Nerd Block  
Group Case

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# Introduction

In this report we will be going over the newly designed database system for the Nerd Block organization to replace the existing one. After reading through the company’s case, we identified all of the deficiencies inside the current system and we have worked very hard to improve those. Some of those deficiencies include struggling to fill orders within a timely matter, and the access database that held the original system became overloaded as they had to add numerous staff to handle the incoming wave of customers. The old database system was not easily accessible by each of these employees, which makes it difficult to access the information needed for each role. It also wasn’t structured in a way that allowed efficient tracking of all the transactions that took place within the system itself. We have focused on improving all of these deficiencies with this new system in a way that everyone will be happy.

When Nerd Block started off they created a nice small company just to get them selves going not expecting a heavy load of customers right away. To their surprise the amount of customers that were coming in was massive to the point where they couldn’t keep up with the orders. Orders were going out late and they were becoming very overwhelmed with all the attention. The main reason that they were having this issue was because they were under staff and the database system that they had was too small. We have created a larger database system that is easier to interact with when it comes to adding or deleting data. Employees could easily be added as well as all the information when it came to keeping track of the orders that were coming in. This will improve overall organization within the company to prevent anyone from getting overwhelmed.

Also with the current system it is very difficult to keep track and perform all transactions on the database. This is a required feature of a system that needs constant updates to the majority of its tables. With the new system it will not only be easy, but it will also be efficient when it comes to executing transactions of any type against the database. Now with all that being said, the system that we are creating will be better in every way possible, in terms of organization, efficiency, and overall ease of use.

In terms of technology, we chose to implement a 3 tiered architecture in our application. The front-end is Windows Forms, which is a commonly used front-end that users will be familiar with. The main logic is implemented with C# and .Net, which lets us use the powerful reflection system to make our code essentially write itself. Finally, the backend is implemented in postgres, which is a free enterprise-grade database. With how we have designed the internals, both the front-end views and back-end database can be swapped out while retaining functionality. For instance, if NerdBlock eventually wants to use a web-based interface, it would be simple to create a C# http server that implements the IFrontEnd interface.

# Mission Statement

We have been hired by Nerd Block to create a new and improved database that efficiently stores critical information, is easily accessible by employees and useful for creating reports and data sets for this rapidly growing company.

# Mission Objectives

To maintain (Enter, Select, Update, Delete) data on customers   
To maintain (Enter, Select, Update, Delete) data on employees  
To maintain (Enter, Select, Update, Delete) data on addresses  
To maintain (Enter, Select, Update, Delete) data on products   
To maintain (Enter, Select, Update, Delete) data on blocks   
To maintain (Enter, Select, Update, Delete) data on block series  
To maintain (Enter, Select, Update, Delete) data on subscriptions   
To maintain (Enter, Select, Update, Delete) data on billing information   
To maintain (Enter, Select, Update, Delete) data on orders   
To maintain (Enter, Select, Update, Delete) data on transfers   
To maintain (Enter, Select, Update, Delete) data on genres   
To maintain (Enter, Select, Update, Delete) data on suppliers

To perform searches on customers   
To perform searches on employees   
To perform searches on products   
To perform searches on blocks   
To perform searches on subscriptions   
To perform searches on orders   
To perform searches on transfers   
To perform searches on genres

To track the status of customers   
To track the status of employees   
To track the status of subscriptions   
To track the status of orders   
To track the status of transfers

To report on customers   
To report on employees   
To report on subscriptions   
To report on orders   
To report on transfers   
To report on blocks   
To report on genres

# 3rd Normal Form Design

**tblAddress** (AddressId, StreetAddress, State, Country, PostalCode, City, ApartmentNumber, SpecialRequests)

**tblCustomer** (CustomerId, Email, DateJoined, Username, HashedPass, LoginToken, PasswordResetToken, FirstName, LastName, HomeAddress, BillingAddress)

