Individual Contribution Report

CMPE 321 – Database Systems

Project 4: Dune Archive System

1 Personal Information

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- **Group Number:** 6

2 Contributions

System Architecture & Design: I designed the overall layered architecture including the storage layer with 4KB page-based file management, catalog layer with JSON metadata storage, and operation layer with command processing. I established core system parameters such as page size, record limits, and file size constraints (100 pages per file).

Error Handling Implementation: I implemented comprehensive multi-layer error handling following Q&A guidelines to ensure no system crashes under any input conditions. This included developing graceful failure recovery mechanisms, detailed logging with Unix timestamps, and robust input validation pipelines with command format validation and type checking.

Data Storage & Binary Operations: I implemented binary data packing and unpacking using Python's struct module for efficient storage, designed fixed-length record structures with validity flags, and created page loading/saving mechanisms with lazy loading for memory efficiency.

Validation & Type Safety: I developed strict validation rules including alphanumeric-only constraints for names and string values, isinstance() type checking for enhanced type safety, and comprehensive edge case handling for duplicate detection and malformed input.

3 Teamwork

Collaboration Methods: We coordinated through WhatsApp for quick updates and used Google Meet for detailed discussions about implementation decisions. We shared code updates and debugging sessions in real-time.

Division of Responsibilities: I focused on the core database engine implementation, error handling, and validation systems, while Bora concentrated on testing, documentation refinement, and input file preparation. We collaborated on the overall design decisions and Q&A compliance analysis.

Code Integration: We worked iteratively, with regular code reviews and joint debugging sessions. I handled the main system implementation while Bora provided testing feedback and helped with edge case identification.

4 Self-Reflection

Learning Experience: This project significantly deepened my understanding of database internals, particularly page-based storage systems and binary data management. I gained valuable experience in building robust error handling systems that maintain stability under failure conditions.

Skills Improved:

- **Low-level Programming:** Binary data manipulation and memory management
- **Error Handling:** Professional-level exception management and recovery strategies
- **System Design:** Layered architecture design and component interaction
- **Validation Systems:** Comprehensive input validation and type safety implementation
- **Database Concepts:** Page organization, record management, and catalog systems

Technical Growth: I developed a much stronger understanding of how database management systems work internally, from storage organization to query processing. The project taught me the importance of defensive programming and graceful error handling in production systems.

Challenges Overcome: The most challenging aspect was implementing the comprehensive error handling system that meets Q&A requirements while maintaining system functionality. Learning to balance strict validation with usability required careful design consideration and multiple iterations.