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AD Books

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INTRODUCTION AND PROJECT CONTEXT

In this proposal, we outline plans for a database system pertaining to a bookstore with a brick-and-mortar front that is simultaneously complemented by e-commerce functionality. Here we describe database design considerations to be made in accordance with present-day market research that we have conducted, and we further provide business specifications for a bookstore which we also translate into corresponding ERDs. The two ERDs stipulated will further be implemented in the course of this project as physical database models using MySQL.

PROJECT RESEARCH

Manual bookkeeping systems are a thing of the past. We are trying to build a computerized bookshop management system where users can query the availability of books just by a simple search. The objective of a solid book shop management system would be to support the business rules wants and needs. However, as database designers we must understand that a bookshop management system should be a **multi-user**, **centralized**, and **relational** database. A bookshop management system should allow for a multi-user environment where users or developers can make changes to the database concurrently. For example, books can be added by separate users at the same time, therefore a multiuser environment is important and makes sure the database can be accessed and changed at all times [1]. The location of the database is also important, starting out as a small company or service hosting the database in a single location makes the most sense in terms of cost. A centralized database is hosted on a central computer that can also be accessed through a computer network to maintain the data within the system. Other options like a cloud database or a distributed database can be taken into consideration. A cloud database is built to run in a public or hybrid environment and can help organize,store, and manage data access within an organization [2]. This type of database would be deployed on a cloud based virtual machine and managed by a qualified team. This type of service can turn out to be costly for a smaller organization. Furthermore, the database management system has to be a relational system. The relational system provides an intuitive way to represent data. Organizations that need to maintain and manage structured data would prefer to have a system that is capable of the following instances [3]. Tracking user search history and order history. Moreover, the flexibility of adding new books to the databases and making other changes to the data without impacting existing or underlying applications. This type of database also has built in security where a limited specified number of users can only access the data.

Notable Case Studies: Borders and Barnes & Nobles

The book retail sector is a highly varied and competitive landscape. A customer has the choice to buy physical books from a brick and mortar retailer, which may further vary in size and management types. Retailers may range from large book chains such as Borders or Barnes and Noble, small independent businesses, to even being retailers selling items that are not only limited to books. Additionally, a customer may even decide to purchase books online, whether they may be physical items that would require delivery or instead audiobook versions of their desired text. With the advent of this online environment, the importance of price differences between online stores and brick and mortar retailers has not gone amiss. Specifically, locally owned physical stores are being severely impacted by e-commerce's looser restrictions on matters such as sales taxes, along with the potentially fewer operating costs associated with ecommerce, such as labor wages and rent considerations.

With these key challenges in mind, it is not surprising that large chains such as Barnes and Noble and Borders have opted for a hybrid mix of in-store and online retail options, thus preserving the ability to provide customers a high quality in-person shopping experience, whilst also allowing those who prefer shopping from their own homes a chance to reap the benefits of potential online discounts and increases in convenience.

When looking closely at Barnes and Nobles in particular, this 136 year old company has undergone numerous management changes and has seen significant technical expansion and upgrades over the years. Furthermore, B&N sells over 190 million physical books in a year, and as such, it is responsible for recording and storing an impressively large amount of data spanning the duration of its operations since 1873 [4]. According to a 2007 report, B&N began using Initiate Systems master data management software in a tie-up with Accenture, in order to start building an entirely new customer-oriented database system [5]. A key feature of this system is the ability to leverage the volume of customer data and successfully “to improve customer recognition at all interaction points' '. Also noteworthy in the B&N data legacy is their September 2011 acquisition of the database of consumer records from a then bankrupt Borders group, demonstrating the power of B&N as a major data company, along with the growing volume of data in their possession[6].

Conceptualizing Our Business and Developing Our Data Model

Upon examining the data-centric operations of B&N, it influenced much of the business rules and design of our own bookstore database model. However, we recognise that our relational database approach does not entirely match the needs of organizations with Big Data challenges - hence, in this report, we propose a scaled-down version of such a business; our model is comprised of multiple brick-and-mortar stores with access to one central warehouse which simultaneously operates a parallel online presence with e-commerce functionality. Thus, whilst our business rules are designed for a smaller operation, we offer complexity and competitiveness to rival that of business such as B&N given that we include features like online member discounts and multiple store locations for an in-person experience. Moreover, we maintain attractive pricing by purchasing books directly from publishers at wholesale rates as well. Finally we offer variety and convenience to customers with our multiple store locations in addition to ecommerce, and we further have a feature where out-of-stock books can be ordered in from other stores or the warehouse, or specially ordered from a publishing house as well.