**tblEmployees** (EmployeeId, DateJoined, SIN, FirstName, LastName, Phone, Email, HomeAddress, RoleId, TerminationDate)

**tblEmployeeRole** (RoleId, Name, Description)

**tblBillingInfo** (BillingInfoId, PaymentType, Address, AccountNum, Token)

**tblGenre** (GenreId, Title, Description)

**tblBlockSeries** (SeriesId, GenreId, Title, StartDate, EndDate, SubscriptionPrice, BlockVolume)

**tblSubscription** (SubscriptionId, CustomerId, SeriesId, StartedOn, EndedOn, BillingType, ShippingAddress)

**tblPaymentInstance** (SubscriptionId, PaymentDate, BillingInfoId, IsPayed)

**tblProduct** (ProductId, Name, Description, Width, Height, Depth, NumDamaged)

**tblBlock** (BlockId, SeriesId, Title, Description, ShippedBy)

**tblBlockItem** (BlockId, ProductId, Quantity)

**tblSubscriptionFullfillment** (SubscriptionId, BlockId, TrackingNumber, FullfillingEmployee, ShippedOn)

**tblSupplier** (SupplierID, Company, Address, Phone)

**tblSupplierContact** (ContactId, Company, FirstName, LastName, PhoneNumber, Email)

**tblOrder** (OrderId, DateOrdered, OrderedBy, SupplierId)

**tblOrderLineItem** (OrderId, ProductId, Quantity, BatchCost)

**tblMortarStore** (StoreId, Address, PhoneNumber, GeneralManager)

**tblTransfer** (TransferId, StoreId, TransferDate)

**tblTransferLineItem** (TransferId, ProductId, TransferDate)

# Functional Dependencies

When it comes to functional dependencies for each of the tables there is a pattern that can be followed. Typically, each of the individual fields in the tables is functionally dependent on their primary key which makes perfect sense. There is one exception to this pattern and that is if there is a combined primary key of which we can see in the invoice table. In that case they, just act like a regular primary key in this case.

|  |  |  |
| --- | --- | --- |
| tblAddress | | |
| Determinant | Dependency | Dependent Attribute |
| AddressId | 🡪 | StreetAddress |
| AddressId | 🡪 | State |
| AddressId | 🡪 | Country |
| AddressId | 🡪 | PostalCode |
| AddressId | 🡪 | City |
| AddressId | 🡪 | ApartmentNumber |
| AddressId | 🡪 | SpecialRequests |

|  |  |  |
| --- | --- | --- |
| tblCustomers | | |
| Determinant | Dependency | Dependent Attribute |
| CustomerId | 🡪 | Email |
| CustomerId | 🡪 | DateJoined |
| CustomerId | 🡪 | Username |
| CustomerId | 🡪 | HashedPass |
| CustomerId | 🡪 | LoginToken |
| CustomerId | 🡪 | PasswordResetToken |
| CustomerId | 🡪 | FirstName |
| CustomerId | 🡪 | LastName |
| CustomerId | 🡪 | HomeAddress |
| CustomerId | 🡪 | BillingAddress |

|  |  |  |
| --- | --- | --- |
| tblEmployees | | |
| Determinant | Dependency | Dependent Attribute |
| EmployeeId | 🡪 | DateJoined |
| EmployeeId | 🡪 | SIN |
| EmployeeId | 🡪 | FirstName |
| EmployeeId | 🡪 | LastName |
| EmployeeId | 🡪 | Phone |
| EmployeeId | 🡪 | Email |
| EmployeeId | 🡪 | HomeAddress |
| EmployeeId | 🡪 | RoleId |
| EmployeeId | 🡪 | TerminationDate |

|  |  |  |
| --- | --- | --- |
| tblEmployeeRole | | |
| Determinant | Dependency | Dependent Attribute |
| RoleId | 🡪 | Name |
| RoleId | 🡪 | Description |

|  |  |  |
| --- | --- | --- |
| tblBillingInfo | | |
| Determinant | Dependency | Dependent Attribute |
| BillingInfoId | 🡪 | PaymentType |
| BillingInfoId | 🡪 | Address |
| BillingInfoId | 🡪 | AccountNum |
| BillingInfoId | 🡪 | Token |

|  |  |  |
| --- | --- | --- |
| tblGenre | | |
| Determinant | Dependency | Dependent Attribute |
| GenreId | 🡪 | Title |
| GenreId | 🡪 | Description |
| GenreId | 🡪 | IsActive |

|  |  |  |
| --- | --- | --- |
| tblBlockSeries | | |
| Determinant | Dependency | Dependent Attribute |
| SeriesId | 🡪 | GenreId |
| SeriesId | 🡪 | Title |
| SeriesId | 🡪 | StartDate |
| SeriesId | 🡪 | EndDate |
| SeriesId | 🡪 | SubscriptionPrice |
| SeriesId | 🡪 | BlockVolume |

|  |  |  |
| --- | --- | --- |
| tblSubscription | | |
| Determinant | Dependency | Dependent Attribute |
| SubscriptionId | 🡪 | CustomerId |
| SubscriptionId | 🡪 | SeriesId |
| SubscriptionId | 🡪 | StartedOn |
| SubscriptionId | 🡪 | EndedOn |
| SubscriptionId | 🡪 | BillingType |
| SubscriptionId | 🡪 | ShippingAddress |

