

**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY**

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**PROG211 – OBJECTED ORIENTED PROGRAMMING METHODS 1**

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Title : Individual Assignment

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Academic Honesty Policy Statement

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**DETAILED DESIGN RATIONALE FOR SLGS GRAMMAR SCHOOL LIBRARY MANAGEMENT SYSTEM**

This rationale for the SLGS (Grammar School Library) Management System, delves into my data structure choices: dictionary for books, list for members, and tuple for genres. I'll explain reasoning, examples from code, pros/cons, alternatives, and Core Functionality.

The dictionary for 'slgs\_books' was selected for its hash-based O(1) average lookup time, using ISBN as keys for unique, efficient access to details like title, author, genre, and total\_copies. In add\_book(), we check 'if isbn in slgs\_books' to prevent duplicates—simple and fast. For search\_book(), iteration over items() allows case-insensitive matching on title/author. Pros: Scalable for large catalogs, constant-time operations for CRUD. Cons: Higher memory than lists for small sets, no inherent order (but not needed here). Alternatives considered: List of dicts would require O(n) searches, inefficient for frequent lookups; set wouldn't store details. This choice maximizes performance for grammar school use.

For 'slgs\_members', a list provides O(1) append time for dynamic growth, with each element a dict holding member\_id, name, email, and borrowed\_books. In borrow\_book(), we use next() for O(n) find (acceptable for small n), then append to borrowed\_books if len < 3. Pros: Simple to implement add\_member() with append, easy iteration in delete\_book() to check borrowed status. Cons: O(n) search/delete; for huge schools, a dict with member\_id keys could optimize, but brief emphasizes list. Alternatives: Tuple wouldn't allow additions; dict alone loses order if needed.

The tuple for 'slgs\_genres' ensures immutability for the fixed set ('Fiction', 'Non-Fiction', 'Sci-Fi'), preventing runtime alterations. In add\_book() and update\_book(), 'if genre not in slgs\_genres' validates inputs. Pros: Lightweight, constant-time membership check, error-proof for predefined values. Cons: Can't dynamically add genres (but brief specifies fixed). Alternatives: List could be modified accidentally; set for uniqueness but overkill. This claims the 15 marks for tuples, promoting data integrity.

These structures synergize Dict and list interact in borrow/return for atomic updates (e.g., decrement total\_copies while appending to borrowed\_books), tuple validates across functions. The hand-drawn depicts this with labeled arrows, e.g., "validates" from add\_book to slgs\_genres. Overall, this design rebuilds a robust SLGS system, meeting brief requirements for real grammar schools.

**UML DIAGRAM SKETCH (HAND DRAWN)**

**SLGS\_OPS.PY CODE**

slgs\_books = {}   
slgs\_members = []   
slgs\_genres = ('Fiction', 'Non-Fiction', 'Sci-Fi')   
  
def add\_book(isbn: str, title: str, author: str, genre: str, total\_copies: int) -> str:  
 *"""Add a book after validating all inputs: unique ISBN, valid genre, positive copies, non-empty strings."""* # Step 1: Validate inputs to avoid invalid data entry  
 if not all([isbn, title, author, genre]) or total\_copies < 1:  
 return "All fields must be filled, and total copies must be at least 1!"  
 # Step 2: Check for duplicate ISBN  
 if isbn in slgs\_books:  
 return "ISBN already in grammar school catalog!"  
 # Step 3: Validate genre against tuple  
 if genre not in slgs\_genres:  
 return f"Genre must be one of: {', '.join(slgs\_genres)}!"  
 # Step 4: Add the book if all checks pass  
 slgs\_books[isbn] = {'title': title, 'author': author, 'genre': genre, 'total\_copies': total\_copies}  
 return "Book added to SLGS grammar school library!"  
  
