Database System Overview

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CS660 – Database Systems

Colorado Technical University

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April 7, 2024

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Database System Overview (Week 1)

The purpose of this assignment is to create a course of action to develop and implement a purposeful database management system for a fictional company of our choice. Throughout my time at Colorado Technical University, I've developed a fictional bookstore called Heartland Escapes. Previous projects include a migration plan from an on-premises system to an Azure Cloud environment, a system networking plan for cloud computing, and a system security management and maintenance plan. I think it's only natural to continue working with this fictional store here and develop a purposeful data environment for this business as well.

As stated previously, Heartland Escapes is a bookstore in Lincoln Nebraska with two locations. They have seen recent growth and consumer interest due to their growing presence in social media. Their business model is heavily centered around hosting events at their stores, including author meet and greets, summer reading programs, holiday-oriented events (like scary story readings on Halloween, Santa reads Christmas stories), and many others. Because of their marketing of these events, they've received a lot of local publicity and foot traffic in store. With the growth they've seen over the past year, Heartland Escapes would like to expand to two neighboring cities in Nebraska with a new location in Omaha Nebraska, and a new location in Beatrice Nebraska. To perform this feat, they have the desire to upgrade their existing technology to better support their employees and customers, which includes and improvement to their existing database management system and the development of an e-commerce marketplace.

Business Environment

Heartland Escapes started out as a form of community necessity. The public libraries were well stocked with books but lacked in providing young people with the spark to enjoy reading. The owners of the company are avid book readers themselves and have always enjoyed sharing their literary journeys

with other like-minded individuals. Heartland Escapes mission is to be a shared "Escape" for others to enjoy captivating stories and their love for books with each other. The first store opened in 2010, and it was a slow start to get people in the door with competing companies like Barnes and Noble around. As people began seeing the benefits of community-oriented storytelling, traction accrued to the point that Heartland Escapes had the financial stability to open a second store in 2017. The first year of the pandemic was difficult for the company, but after the guidelines loosened and the public started feeling more comfortable leaving their homes, business caught its stride once again. Since then, Heartland Escapes has seen nothing but growth and enthusiastic customers.

Both stores are equipped with 12 staff, 2 assistant managers, one manager, and one of the owners acts as a general manager of both locations. The other original owner is responsible for human resources and supports the GM with day-to-day operations. There are two additional stakeholders that fit the roles of chief financial officer and chief information officer.

When Heartland Escapes started their journey, they developed their own point-of-sale system and inventory management API. Married to these systems are the Accounting Database and the Inventory Database. Additionally, they have a public facing website that users can search store inventory with and see store hours and event schedules. These home-grown systems are all still being used to this day. As their store has risen in popularity, Heartland Escapes junior and senior staff have all began to feel growing pains. These pains include:

1. Customer Management

2. Inventory Control

3. System Documentation

4. Lack of Online Capabilities

5. Lack of Events Management

As stated previously, Heartland Escapes has the desire to offer e-commerce services to their customers, which will require customer data storage and management along with more robust inventory controls. In previous meetings with Heartland Escapes senior management, they've expressed the desire to offer subscription boxes to interested customers that contain Heartland Escapes books and merchandise. Additionally, the pandemic made stakeholders incredibly nervous. Foot traffic through the store is the main avenue through which Heartland Escapes makes its revenue. If customers had the ability to order books online, that may have lessened the financial impact of the pandemic on their stores.

Advancement in inventory controls would allow for optimal stock of products and automated re-stocking of books. With the impending expansion of their business, these functions will be crucial to maintain between all four stores. The original in-house software and database systems are not well documented, which makes maintenance and upgrades difficult to perform.

Because their business model is very event based, Heartland Escapes desires the ability to post events more easily on their website. As it is now, customers need to subscribe to Heartland Escapes social media channels to stay up to date with up-coming events. Although posts to their social media profiles will continue, having a central place to see all event schedules for each store would be incredibly helpful to their customers when Heartland Escapes opens their two new locations.

