

Lab 2 Section 1-2 - Product Specification

Team Red - AskMissy

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1 Introduction

High School students face two large problems in the domain of reading. The first problem: High School students lack easy access to relevant resources in relation to assignments they receive in school, notably in grades 9-12. The second problem is a general downward trend in the interest in reading for students of all ages. Whether the students come from historically underprivileged backgrounds, or they are exploring concepts that are underrepresented in traditional literature, a weak beginning in literature leads to a lack of interest, trust, and reliance on reading skills. These are skills that many professionals find necessary for their day to day lives after their school careers (McLean, 2022).

In a 2007 study, researchers from the National Endowment of the Arts found that American students are reading less (Fuglei, 2019). From 1992 to 2002 students showed a 5% decline in extracurricular reading. This decline grew more severe for adults in this time frame, decreasing to 7%. Additionally, a study by the Pew Research Center found that adults who have lower levels of education - or are members of economically disadvantaged demographics - are less likely to read than adults with higher levels of education or economic advantage (Gelles-Watnick & Perrin, 2021). This shows a compounding effect where a low interest in reading at a young age leads to further disinterest as an adult.

To address both the symptoms and core problems, AskMissy is a software application designed for students, teachers and librarians in grades 9-12 to help users find the resources necessary to bridge the gap between conventional and digital learning for a more personalized experience. Machine learning algorithms shall be implemented to personalize the experience for users and predict the types of resources from which the user would most benefit.

1.1 Purpose

AskMissy is a web-based software application designed to help users in grades 9-12 find resources such as books to both aid them in their school careers and to invigorate their interest in reading. AskMissy shall provide recommendations by implementing machine learning algorithms to learn from the search results of the users over time and incorporate the learned preferences into future results. AskMissy databases shall connect directly to the library databases of school libraries to allow users to plan out their resource acquisition through a number of options. Students shall search for books in the library based on several criteria such as book title, author, isbn number, or subject matter. Teachers shall directly recommend resources to their students who are organized in groups based on their classes. Librarians shall maintain their libraries inventory and receive feedback from students and teachers for specific resources, as well as see statistics to reflect the popularity of those resources.

AskMissy shall not function as a social media platform for Students to use. Students shall not communicate with one another except through predefined channels designed to facilitate information sharing regarding the books that the Students read and review. AskMissy shall not contain the book contents, AskMissy shall only contain data on the Book and whether or not the book is checked out from the School's library. AskMissy shall not allow users to input their own tags for books contained in the database. This is to ensure that there is a level of consistency when the algorithm makes recommendations. User input may negatively impact the algorithm's ability to personalize the results due to the possibility of user error, intentional or not.

1.2 Scope

The prototype for AskMissy keeps most of the functionality as in the real-world product, but with a reduced scale. The application utilizes the AskMissy Search to personalize the recommended book to the individual user, so long as the user is logged in and is not a guest. The tag creation algorithm is implemented in the prototype to fill the test data set with workable tags for the AskMissy Search to use but is not implemented in the RWP. Communication between the user types is modeled to showcase the types of communication in the RWP. Users are organized into different classes and schools, with separated library catalogs to simulate access to different data sets. In the prototype the simulated users have simple profiles, only having enough details to test the AskMissy Search. The prototype shall not have real connection to a school's database of students, teachers, and librarians - instead, it provides a simulation of administrators authenticating the registration of the school side users. Users are able to view their previous searches and statistics which AskMissy gathers about them.

The data used to fill the AskMissy Database and simulated School Library Databases are taken from the Goodbooks-10k Github, a repository of approximately 10,000 books and approximately 6,000,000 ratings. The latest version of the data was updated on October 1, 2018. This repository is full of historical data from the Goodreads website, with each numbered user review corresponding to an anonymous real world Goodreads user. As such, this data is used to provide an approximation of reading trends. This data does not contain books published after the last update.

