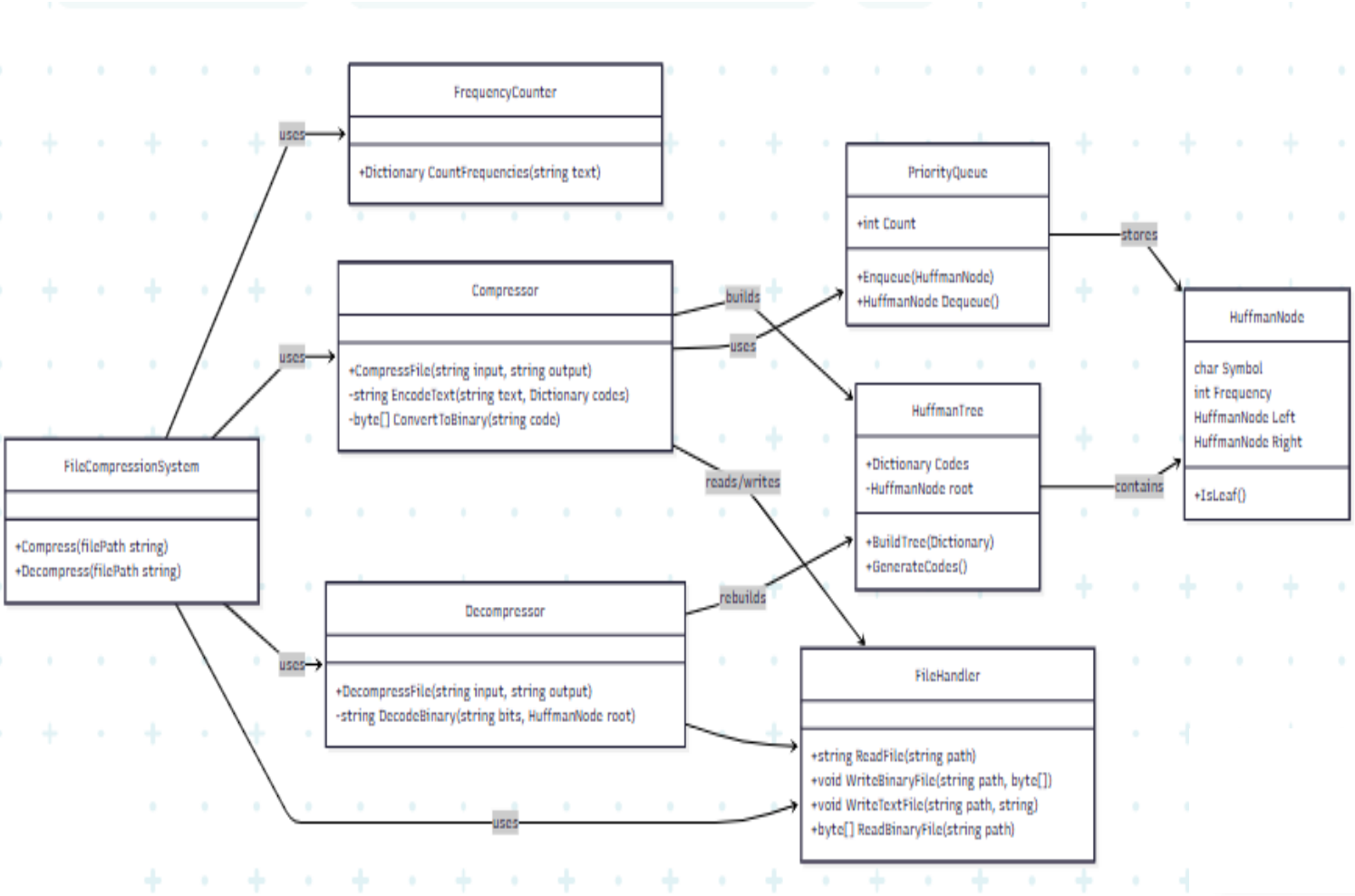
PROJECT ABSTRACT:

This project proposes the development of a file compression and decompression system based on the Huffman Coding algorithm, implemented in the C# programming language. Huffman Coding is a variable length, prefix-free encoding technique used to reduce file sizes by assigning shorter binary codes to frequently occurring characters.

The system will allow users to load text files, compress them into a custom .huff format, and decompress them back to their original content. The program will include modules for building Huffman trees, generating binary codes, encoding file data, and decoding compressed content. Additionally, the software will display statistics such as compressed size, original size, compression ratio, and processing time.

By implementing this tool, the project demonstrates practical use of algorithmic concepts taught in the Data Structures and Algorithms course, bridging theory with real-world application through efficient data compression strategies.

CLASS DIAGRAM:



PROJECT FUNCTIONALITIES:

1. File Compression

- Select a .txt file for compression
- Read and analyze character frequencies
- Build Huffman tree using priority queue
- Generate prefix-free binary codes
- Encode the file into binary data
- Save the compressed file with metadata

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2. File Decompression

- Load .huff compressed file
- Read stored code map or Huffman tree info
- Decode binary data
- Reconstruct original text file
- Save or display the restored text

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3. Statistics and Reporting

- Display original file size
- Display compressed file size
- Compression ratio calculation
- Total unique characters analyzed

- Time taken for compression and decompression

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4. Optional Enhancements

- Visual representation of Huffman tree
- Display character-to-binary code mapping
- Sorting frequencies using Radix Sort
- Save logs of previous operations

MODULE DISTRIBUTION:

1. Muhammad Hammad Asher (02-131242-066) - Team Lead

- **Decompression Module**
- Load and read compressed .huff file
- Read stored Huffman metadata
- Rebuild Huffman tree from saved data
- Decode binary content back to text
- Restore and export original file
- Manage team coordination
- Handle integration and final testing

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2. Syed Shayan Agha (02-131242-093)

- Frontend UI development (WinForms or WPF)
- File selection dialogs (Open/Save)
- Display statistics and optional visual outputs

- Error & Exception handling
- Database Manager

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3. Samiullah Baig (02-131242-012)

- Frequency counting and analysis
- Huffman Node and Tree structure implementation
- Priority queue logic for tree building
- Assist in generating binary codes

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4. Muhammad Affan bin Aamir (02-131242-064)

- File compression logic
- Generate binary codes for each character
- Encode file contents into binary string
- Save compressed file format
- Implement size and execution-time calculations

Teacher Signature: _____

Remarks: _____

Submission Date: _____18/11/2025_____