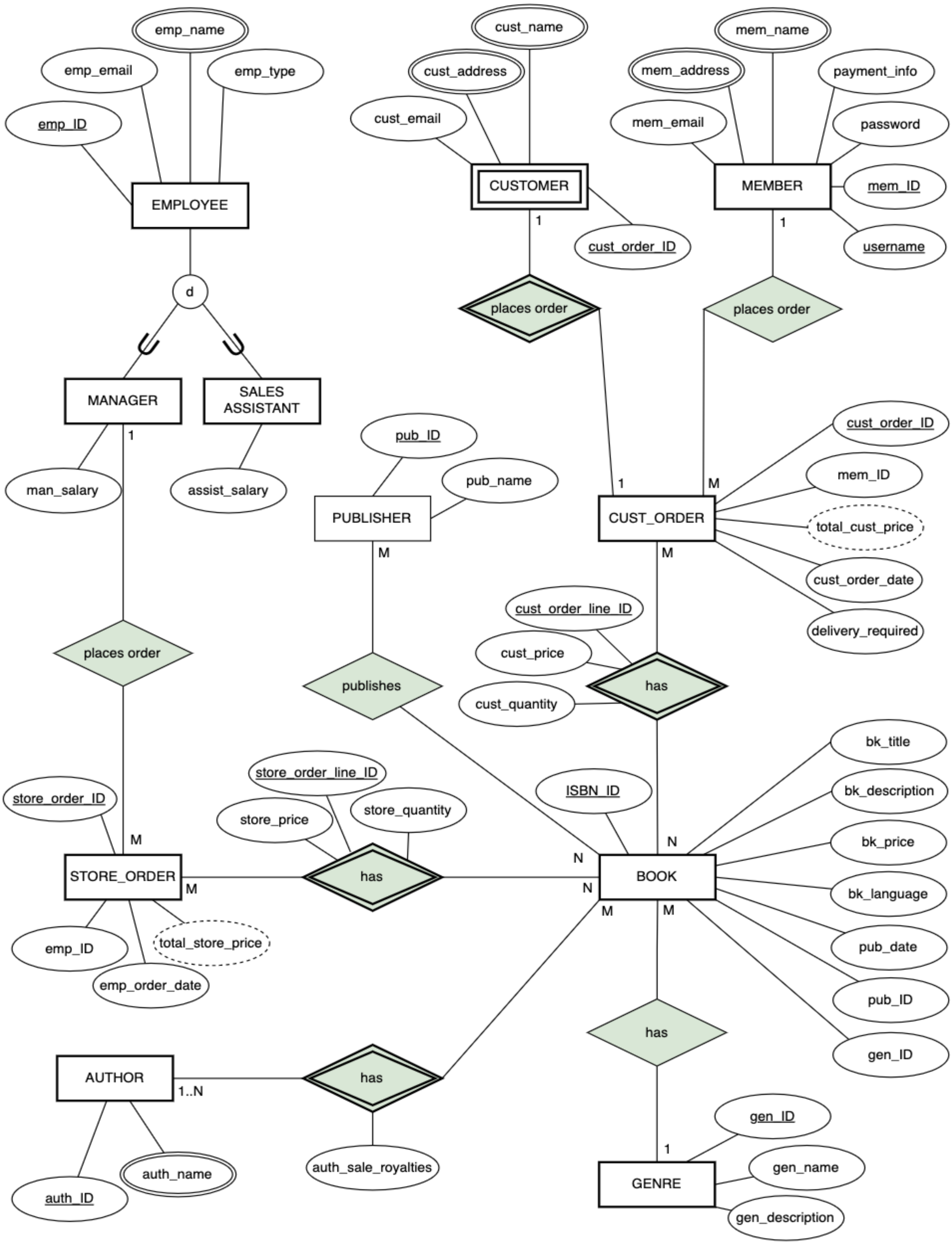
BUSINESS ANALYSIS & SPECIFICATIONS

Business Rules

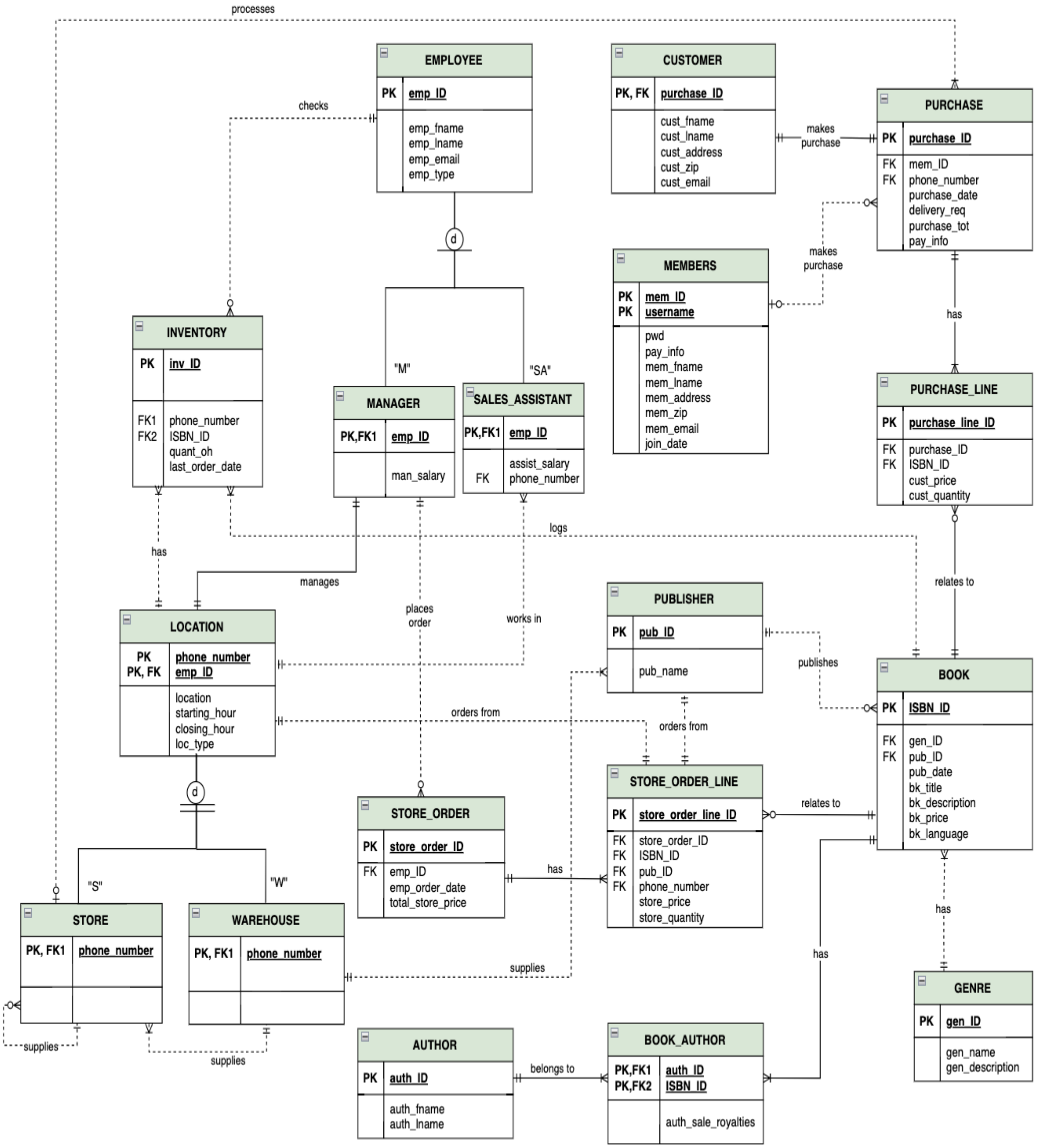
- One warehouse restocks inventory for many stores
- A store sells many books
- A store has many employees, and one manager
- If a store has run out of a book, it can order it from another store
- A manager may place many orders for many books that have run out in all stores and the warehouse.
- Books are supplied by publishers directly to the main warehouse. Books are supplied at a special wholesale price.
- A book may be written by at least one, if not many authors
- An author can write many books