Database Goals and Objectives

A Database Management System's purpose is to support and serve the applications through which Heartland Escapes users interact. This is inclusive between all applications and individuals, administrators, customers, and staff. Our database goals for Heartland Escapes are to support their expansion interests in the best way we can. With this in mind, here is our list of objectives as database administrators:

1. Support an enhanced customer management system.

2. Support for subscription-based product management.

3. Support a flexible event management system.

4. Improve and automate replenishment and ordering processes.

5. Protect customer data using regulations provided by the Payment Card Industry Data

    Security Standard.

6. Architect our databases in such a way that they support scaling and growth.

7. Utilize industry data security standards using role-based access controls.

8. Facilitate data loss prevention through use of regular backup schedules and data replication

    processes.

How the proposed database system addresses business problem(s)

Heartland Escapes is seeing unprecedented growth in their business and feels that the best way

to capitalize on this growth is to expand both physically, and technologically. With this expansion effort,

they've verbalized their desire to support customer management, customer online sales, subscription-

based products, smart and automated inventory management, and store-to-store event management.

They've also expressed that their current inventory management system is lack-luster and fails to

accommodate any of these features. Our database goals explicitly state the desire to support these

efforts requested by Heartland Escapes stakeholders.

Mission and Goals Alignment

Heartland Escapes' primary mission is to provide their communities with a space for individuals

to fall in love with reading. Within this larger mission statement lies many objectives and opportunities

to better achieve this goal. In the eyes of Heartland Escapes stakeholders, the current optimal course of

action is to provide a central area that customers can receive information about upcoming events, offer

consistent availability of books to customers, allow for customers to order books from the comfort of their own homes, and build customer engagement by offering subscription-based products. Our goals as database administrators are derived from the goals of Heartland Escapes, with our primary goal being to support Heartland Escapes in their current endeavor.

Analysis of how the project fulfills the mission/goals of the target organization.

In the Problem Based Learning scenario, the example company is looking to:

1. improve customer satisfaction by allowing them to order business products online.

2. Reduce employee turnover rate by improving system efficiency and useability (therefore also reducing customer complaints).

3. Take advantage of back-office system operation automation.

4. Improve back-office systems across the board.

I believe that the narrative I've written for the fictional Heartland Escapes business fully emulates the same (if not similar) concerns as the Problem Based Learning scenario. I also believe that the goals I've outlined for Heartland Escapes, and the goals I've expressed for the database administration team are in sync with one another. Later sections of this assessment will further explain how these goals will be achieved for Heartland Escapes.

Entity Relationship Model (Week 2)

Subjects of Interests

There are several entities in this preliminary entity relationship model. The primary subjects of interest are Stores, Customers, Orders, Products, Events, Promotions and Store Inventory. Because our client wants to begin the process of supporting an e-commerce site, we need to build a robust and flexible entity relationship model that supports all these primary subjects of interest. It also needs to be open to expansion. This includes a lot of supporting entity tables, data link tables, and tables explicitly used to enforce business rules.

Business Rules

- A store must have its own inventory of products.

- Each product must have at least one store inventory

- Each store inventory product must have a minimum restock threshold

- Each store must have a unique name.

- Each Customer must have at least one address.

- Each Product has a minimum of one category.

- Each Order has a minimum of one line-item.

- Each Order has one and only one status.

- Status must exist within the order_status table.

- Each Order must have an originating store.