|  |  |  |
| --- | --- | --- |
| tblPaymentInstance | | |
| Determinant | Dependency | Dependent Attribute |
| SubscriptionId, PaymentDate | 🡪 | BillingInfoId |
| SubscriptionId, PaymentDate | 🡪 | IsPayed |

|  |  |  |
| --- | --- | --- |
| tblProduct | | |
| Determinant | Dependency | Dependent Attribute |
| ProductId | 🡪 | Name |
| ProductId | 🡪 | Description |
| ProductId | 🡪 | Width |
| ProductId | 🡪 | Height |
| ProductId | 🡪 | Depth |
| ProductId | 🡪 | NumDamaged |

|  |  |  |
| --- | --- | --- |
| tblBlock | | |
| Determinant | Dependency | Dependent Attribute |
| BlockId | 🡪 | SeriesId |
| BlockId | 🡪 | Title |
| BlockId | 🡪 | Description |
| BlockId | 🡪 | ShippedBy |

|  |  |  |
| --- | --- | --- |
| tblBlockItem | | |
| Determinant | Dependency | Dependent Attribute |
| BlockId, ProductId | 🡪 | Quantity |

|  |  |  |
| --- | --- | --- |
| tblSubscriptionFullfillment | | |
| Determinant | Dependency | Dependent Attribute |
| SubscriptionId, BlockId | 🡪 | TrackingNumber |
| SubscriptionId, BlockId | 🡪 | FullfillingEmployee |
| SubscriptionId, BlockId | 🡪 | ShippedOn |

|  |  |  |
| --- | --- | --- |
| tblSupplier | | |
| Determinant | Dependency | Dependent Attribute |
| SupplierId | 🡪 | Company |
| SupplierId | 🡪 | Address |
| SupplierId | 🡪 | Phone |

|  |  |  |
| --- | --- | --- |
| tblSupplierContact | | |
| Determinant | Dependency | Dependent Attribute |
| ContactId | 🡪 | Company |
| ContactId | 🡪 | FirstName |
| ContactId | 🡪 | LastName |
| ContactId | 🡪 | PhoneNumber |
| ContactId | 🡪 | Email |

|  |  |  |
| --- | --- | --- |
| tblOrder | | |
| Determinant | Dependency | Dependent Attribute |
| OrderId | 🡪 | DateOrdered |
| OrderId | 🡪 | OrderedBy |
| OrderId | 🡪 | SupplierId |

|  |  |  |
| --- | --- | --- |
| tblOrderLineItem | | |
| Determinant | Dependency | Dependent Attribute |
| OrderId, ProductId | 🡪 | Quantity |
| OrderId, ProductId | 🡪 | BatchCost |

|  |  |  |
| --- | --- | --- |
| tblMortarStore | | |
| Determinant | Dependency | Dependent Attribute |
| StoreId | 🡪 | Address |
| StoreId | 🡪 | PhoneNumber |
| StoreId | 🡪 | GeneralManager |

|  |  |  |
| --- | --- | --- |
| tblTransfer | | |
| Determinant | Dependency | Dependent Attribute |
| TransferId | 🡪 | StoreId |
| TransferId | 🡪 | TransferDate |

|  |  |  |
| --- | --- | --- |
| tblTransferLineItem | | |
| Determinant | Dependency | Dependent Attribute |
| TransferId, ProductId | 🡪 | Quantity |