- Each book corresponds to a genre, and a genre can have many books
- Both customers and members can place orders, and each order can be for many books.
- Previous order history is only recorded and stored only for members. If a regular customer makes an order, they are then identifiable by their last order.
- Members get a special membership discount and do not require a previous purchase history to exist..
- An order can come with the option of home-delivery.
- A customer may further choose to opt into the store membership plan, which entails creating an online account and registering payment methods.
- All employees are automatically registered as store members
- Each order placed may be delivered if that option is chosen by the customer

Conceptual Database For One-Store Model - Chen ERD - ***(Note: cardinality omitted for simplicity, only basic connectivities shown)***



Internal Model: Multiple Branches and Warehouse Added - Crow's Foot ERD: ***Shows deconstructed M:N relationships. This ERD presents an outline for our physical implementation plan.***



User Roles and Interactions: In-Depth Entity Relation Table

(M:N connections are now broken down)

Entity	**Relation**	**Entity**	**Cardinality**	**NOTES**
MEMBER	places order	CUST_ORDER	(1,1)-(0,M)	
CUSTOMER	places order	CUST_ORDER	(1,1)-(1,1)	A strong (identifying) association because an customer cannot exist without a purchase having been made
CUST_ORDER	has	CUST_ORDER_LINE	(1,1)-(1,M)	Strong association: CUST_ORDER does not exist without at least 1 purchase (each "order line" corresponds to one book title with min quantity = 1).
BOOK	relates to	CUST_ORDER_LINE	(1,1)-(0,M)	Strong association: ORDER_LINE not possible without a corresponding book.
GENRE	has	BOOK	(1,1)-(1,M)	
BOOK	has	BOOK_AUTHOR	(1,1)-(1,M)	Strong. Book must have author(s).
AUTHOR	belongs to	BOOK_AUTHOR	(1,1)-(1,M)	Ie; an author can "belong to" a group of authors that worked on the same book. Strong since group can only exist if there is at least 1 auth
PUBLISHER	publishes	BOOK	(1,1)-(0,M)	
MANAGER	places order	STORE_ORDER	(1,1)-(0,M)	
STORE_ORDER	has	STORE_ORDER_LINE	(1,1)-(1,M)	Strong.
BOOK	relates to	STORE_ORDER_LINE	(1,1)-(0,M)	Strong (refer to

				cust_order_line reasoning)
PUBLISHER	supplies	STORE_ORDER_LINE	(1,1)-(0,M)	Strong. Since stores order directly from publisher(s).

Entity-Attribute Details Table

Entity	**Attribute**	**Key Designation**	**Attribute Type**

MEMBER	**mem_ID**
	username
	password
	payment_info
	mem_fname
	mem_lname
	mem_address
	mem_zip
	mem_email
		PK
		PK
			CHAR(10)
			VARCHAR(50)
			VARCHAR(70)
			CHAR(16) - *eg: card num*
			VARCHAR(50)
			VARCHAR(50)
			VARCHAR(200)
			CHAR(5)
			VARCHAR(256)

CUST_ORDER	**cust_order_ID**
	mem_ID
	cust_order_date
	delivery_required
	total_cust_price
		PK
		FK
			CHAR(12)
			CHAR(10)
			DATE
			CHAR(1) – eg: “Y” or “N”
			NUMBER(8,2)

CUST_ORDER_LINE
Since one order can have many lines that each correspond to a book to be purchased
	cust_order_line_ID
	cust_order_ID
	ISBN_ID
	cust_price
	cust_quantity
		PK
		FK
		FK
			CHAR(15)
			CHAR(12)
			CHAR(13)
			NUMBER(8,2)
			INT

CUSTOMER	**cust_order_ID**
	cust_fname
	cust_lname
	cust_address
	cust_zip
	cust_email
		PK, FK	CHAR(12)
			VARCHAR(50)
			VARCHAR(50)
			VARCHAR(200)
			CHAR(5)
			VARCHAR(256)

BOOK	**ISBN_ID**
	gen_ID
	pub_ID
	pub_date
	bk_title
		PK
		FK
		FK
			CHAR(13)
			CHAR(10)
			CHAR(10)
			DATE
			VARCHAR(100)

	bk_description
	bk_price
	bk_language
			VARCHAR(800)
			NUMBER(8,2)
			VARCHAR(80)

AUTHOR	**auth_ID**
	auth_fname
	auth_lname
		PK	CHAR(10)
			VARCHAR(50)
			VARCHAR(50)