Because of this, the data shall be used for a proof of concept and to enable the functionality of the prototype. The results of using AskMissy shall not reflect any current real

world circumstances relating to published books or their popularity, subject matter or other topics of interest.

1.3 Definitions, Acronyms, and Abbreviations

Administrator: A user who is responsible for managing a majority of AskMissy's working data.

Agile: A set of frameworks and practices where solutions evolve through collaboration between self-organizing cross-functional teams.

Acknowledgement: A message delivered to an authenticated user in response to their submitted bug report.

Activity: Any action undertaken by a user in relation to the AskMissy application.

Announcement: A message delivered to lower level users from a higher level user, usually in the case of a Librarian or Teacher to a student.

AskMissy: A software application that shall help users find more relevant resources.

AskMissy Library: The total collection of metadata from which other libraries and functions Extract data from.

Application Programming Interface (API): A software intermediary that allows two applications to talk to each other.

Apriori Algorithm: An algorithm designed to find Itemsets in a dataset for boolean association rules. Itemsets are groups of books found to be read together with a high frequency, implying similar future association.

Authenticated User: A user who possesses an account in AskMissy, i.e. not a guest.

Association Rule (Algorithm): A statement that a book or group of books implies the presence

of another item with some probability.

Basic Search: A search function that lists the highest rated books based on the search criteria, including genre, author, title, and publication date. This search does not utilize the Apriori Algorithm or any specific school library.

Book Data: Data about a book entry in either a School Library or the AskMissy Library, describing the book's title, author, isbn number, genres, average rating, number of ratings, publication date, original title (if any), and language.

Bug: An error in the AskMissy application that causes it to produce an incorrect result or behave in unintended ways.

Bug Report: A Message from an AskMissy user describing an error they encountered which is delivered to the Administrator.

Bug Report Database: The central repository containing all the bug reports.

Categorize: A feature of the bug reporting system which lets a user assign greater specificity to the nature of a bug.

Classes: The sections of a course that are scheduled for a specific academic year, assigned to Teachers, and include a roster of Students.

Confidence (Algorithm): The ratio of transactions that contain book A and B to transactions that contain book A.

Conviction (Algorithm): The ratio of expected support of book A occurring without book B assuming that books A and B are independent, to the observed support of A occurring without Y.

Courses: The programs of study which the Authenticated Users of AskMissy are enrolled in.

Cascading Style Sheet Revision 5 (CSS5): A style sheet language used for the presentation of documents written in a markup language such as HTML, CSS5 is the fifth version of the original

CSS version.

Comma-Separated Values (.CSV): A delimited text file that utilizes commas to separate values.

Current Books: The list of books that an Authenticated User has declared they are actively reading.

Data Retention: The continued storage of an organization's data for compliance or business reasons.

Database: An organized collection of structured information, data, typically stored in a computer system.

Economically Disadvantaged: A student eligible for Free/Reduced Meals who receives Temporary Assistance for Needy Families (TANF) or is eligible for Medicaid.

Exact Match Search: A search for a single specific type of resource.

Extract: To receive or collect data from a data source, usually one of the library databases associated with AskMissy.

Federal School Code: A six digit character code to identify a specific school or educational institute.

Feed Database: The central repository containing group interactions.

Flask: A micro web framework primarily written in Python.

File Server: A device that controls access to separately stored files.

Filter: To specify the results to view from an inquiry.

Goodreads: A subsidiary database of Amazon that stores books, annotations, quotes, and reviews.

Group: A collection of users organized into two possible levels - Classroom or School. Students

and Teachers shall be part of a classroom group and a school group, Librarians shall be part of a school group.

Guest: A user who is not a student, teacher, librarian, or administrator; who has limited access to the AskMissy application.

Hypertext Markup Language Revision 5 (HTML5): A type of markup language primarily used for implementing content in the World Wide Web, this is the fifth version of its original version.

Input: Supplying data to the AskMissy application, or the data being supplied.

Interaction: The means by which one user may share information or otherwise communicate with another user. This may be done predominantly through the use of Messages, unless otherwise specified.