# Data Dictionary

This is the data dictionary on the newly developed database for the Nerd Block Organization that has been created to replace the existing system. At the top of each table is the table name that is located in the database. Under the table name you can see the name of the field, the data type, a small description, the length, the kind of key, and whether the field is required or not. The length of the fields may vary depending on what specifics the business wants, so it was difficult to choose that piece of information.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblAddress | | | | | |
| Name | Type | Description | Length | Key | Req. |
| AddressId | Serial | Unique Identifier for Addresses | Varies | PK | Y |
| StreetAddress | VarChar | Represents street address for the location | 100 Char |  | Y |
| State | VarChar | Represents the state for the location | 30 Char |  | Y |
| Country | VarChar | Represents the country for the location | 40 Char |  | Y |
| PostalCode | VarChar | Represents the Postal Code | 10 Char |  | N |
| City | VarChar | Represents the city | 64 Char |  | N |
| ApartmentNumber | Int | Represents the apartment number if exists | Varies |  | N |
| SpecialRequests | Text | For any special requests for the location | Varies |  | N |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblCustomers | | | | | |
| Name | Type | Description | Length | Key | Req. |
| CustomerId | Serial | Unique Identifier for customers | Varies | PK | Y |
| Email | VarChar | Represents email for customer | 255 Char |  | Y |
| DateJoined | Date | Represents the date that they joined | Varies |  | Y |
| Username | VarChar | Represents their login username | 30 Char |  | Y |
| HashedPass | VarChar | Represents their password (encrypted) | 32 Char |  | Y |
| LoginToken | VarChar | Field for extra login information | 255 Char |  | N |
| PasswordResetToken | VarChar | Field for a generated password for request | 255 Char |  | N |
| FirstName | VarChar | Represents first name of customer | 30 Char |  | Y |
| LastName | VarChar | Represents last name of customer | 50 Char |  | Y |
| HomeAddress | Int | AddressId for home address | 1 Char | FK | Y |
| BillingAddress | Int | AddressId for billing address | 1 Char | FK | N |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblEmployees | | | | | |
| Name | Type | Description | Length | Key | Req. |
| EmployeeId | Serial | Unique identifier for employees | Varies | PK | Y |
| DateJoined | Date | Represents the date employee was hired | Varies |  | Y |
| SIN | VarChar | Represents the employee’s social insurance # | 9 Char |  | Y |
| FirstName | VarChar | Represents the employees first name | 30 Char |  | Y |
| LastName | VarChar | Represents the employees last name | 50 Char |  | Y |
| Phone | BigInt | Represents the employees phone number | 10 Char |  | N |
| Email | VarChar | Represents the employees email | 100 Char |  | N |
| Homeaddress | Int | AddressId for home address | Varies | FK | Y |
| RoleId | Int | RoleId for the employee role | Varies | FK | N |
| TerminationDate | Date | Represents the date the employee was let go | Varies |  | N |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblEmployeeRole | | | | | |
| Name | Type | Description | Length | Key | Req. |
| RoleId | Serial | Unique identifier for employee roles | Varies | PK | Y |
| Name | VarChar | Represents name of the role | 50 Char |  | Y |
| Description | VarChar | Represents the description of the role | 100 Char |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblBillingInfo | | | | | |
| Name | Type | Description | Length | Key | Req. |
| BillingInfoId | Serial | Unique identifier for billing info | Varies | PK | Y |
| PaymentType | VarChar | Represents the payment type | 10 Char |  | Y |
| Address | Int | Address Id for billing info address | Varies | FK | Y |
| AccountNum | BigInt | Represents the account number if there is one | Varies |  | N |
| Token | VarChar | Field for extra billing info information | 255 Char |  | N |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblGenre | | | | | |
| Name | Type | Description | Length | Key | Req. |
| GenreId | Serial | Unique Identifier for genre | Varies | PK | Y |
| Title | VarChar | Represents the title of the genre | 32 Char |  | Y |
| Description | Text | Represents the description of the genre | Varies |  | Y |
| IsActive | Boolean | Represents whether the genre is active or not | N/A |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblBlockSeries | | | | | |
| Name | Type | Description | Length | Key | Req. |
| SeriesId | Serial | Unique Identifier for the series | Varies | PK | Y |
| GenreId | Int | GenreId for this series | Varies | FK | Y |
| Title | VarChar | Represents the title of the series | 32 Char |  | Y |
| StartDate | Date | Represents the start date | Varies |  | Y |
| EndDate | Date | Represents the end date | Varies |  | Y |
| SubscriptionPrice | Money | Represents the price of the subscription | Varies |  | Y |
| BlockVolume | Int | Represents the volume of the block | Varies |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblSubscription | | | | | |
| Name | Type | Description | Length | Key | Req. |
| SubscriptionId | Serial | Unique identifier for subscriptions | Varies | PK | Y |
| CustomerId | Int | CustomerId for customer | Varies | FK | Y |
| SeriesId | Int | SeriesId for series | Varies | FK | Y |
| StartedOn | Date | Represents the start date of the subscription | Varies |  | Y |
| EndedOn | Date | Represents the end date of the subscription | Varies |  | N |
