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**1. Introduction**

This document outlines the design decisions for the Library Management System, focusing on the strategic use of Python's core data structures. The system efficiently handles book cataloging, member management, and lending operations through carefully selected data structures that optimize performance and maintainability for this specific application domain.

**2. Data Structure Selection**

**2.1 Dictionary for Books**

Dictionaries were chosen for book storage due to their optimal key-value pairing capabilities. The ISBN serves as a natural unique identifier, and dictionary's O(1) lookup time ensures rapid access during frequent operations like borrowing and returns. This structure mirrors real-world library systems where books are primarily accessed via their unique identifiers, making it the most logical choice for efficient data retrieval and management.

**2.2 List for Members**

Lists were selected for member management because member operations typically involve sequential processing rather than frequent random access. Activities like generating reports or sending notifications require iterating through all members, where lists provide optimal performance. While search operations are O(n), this remains efficient for the expected scale of hundreds to thousands of members in typical library scenarios.

**2.3 Tuple for Genres**

Tuples were implemented for genre management due to their immutable nature. Genre categories represent fixed, stable data that shouldn't change during program execution. This immutability ensures data integrity while providing performance benefits through faster iteration compared to lists. The tuple structure clearly communicates that these values are constant throughout the system lifecycle.

**3. System Architecture**

The system follows a modular design with clear separation between data management and business logic. Each function addresses specific library workflows while maintaining data consistency. Validation mechanisms are integrated throughout, ensuring genre validity, member borrowing limits, and preventing invalid state transitions. The architecture supports essential library operations including inventory management, patron services, and transactional tracking while maintaining simplicity and reliability.

**4. Conclusion**

The selected data structures provide an optimal balance of performance, simplicity, and appropriateness for the library management domain. Dictionaries enable efficient book access, lists accommodate natural member processing patterns, and tuples ensure genre data integrity. This combination delivers a robust foundation that meets all functional requirements while maintaining code clarity and operational efficiency.

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