- Additional business rules are defined below by entity relationships

Entity Relationship (ER) Diagram

This is the entity relationship diagram using crows foot notation. Each column in each table is by default not nullable, unless defined otherwise with a "?" character after the type definition. Each table contains audit fields defined by the structure titled "Entity Base Fields".
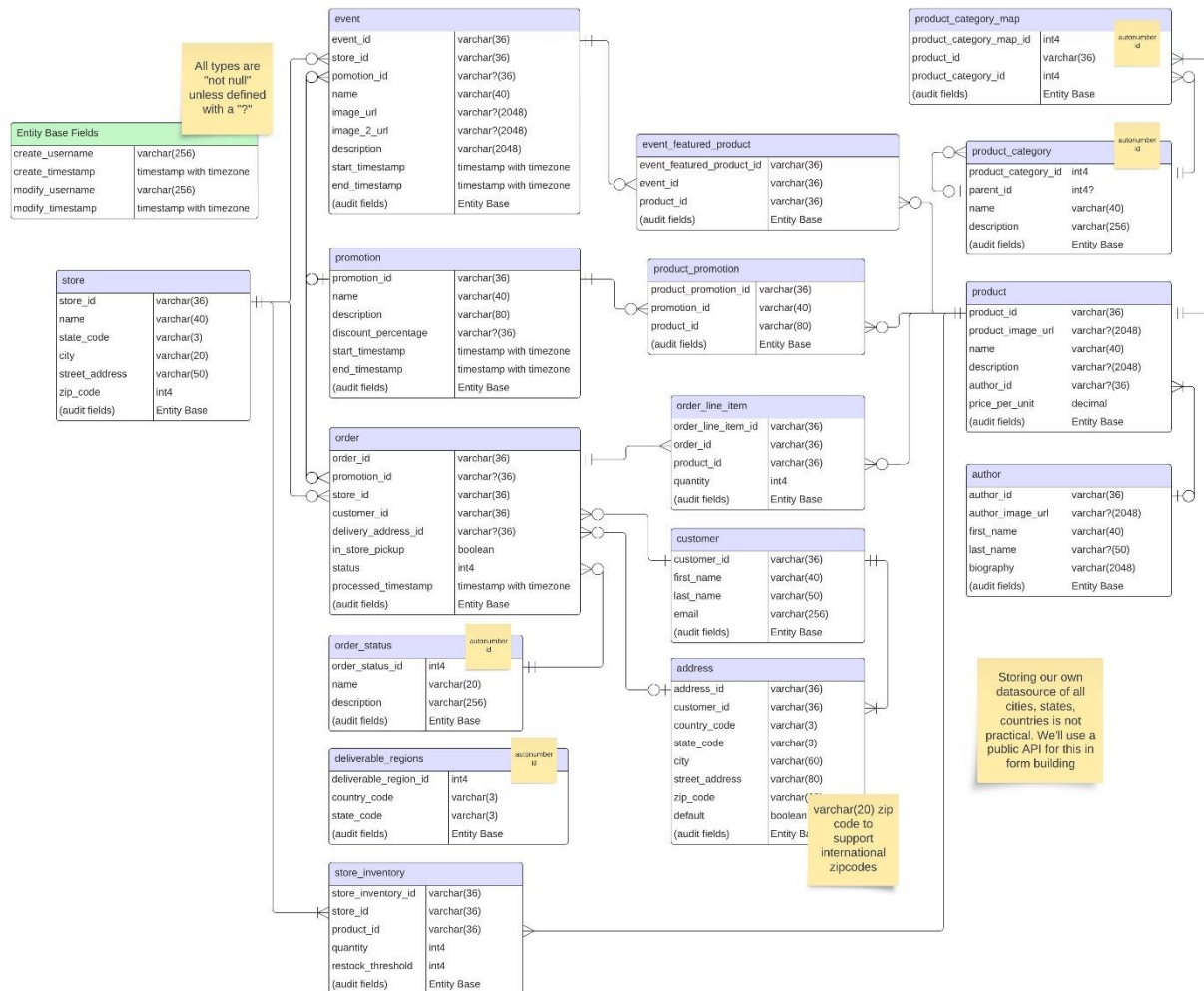
Table of Entities, Attributes (with data types), Relationships, and Cardinality Constraint