Interests: Aspect of the User Profile based on the user's liked books.

Itemsets (Algorithm): a grouping of books found to be associated with each other across multiple user's past reading.

Lesson Plan: Input supplied by Teachers to the AskMissy application to provide a template set of search parameters which other Authenticated Users may use to perform an AskMissy Search, usually relating to one or more Courses.

Librarian: A user responsible for managing the library's inventory/database, communicating with teachers and students.

Lift (Algorithm): The ratio of observed support of book A and B to the expected support of book A and B.

List (Algorithm): a comma delimited file (.csv) consisting of one or more columns containing one or more entries in the format of rows, with each data form separated by a comma.

JavaScript: A programming language that is used for implementing websites on the World Wide Web.

Message: A communication in the form of a string data type between one or more users.

Metadata: Data that provides information about other data.

Personal Learning: An educational approach that aims to customize learning for each user's strengths, needs, skills, and interests.

Profile: The displayed data for an authenticated user. This data describes the user's type,

Private (Data): Authenticated User Activity which cannot be viewed by other Authenticated Users.

Public (Data): Authenticated User Activity which can be viewed by other Authenticated Users.

Python: A high-level programming language.

Query: An action Functions perform to obtain data corresponding to one or more Activities the user is performing.

Rate: A numeric measure of the quality of any given book on a scale from 1 (lowest quality) to 5 (highest quality).

Recommendation: A specific book that a Teacher or Librarian may submit for Students to view.

Request: A Message from a Student to a Teacher or Librarian specifically to bring attention to the Student's desire for a book to be included in the School Library. Individual Requests can also be sent from the Teacher to the Librarian to emphasize the importance of that Request.

Real World Product (RWP): Refers to the physical version of any digital abstraction described within the AskMissy documentation.

Register: The process that a guest user takes to create an account verified by their school's database.

Resolved (Bug Report): Any Bug Report which is marked inactive in the Bug report Database.

Review (Communication): A text assessment submitted by an Authenticated User regarding a particular book.

Review (Administrator): An activity the Administrator User can perform to access the AskMissy data in any form, and make minor modifications according to the context of the documentation.

School Library: The database of books registered in the Real World school.

Standards of Learning (SOL): An examination conducted by Virginia Public Schools that tests the minimum required expectations for every student enrolled in the state of Virginia.

Student: A user studying at a K-12 education institution.

Student Feed: A portion of the user interface that allows student users to view the most recent books read and/or reviewed by their fellow students, and view books specifically recommended by the Teacher assigned to their class.

Support (Algorithm): The ratio of transactions that contain an itemset to all transactions.

Shelves: Term used in the Test Library for attributes that describe a book's subject matter and metadata. Synonymous with Tags.

Short Message: A Message specifically no longer than 200 characters, spaces included.

Submit: The process of Inputting a required data type for the intended process.

Tags: Term used for attributes that describe a book's subject matter and metadata. Synonymous with Shelves.

Teacher: A user who helps K-12 students acquire knowledge. They are responsible for making plans and managing students' groups/communication.

Teacher Feed: A portion of the user interface that allows teachers to view the most recent books

read by that teacher's students, and view recommendations by other Teachers and Librarians.

Temporary Assistance for Needy Families (TANF): A program that provides eligible families with a monthly cash payment to meet their basic needs.

Test Library: Database of books, users, shelves/tags, and ratings drawn from the goodbooks-10k GitHub repository.

Tester: A user responsible for designing and conducting testing suites for usability testing.

Unresolved (Bug Report): Any Bug Report which is marked active in the Bug Report Database.

User: An individual using the AskMissy Interface.

User Interface/User Experience (UI/UX): The visual representation of the data AskMissy provides to the user on the user's computer.

View: The current information being displayed in the UI/UX to the user, or the Activity of interacting with the UI/UX.

Web Scraping: The process of extracting content and data from a website.

Web Server: A computer program that distributes web pages as they are requisitioned.