| BillingType | VarChar | Represents the billing type | 2 |  | Y |
| ShippingAddress | Int | AddressId for shipping address | Varies | FK | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblPaymentInstance | | | | | |
| Name | Type | Description | Length | Key | Req. |
| SubscriptionId | Int | SubscriptionId for subscriptions | Varies | PK | Y |
| PaymentDate | Date | Represents the date the payment was made | Varies | PK | Y |
| BillingInfoId | Int | BillingInfoId for billing info | Varies | FK | Y |
| IsPayed | Boolean | Represents whether is has been payed for or not | N/A |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblProduct | | | | | |
| Name | Type | Description | Length | Key | Req. |
| ProductId | Serial | Unique identifier for products | Varies | PK | Y |
| Name | VarChar | Represents the product name | 255 Char |  | Y |
| Description | Text | Represents the description of the product | Varies |  | Y |
| Width | Decimal | Represents the width | Varies |  | Y |
| Height | Decimal | Represents the height | Varies |  | Y |
| Depth | Decimal | Represents the depth | Varies |  | Y |
| NumDamaged | Int | Represents the number of damaged products | Varies |  | N |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblBlock | | | | | |
| Name | Type | Description | Length | Key | Req. |
| BlockId | Serial | Unique identifier for a block | Varies | PK | Y |
| SeriesId | Int | SeriesId for the series | Varies | FK | Y |
| Title | VarChar | Represents the Title of the block | 255 Char |  | Y |
| Description | Text | Represents the description of the block | Varies |  | Y |
| ShippedBy | Date | Represents the day of shipping | Varies |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| TblBlockItem | | | | | |
| Name | Type | Description | Length | Key | Req. |
| BlockId | Int | BlockId for the block | Varies | PK | Y |
| ProductId | Int | ProductId for the product | Varies | PK | Y |
| Quantity | Int | Represents the amount of each product | Varies |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblSubscriptionFullfillment | | | | | |
| Name | Type | Description | Length | Key | Req. |
| SubscriptionId | Int | SubscriptionId for the subscription | Varies | PK | Y |
| BlockId | Int | BlockId for the block | Varies | PK | Y |
| TrackingNumber | VarChar | Represents the tracking number | 255 Char |  | Y |
| FullfillingEmployee | Int | EmployeeId for the fulfilling employee | Varies | FK | Y |
| ShippedOn | Date | Represents the date it shipped | Varies |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblSupplier | | | | | |
| Name | Type | Description | Length | Key | Req. |
| SupplierId | Serial | Unique Identifier for suppliers | Varies | PK | Y |
| Company | VarChar | Represents the company | 255 Char |  | Y |
| Address | Int | AddressId for the address of the company | Varies |  | Y |
| Phone | BigInt | Represents the phone number of the company | 10 Char |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblSupplierContact | | | | | |
| Name | Type | Description | Length | Key | Req. |
| ContactId | Serial | Unique identifier for the contact | Varies | PK | Y |
| Company | Int | SupplierId for the company supplier | Int | FK | Y |
| FirstName | VarChar | Represents the first name of the contact | VarChar |  | Y |
| LastName | VarChar | Represents the last name of the contact | VarChar |  | Y |
| PhoneNumber | BigInt | Represents the phone number of the contact | BigInt |  | Y |
| Email | VarChar | Represents the Email of the contact | VarChar |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblOrder | | | | | |
| Name | Type | Description | Length | Key | Req. |
| OrderId | Serial | Unique Identifier for an order | Varies | PK | Y |
| DateOrdered | Date | Represents the date the order was placed | Varies |  | Y |
| OrderedBy | Int | EmployeeId for the employee who ordered | Varies | FK | Y |
| SupplierId | Int | ContactId for the supplier contact | Varies | FK | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblOrderLineItem | | | | | |
| Name | Type | Description | Length | Key | Req. |
| OrderId | Int | OrderId for the current order | Varies | PK | Y |
| ProductId | Int | productId for the product | Varies | PK | Y |
| Quantity | Int | Represents the quantity of the product | Varies |  | Y |
| BatchCost | Money | Represents the cost of the product | Varies |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblMortarStore | | | | | |
| Name | Type | Description | Length | Key | Req. |
| StoreId | Serial | Unique identifier for the store | Varies | PK | Y |
| Address | Int | AddressId for the address of the store | Varies | FK | Y |
| PhoneNumber | BigInt | Represents the stores phone number | Varies |  | Y |
| GeneralManager | Int | EmployeeId for the general manager | Varies | FK | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblTransfer | | | | | |
| Name | Type | Description | Length | Key | Req. |
| TransferId | Serial | Unqiue identifier for the transfer | Varies | PK | Y |
| StoreId | Int | StoreId for the store being trasnfered to | Varies | FK | Y |
| TransferDate | Date | Represents the date of the transfer | Varies |  | Y |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| tblTransferLineItem | | | | | |
| Name | Type | Description | Length | Key | Req. |
| TransferId | Int | TransferId for the transfer | Varies | PK | Y |
| ProductId | Int | ProductId for the product | Varies | PK | Y |
| Quantity | Int | Represents the quantity of the product | Varies |  | Y |

# Gantt Chart