Entity	Attributes	Relationships	Cardinality
customer	customer_id (PK) (varchar(36))	Has Addresses Has Orders	1:Many 1:Many
customer	first_name (varchar(40))		
customer	last_name (varchar(50))		
customer	email (varchar(256))		
product	product_id (PK) (varchar(36))	Can have product_promotions Has at least one product_category_map Can have order_line_items Has at least one store_inventory Can be associated with an Author	1:Zero or More 1:Many 1:Zero or More 1:Many 1:Zero or One
product	product_image_url (varchar?(2048))		
product	name (varchar(40))		
product	description (varchar?(2048))		
product	author_id (varchar?(36))	Can have author	1:Zero or One
product	price_per_unit (decimal)		
store	store_id (PK) (varchar(36))	Can have events Can have orders Has store_inventories	1:Zero or More 1:Zero or More 1:Many
store	name (varchar(40))		
store	state_code (varchar(3))		

Table of Entities, Attributes (with data types), Relationships, and Cardinality Constraint

store	city (varchar(20))		
store	street_address (varchar(50))		
store	zip_code (int4)		
store_inventory	store_inventory_id (PK) (varchar(36))	Is associated with a product Is associated with a store	1:1 1:1
store_inventory	store_id (FK) (varchar(36))	Is associated with a store	1:1
store_inventory	product_id (FK) (varchar(36))	Is associated with a product	1:1
store_inventory	quantity (int4)		
store_inventory	restock_threshold (int4)		
address	address_id (PK) (varchar(36))	Has a customer Can be associated with an order	1:1 1:Zero or More
address	customer_id (FK) (varchar(36))	Has a customer	1:1
address	country_code (varchar(3))		
address	state_code (varchar(3))		
address	city (varchar(60))		
address	street_address (varchar(80))		
address	zip_code (varchar(20))		
address	default (boolean)		
order	order_id (PK) (varchar(36))	Has at least one order_line_item	1:1 or more

		Has a customer	1:1
		May have a delivery address	1:Zero or 1
		Has a store	1:1
		Has an order_status	1:1
		May have a promotion	1:Zero or 1
order	promotion_id (FK) (varchar?(36))	May have a promotion	1:Zero or 1
order	store_id (FK) (varchar(36))	Has a store	1:1
order	customer_id (FK) (varchar(36))	Has a customer	1:1
order	delivery_address (varchar?(36))	May have a delivery address	1:Zero or 1
order	in_store_pickup (boolean)		
order	status (int4)	Has an order_status	1:1
order	processed_timestamp (timestamp with timezone)		
order_status	order_status_id (PK) (int4)	May have multiple orders	1:Zero or More
order_status	name (varchar(20))		
order_status	description (varchar(256))		
order_line_item	order_line_item_id (PK) (varchar(36))	Is associated with an order / Is associated with a product	1:1 / 1:1
order_line_item	order_id (FK) (varchar(36))	Is associated with an order	1:1
order_line_item	product_id (FK) (varchar(36))	Is associated with a product	1:1
order_line_item	quantity (int4)		

event	event_id (PK) (varchar(36))	Is associated with a store May have associated event_featured_products May be associated with a promotion	1:1 1:Zero or more 1:Zero or 1
event	store_id (FK) (varchar(36))	Is associated with a store	1:1
event	pomotion_id (varchar?(36))	May be associated with a promotion	1:Zero or 1
event	name (varchar(40))		
event	image_url (varchar?(2048))		
event	image_2_url (varchar?(2048))		
event	description (varchar(2048))		
event	start_timestamp (timestamp with timezone)		
event	end_timestamp (timestamp with timezone)		
event_featured_product	event_featured_product_id (PK) (varchar(36))	Is associated to an event Is associated to a product	1:1 1:1
event_featured_product	event_id (FK) (varchar(36))	Is associated with an event	1:1
event_featured_product	product_id (FK) (varchar(36))	Is associated with a product	1:1
product_category	product_category_id (PK) (int4)	Can be associated with a product_category Can have many product_categories Can have many product_category_maps	1:Zero or 1 1:Zero or Many 1:Zero or Many
product_category	parent_id (FK) (int4?)	Can be associated with a product_category	1:Zero or 1
product_category	name (varchar(40))		