Windows: A series of operating systems developed by Microsoft.

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1.5 Overview

This product specification provides the hardware and software configuration, external interfaces, capabilities, and features of the AskMissy prototype. The information provided in the remaining sections of this document includes; a detailed description of the hardware, software, and external interface architecture of the AskMissy prototype; the key features of the prototype; the parameters that shall be used to control, manage, or establish that feature; and the performance characteristics of that feature in terms of outputs, displays, and user interaction.

2 General Description

The AskMissy prototype shall consist of a web application and virtual machine containing the operational data, frontend and backend functionality, and machine learning algorithms. The core features from the RWP shall be implemented which are book recommendations, group organization, machine learning and user authentication.

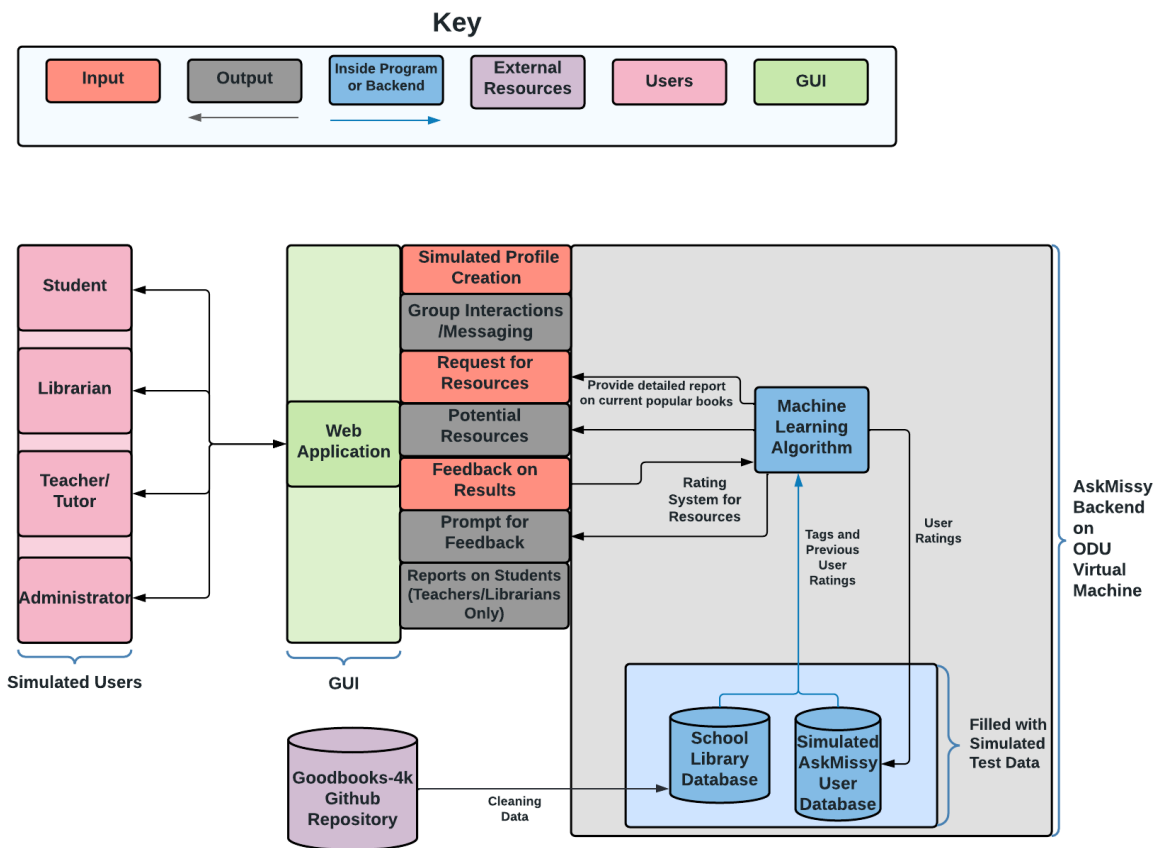
2.1 Prototype Architecture Description

The AskMissy Prototype is housed on Old Dominion University (ODU) infrastructure. A Docker system shall be used to organize the various files in the AskMissy Database, School Library Database, as well as other databases targeted for users to interact with. The User Interface shall be the means by which all users interact with the AskMissy prototype. This can be done from any device capable of internet connection, but is optimized for use on a desktop or laptop. The AskMissy Database shall be the central repository for all Book Data, while a School Library Database shall be a subcontainer of the AskMissy Database, where any book contained in the School Library Database shall be contained in the AskMissy Database. Users shall query

the School Library database by supplying input composed of any of the following: a book title, author, publication date, or genre. The user shall also have the ability to supply Tags, descriptors used to identify key aspects of a book with more specificity than genre. Users shall interact with the books returned to them with the options to rate and review these books, as well as recommend a book to other users. Users shall also prepare a report detailing their profile information and search history.

Figure 1.

AskMissy Prototype Architecture Diagram



2.2 Prototype Functional Description