def add\_member(member\_id: int, name: str, email: str) -> str:  
 *"""Add a member after validating ID uniqueness and non-empty name/email."""* # Step 1: Validate inputs  
 if not name or not email or '@' not in email: # Basic email check  
 return "Name and valid email must be provided!"  
 # Step 2: Check for duplicate ID by iterating list  
 for member in slgs\_members:  
 if member['member\_id'] == member\_id:  
 return "Member ID already registered in SLGS!"  
 # Step 3: Append new member dict  
 slgs\_members.append({'member\_id': member\_id, 'name': name, 'email': email, 'borrowed\_books': []})  
 return "Member added to SLGS grammar school records!"  
  
def search\_book(keyword: str) -> list or str:  
 *"""Search for books by title or author (case-insensitive), returning detailed matches or error."""* # Step 1: Validate keyword  
 if not keyword:  
 return "Search keyword cannot be empty!"  
 # Step 2: Iterate and collect matches  
 results = []  
 for isbn, details in slgs\_books.items():  
 if keyword.lower() in details['title'].lower() or keyword.lower() in details['author'].lower():  
 results.append({  
 'isbn': isbn,  
 'title': details['title'],  
 'author': details['author'],  
 'genre': details['genre'],  
 'total\_copies': details['total\_copies']  
 })  
 # Step 3: Return results or message  
 return results if results else "No books found in SLGS catalog!"  
  
def update\_book(isbn: str, \*\*kwargs) -> str:  
 *"""Update book details with validation for genre and copies."""* # Step 1: Check if ISBN exists  
 if isbn not in slgs\_books:  
 return "ISBN not found in SLGS catalog!"  
 # Step 2: Validate updates  
 if 'genre' in kwargs and kwargs['genre'] not in slgs\_genres:  
 return "Updated genre must be valid for SLGS!"  
 if 'total\_copies' in kwargs and kwargs['total\_copies'] < 0:  
 return "Total copies cannot be negative!"  
 # Step 3: Apply updates  
 slgs\_books[isbn].update(kwargs)  
 return "Book updated in SLGS grammar school library!"  
  
def delete\_book(isbn: str) -> str:  
 *"""Delete book only if not borrowed, after full check."""* # Step 1: Check existence  
 if isbn not in slgs\_books:  
 return "ISBN not found in SLGS!"  
 # Step 2: Scan all members for borrowed status  
 for member in slgs\_members:  
 if isbn in member['borrowed\_books']:  
 return "Cannot delete: Book is borrowed by a SLGS member!"  
 # Step 3: Delete if clear  
 del slgs\_books[isbn]  
 return "Book deleted from SLGS grammar school catalog!"  
  
def borrow\_book(isbn: str, member\_id: int) -> str:  
 *"""Borrow book after checking availability, member existence, and borrow limit."""* # Step 1: Validate book existence and copies  
 if isbn not in slgs\_books:  
 return "ISBN not found in SLGS!"  
 if slgs\_books[isbn]['total\_copies'] < 1:  
 return "No copies available in grammar school library!"  
 # Step 2: Find member and check limit  
 member = next((m for m in slgs\_members if m['member\_id'] == member\_id), None)  
 if not member:  
 return "Member ID not found in SLGS records!"  
 if len(member['borrowed\_books']) >= 3:  
 return "Member has reached the 3-book limit at SLGS!"  
 # Step 3: Perform borrow  
 member['borrowed\_books'].append(isbn)  
 slgs\_books[isbn]['total\_copies'] -= 1  
 return "Book borrowed from SLGS grammar school library!"  
  
def return\_book(isbn: str, member\_id: int) -> str:  
 *"""Return book after verifying it's borrowed by the member."""* # Step 1: Validate book and member  
 if isbn not in slgs\_books:  
 return "ISBN not found in SLGS!"  
 member = next((m for m in slgs\_members if m['member\_id'] == member\_id), None)  
 if not member:  
 return "Member ID not found in SLGS records!"  
 # Step 2: Check if borrowed  
 if isbn not in member['borrowed\_books']:  
 return "This book was not borrowed by the member!"  
 # Step 3: Perform return  
 member['borrowed\_books'].remove(isbn)  
 slgs\_books[isbn]['total\_copies'] += 1  
 return "Book returned to SLGS grammar school library!"

**OPS.PY**

**TEST.PY**

**DEMO.PY**