BOOK_AUTHOR	**auth_ID**
	ISBN_ID
	auth_sale_royalties
		PK,FK1
		PK,FK2
			CHAR(10)
			CHAR(13)
			NUMBER(8,2)

GENRE	**gen_ID**
	gen_name
	gen_description
		PK	CHAR(10)
			VARCHAR(50)
			VARCHAR(200)

PUBLISHER	**pub_ID**
	pub_name
		PK	CHAR(10)
			VARCHAR(50)

EMPLOYEE	**emp_ID**
	emp_fname
	emp_lname
	emp_email
	emp_type
		PK	CHAR(10)
			VARCHAR(50)
			VARCHAR(50)
			VARCHAR(256)
			VARCHAR(3) - *max 3 letters*

SALES_ASSISTANT “SA”	**emp_ID**
	assist_salary
		PK, FK	CHAR(10)
			NUMBER(8,2)

MANAGER “M”	**emp_ID**
	man_salary
		PK, FK	CHAR(10)
			NUMBER(8,2)

STORE_ORDER	**store_order_ID**
	emp_ID
	emp_order_date
	total_store_price
		PK
		FK
			CHAR(12)
			CHAR(10)
			DATE
			NUMBER(8,2)

STORE_ORDER_LINE	**store_order_line_ID**
	store_order_ID
	ISBN_ID
	pub_ID
	store_price
	store_quantity
		PK
		FK
		FK
		FK
			CHAR(15)
			CHAR(12)
			CHAR(13)
			CHAR(10)
			NUMBER(8,2)
			INT

Normalization:

The tables have been designed to be in their most normal form. Some transitive dependencies exist but that should be fine due to the nature of reporting. Eliminating these dependencies would prove to be negligible and only expand the database with tables that we dont really need.

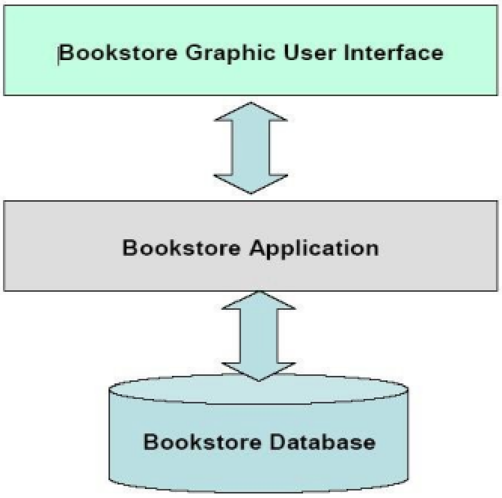
SQL Implementation

We used MySQL workbench to create the database and insert the entities into the database. Moreover, we have done some inserts and queries to test the real world possibilities for our database.

Two SQL files will be sent with this report to verify the inserts and queries for the database.

Development Plans for Supplementary Applications / Programs

The architecture of a bookshop management system requires plans for more than just a database system. Database system would work with a native bookstore application and also a bookstore graphical user interface. Here in this figure we can see that these architectures work together to create a sufficient bookstore management system.



Interactions between the backend of the application and the database need to be implemented. Developers need to be mindful of command-line actions with the database, these need to align with business rules. Additional features should be provided for instance like having a member sale or giving out book recommendations. Moreover, frontend developers are needed and are important for the success of the bookshop. The user interface must go through several lifecycles. The design should cover a larger scope of options and in this project will probably take the longest amount of time to design and build.

Development of the database to handle certain features set by business rules. Certain triggers need to be implemented in the database for example:

- Customers can only rate a book after purchasing it
- Update old rating if a new one is subsequently posted
- Membership discount application to be done in supplemental application
- Publisher sells books to the store at a discounted wholesale rate which can be negotiated and change over time.

CONCLUSION

Throughout working on this database project, we have learned a lot of practical things about databases. The theoretical background learned in class allowed us to create business rules that would align with real world organization needs. We are at a point where we have our ERDs developed according to our business rules. Future considerations for our database system may include how we might cultivate data on our customers to create a more personalized feature of forecasting recommendations according to a customer's tastes. We may even consider how to adapt our database if growing data needs are seen to be a challenge. In our supplemental application, we may further consider how we might automate the store-purchasing in other the case of low inventory or new bestsellers being published. Lastly, we might consider expanding our database framework to include objects beyond just books, in the case that our store expands its selection of items for sale.

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