The major functional components of the AskMissy prototype include the following; User Interface, AskMissy Algorithm, Basic and AskMissy Search, Group Management, Login Authentication. User Interface and Experience: This function provides the capability to interact with all other AskMissy Activities and functionality. The user interacts with this through their device's screen. AskMissy Algorithm: This function returns a list of books and their metadata to the User Interface with input from the user such as title, author, genre and tags. This function also takes the user's profile as input to automate the search process. Basic/AskMissy Search: These functions provide the capability to input search criteria and return Book Data reflecting results which fulfill that criteria. Group Management: This function provides the capability to interact with the groups which an Authenticated User is assigned. This allows the user to view the recommendations and reviews from those other group members, as well as to allow the user to share their own. Login: This function provides the capability for a Guest User to become an Authenticated User by submitting a registration request to be approved by an Administrator.

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Table 1.*AskMissy RWP vs Prototype Table*

This table shall list the different features based on their category and their status in the prototype versus the real world product in terms of development expectations.

Category	Feature	RWP	Prototype
Data Retrieval	Metadata Report	Full	Partial
	Basic Search	Full	Full
	AskMissy Search	Full	Full
Data Management - Live Product	Machine Learning	Full	Partial
	Source Tag Management	Full	Full
	Lesson Plans	Full	None
	AskMissy Database Manipulation	Full	Full
	School Library Database Manipulation	Full	Full
Data Management - Development	Source Tag Development	None	Full
	Machine Learning Training	None	Full
	Simulated Data	None	Full
	User testing reports	None	Full
Security	Login/Authentication	Full	Partial
	Data Encryption, moving	Full	None
	Data Encryption, resting	Full	None
Account Management	User Profile	Full	Partial
	Feedback	Full	Full
	Group Management	Full	Partial
	Login/registration	Full	Full
UI	Group Interaction	Full	Partial
	Bug Report	Full	Partial
	Basic Search	Full	Full
	AskMissy Search	Full	Full
	Communication	Full	Partial
	Personal Data Report	Full	Partial

2.3 External Interfaces

AskMissy's external interfaces shall consist of a Flask instance running in a Docker container on the ODU virtual machine.

2.3.1 Hardware Interfaces

The AskMissy prototype shall run on any device with internet connection.

2.3.2 Software Interfaces

The AskMissy prototype shall utilize a Flask database running on the ODU VM that stores all user data. The UI/UX functionality shall retrieve data from the Python code stored in the same Docker container used to run the Machine Learning functionality.

2.3.3 User Interfaces

The AskMissy prototype shall be accessed via a standard device capable of internet connection.

2.3.4 Communications Protocols and Interfaces

Data transfer between the AskMissy prototype and the database shall be achieved via the Flask connector.

Appendix

The following figures are referenced by Section 3 of this document, not included here.

Table 2.