product_category	description (varchar(256))		
author	author_id (PK) (varchar(36))	Is associated with at least one product	1:1 or More
author	author_image_url (varchar?(2048))		
author	first_name (varchar(40))		
author	last_name (varchar?(50))		
author	biography (varchar(2048))		
deliverable_regions	deliverable_region_id (PK) (int4)		
deliverable_regions	country_code (varchar(3))		
deliverable_regions	state_code (varchar(3))		
product_category_map	product_category_map_id (PK) (int4)	Is associated with a product_category Is associated with a product	1:1 1:1
product_category_map	product_id (FK) (varchar(36))	Is associated with a product	1:1
product_category_map	product_category_id (FK) (int4)	Is associated with a product_category	1:1
promotion	promotion_id (PK) (varchar(36))	Can be associated with multiple events Can be associated with multiple orders Can be associated with multiple product_promotions	1:Zero or More 1:Zero or More 1:Zero or More
promotion	name (varchar(40))		
promotion	description (varchar(80))		

promotion	discount_percentage (varchar?(36))		
promotion	start_timestamp (timestamp with timezone)		
promotion	end_timestamp (timestamp with timezone)		
product_promotion	product_promotion_id (PK) (varchar(36))	Is associated with a single promotion Is associated with a single product	1:1 1:1
product_promotion	promotion_id (FK) (varchar(40))	Is associated with a single promotion	1:1
product_promotion	product_id (FK) (varchar(80))	Is associated with a single product	1:1

Analysis of how the project fulfills the mission/goals of the target organization.

This project fulfills the missions and goals of Heartland Escapes in multiple ways. We now have a way to track inventory individually for each store. The inventory table is also built in a way that will support automated restocking of products for each store. This system is also more flexible and useable in that it will open the door to supporting an e-commerce website. Some additional tables will need to be added in the future to store payment information, or a third party service like google pay will support that behavior depending business decisions. Also, the flexible product category system can be extended in the future to support subscriptions when that functionality is desired.

This is just a preliminary entity relationship model, to support all the features desired by Heartland Escapes we will need to perform much more careful planning and consultation with the client. This, however, will give us the bedrock to further expand the data model as correspondence with Heartland Escapes continues.

Structured Query Language Scripts (Week 3)

DDL – Database Create, Table Create, and Table Alter FK Constraint Scripts

DDL.sql

DML – Data Insert, Update, and Delete Scripts

DML.sql

Reporting – CrossTab, Aggregation, and Querying scripts

Report SQL.sql

Analysis of how the project fulfills the mission/goals of the target organization.

This week was centered around creating a database around the entity relationship diagram and data dictionary provided in the previous section. This was a massive amount of work to complete, but it was a great exercise in finalizing some things about the data dictionary. For example, I found that the seed data I created for the names in the product table were much longer than the max length, so I was able to find out early that that length needed to be more than 40 characters. It also gave me a better idea about how the table relationships would work, and the level of complexity within the product categories table.

I found that it was incredibly difficult to aggregate the total number of products for parent columns in the product category table. I gave up on it for now, but that may require a change in direction for how this part of the system was implemented, which is great to know early on.

These scripts are the first steps in fulfilling the missions and goals of Heartland Escapes. The table creation scripts with constraints gives us a tangible platform to begin visualizing and modelling how the new Heartland Escapes system might work. These constraints enforce the business rules discussed in the previous section, and the tables fulfil our first section of business logic and functionality. Additionally, the seed data inserted allows us to begin working with how to process, manipulate, and query the data in the new Heartland Escapes system. It also allows us to test parts of the request functionality early, and determine what pain points exist in this plan and what refactoring may need to be conducted.

Database Administration Plan (Week 4)

Transaction Management Plan

Database Security procedure

Backup Plan and Recovery Procedure

Analysis of how the project fulfills the mission/goals of the target organization

Future Database System Implementation Plan (Week 5)

Database Differences

Changes needed to build a data warehouse/data mart.

Distributed Database Considerations

Business Intelligence

Data Warehouse Benefits

Return on Investment

Competitive Advantage

Increased Productivity

Data Warehouse Problems

Analysis of how the project fulfills the mission/goals of the target organization

References