Assumptions Table

Subject	Assumptions
Search (general)	Search results shall be organized by default in descending order based on average rating, then alphabetical
	Each Search function shall have an input option to take a string value for: -title -author
Authenticated User	Only Authenticated Users shall have any sort of group interactions
	When a section only refers to an Authenticated User within the first paragraph and makes no distinction between users, it is assumed that only Authenticated Users shall be referred to in this section.
Student	A student shall have the choice to make the following activities public or private at any time: -Interests -Search History -Reading History
Group Interactions	When a user is described as being able to view, share, or otherwise interact with another user, it is assumed that both users shall be in the most specific group possible to their interactions; i.e. A Student and Teacher shall only interact if they are in the same Class Group, while a Student and a Librarian shall only interact if they are in the same School Group. Refer to Figure 3 for the Group Organization.
	When a user is described as 'sending' some form of communication to another user, it is assumed that the sending user shall be inputting their communication to a table which the receiving user shall have the option of viewing according to their own judgment.

Table 3.*Interaction Table*

User Type	Shall share data to:				
	Guest	Student	Teacher	Librarian	Administrator
Guest	-	-	-	-	B
Student	-	V	M, R, S, V	M, R, S, V	M, S, B, V
Teacher	-	M, N, Re, S, V	M, S, V	M, R, S, V	M, S, B, V
Librarian	-	M, Re, S, V	M, S, V	M, S, V	M, S, B, V
Administrator	M, A	M, A	M, A	M, A	M, A
A: Acknowledgement	B: Bug Report	M: Message	N: Announcement	R: Request	Re: Recommendation
S: Short Message	V: Review				

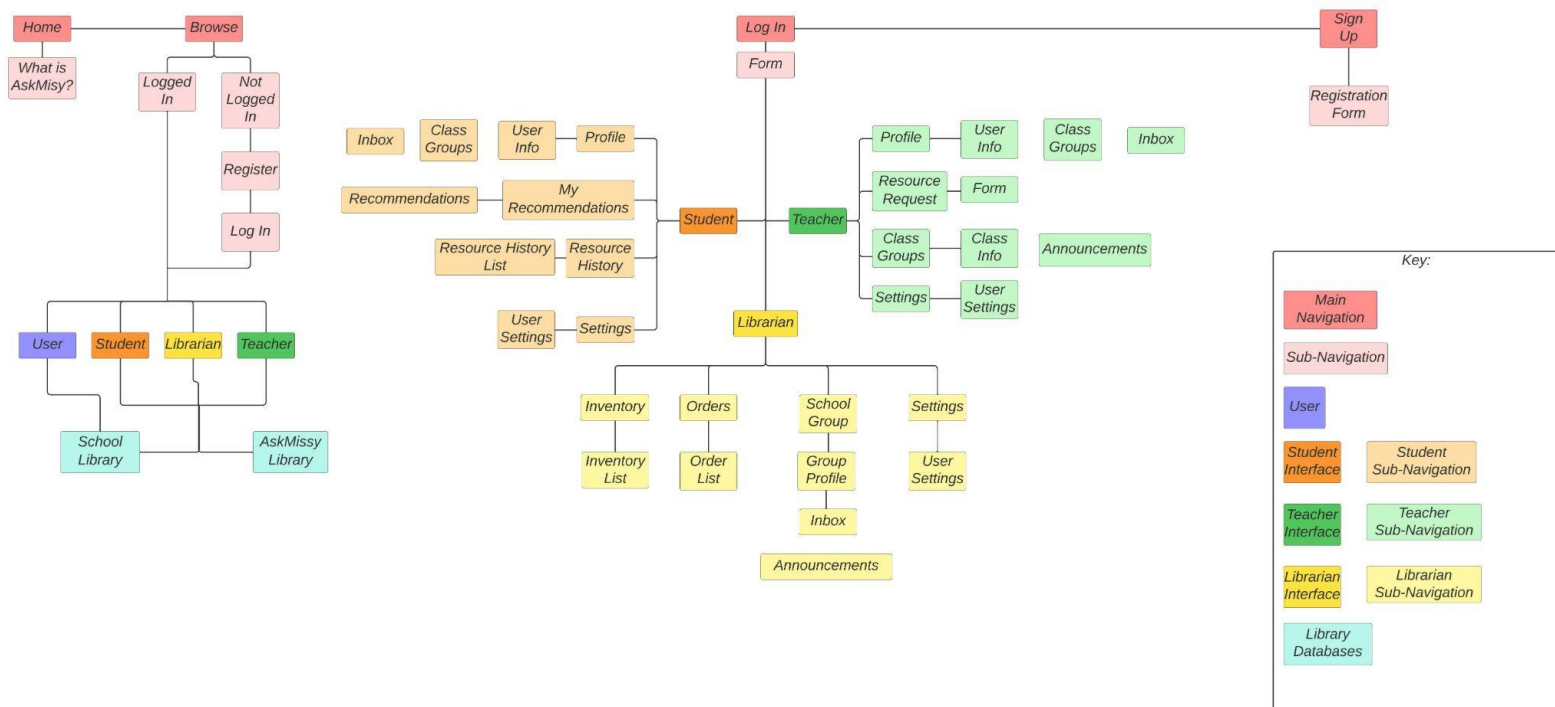
Figure 2.
Site Map

Figure 3.
Group Organization

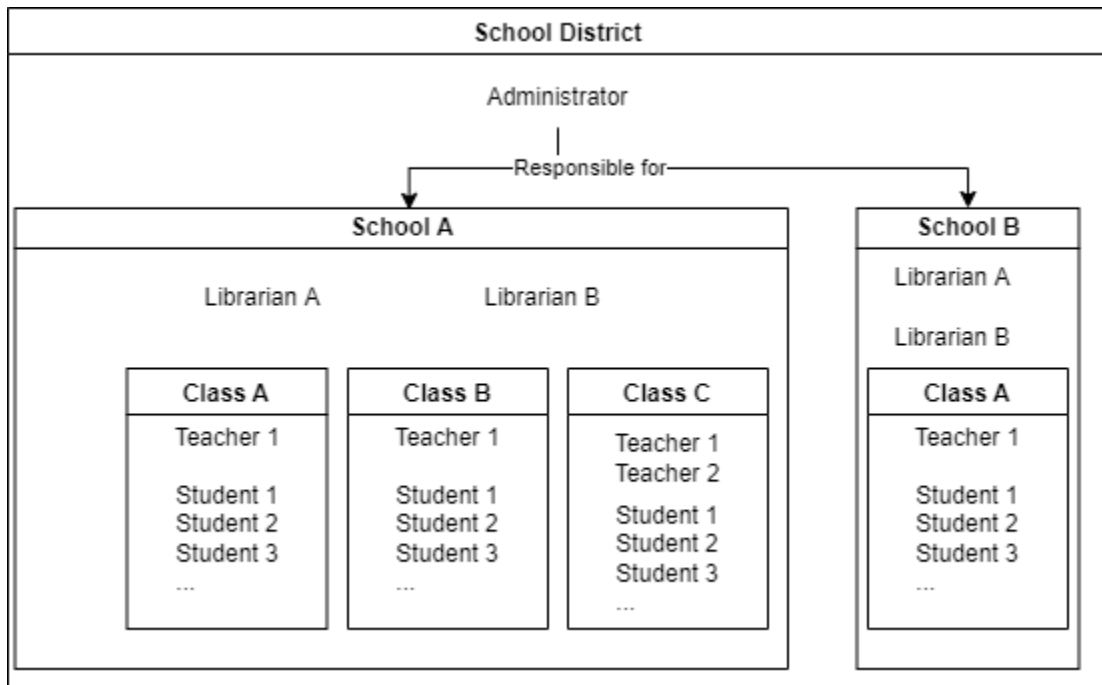


Figure 4.
Apriori Algorithm Flowchart

