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1 Part 1 - Database Design and Implementation

1.1 Task 1.1: E-R Diagram Design

1.2 Task 1.2: SQL Database Schema Creation

```
#connect to the SQLite database
my_connection <- RSQLite::dbConnect(RSQLite::SQLite(),
                                    "../database/ecommerce_database_v1.db")


dbExecute(my_connection,
                "CREATE TABLE IF NOT EXISTS CUSTOMERS
                (
                    customer_id VARCHAR(255) NOT NULL PRIMARY KEY,
                    first_name VARCHAR(255) NOT NULL,
                    last_name VARCHAR(255),
                    username VARCHAR(255),
                    gender TEXT,
                    date_of_birth DATE NOT NULL,
                    email VARCHAR(255) UNIQUE,
```

```
                    phone VARCHAR(20) UNIQUE,
                    street_name VARCHAR(255),
                    city VARCHAR(255),
                    country VARCHAR(255),
                    zip_code VARCHAR(20),
                    account_created_date TIMESTAMP,
                    premium_subscription INTEGER
                );"
          )

dbExecute(my_connection,
                "CREATE TABLE IF NOT EXISTS PRODUCT_CATEGORY
                (
                    category_id VARCHAR(255) NOT NULL PRIMARY KEY,
                    cat_name VARCHAR(255)
                );"
          )

dbExecute(my_connection,
                "CREATE TABLE IF NOT EXISTS SUPPLIERS
                (
                    supplier_id VARCHAR(255) NOT NULL PRIMARY KEY,
                    supplier_name VARCHAR(255),
                    supplier_address VARCHAR(500),
                    supplier_phone VARCHAR(20),
                    supplier_email VARCHAR(255) UNIQUE
                );"
          )

dbExecute(my_connection,
                "CREATE TABLE IF NOT EXISTS PRODUCTS
                (
                    product_id VARCHAR(255) NOT NULL PRIMARY KEY,
                    product_name VARCHAR(255),
                    price REAL,
                    stock_quantity INTEGER NOT NULL,
                    category_id VARCHAR(255) NOT NULL,
                    supplier_id VARCHAR(255) NOT NULL,
                    FOREIGN KEY(category_id) REFERENCES
                          PRODUCT_CATEGORY(category_id),
                    FOREIGN KEY(supplier_id) REFERENCES SUPPLIERS(supplier_id)
                );"
```

```
          )

dbExecute(my_connection,
                "CREATE TABLE IF NOT EXISTS GIFT_CARD
                (
                gift_card_id VARCHAR(50) NOT NULL PRIMARY KEY,
                gift_card_code VARCHAR(50),
                detail INTEGER,
                status VARCHAR(50)
                );"
          )
dbExecute(my_connection,
                "CREATE TABLE IF NOT EXISTS ORDERS
                (
                    order_id VARCHAR(255) NOT NULL PRIMARY KEY,
                    customer_id VARCHAR(255),
                    product_id VARCHAR(255),
                    gift_card_id VARCHAR(255),
                    payment_method TEXT,
                    quantity INTEGER,
                    order_timestamp TIMESTAMP,
                    payment_timestamp TIMESTAMP,
                    order_status VARCHAR(50) NOT NULL,
                    shipment_id VARCHAR(255),
                    FOREIGN KEY(customer_id) REFERENCES CUSTOMERS(customer_id),
                    FOREIGN KEY(product_id) REFERENCES PRODUCTS(product_id),
                    FOREIGN KEY(shipment_id) REFERENCES SHIPMENT(shipment_id),
                    FOREIGN KEY(gift_card_id) REFERENCES GIFT_CARD(gift_card_id)
                );"
          )
dbExecute(my_connection,
                "CREATE TABLE IF NOT EXISTS SHIPMENT
                (
                shipment_id VARCHAR(255) NOT NULL PRIMARY KEY,
                dispatch_timestamp DATETIME,
                delivered_timestamp DATETIME,
                status VARCHAR(50) NOT NULL
                );"
          )

#Check if the tables are created
```

```r
dbGetQuery(my_connection,
    sprintf("SELECT name FROM sqlite_master WHERE type='table';")
  )
```

2 Part 2: Data Generation and Management

2.1 Task 2.1: Synthetic Data Generation

```r
## Find all files matching the pattern
customer_files <- list.files(path = "../datasets"
                             ,pattern = "CUSTOMERS.*\\.csv$",full.names = TRUE)
category_files <- list.files(path = "../datasets"
                             ,pattern = "CATEGORY.*\\.csv$",full.names = TRUE)
gift_card_files <- list.files(path = "../datasets"
                             ,pattern = "GIFT_CARDS.*\\.csv$",full.names = TRUE)
suppliers_files <- list.files(path = "../datasets"
                             ,pattern = "SUPPLIERS.*\\.csv$",full.names = TRUE)
products_files <- list.files(path = "../datasets"
                             ,pattern = "PRODUCTS.*\\.csv$",full.names = TRUE)

customers_df <- readr::read_csv(customer_files[1])
gift_card_df <- readr::read_csv(gift_card_files[1])
suppliers_df <- readr::read_csv(suppliers_files[1])
category_df <- readr::read_csv(category_files[1])
products_df <- readr::read_csv(products_files[1])



#Sample Customers

sample_size <- floor(0.2 * nrow(products_df))
sampled_product_ids <- sample(products_df$product_id,
                              size = sample_size, replace = FALSE)
sampled_products_df <- products_df[products_df$product_id %in%
                                     sampled_product_ids, ]


#Sample Products
```

```r
sample_size <- floor(0.2 * nrow(customers_df))
sampled_customer_ids <- sample(customers_df$customer_id,
                               size = sample_size, replace = FALSE)
sampled_customers_df <- customers_df[customers_df$customer_id %in%
                                     sampled_customer_ids, ]


generate_orders_data <- function(n = 1000) {
  set.seed(123)

  orders_df <- tibble(
    order_id = sprintf("%s-%04d", "ORD", 1:n),
    customer_id = sample(sampled_customers_df$customer_id, n, replace = TRUE),
    product_id = sample(sampled_products_df$product_id, n, replace = TRUE),
    gift_card_id = sample(c(NA, gift_card_df$gift_card_id), n, replace = TRUE),
    payment_method = sample(c("Credit Card", "Debit Card", "PayPal",
                              "Gift Card"),n, replace = TRUE),
    quantity = sample(1:5, n, replace = TRUE),
    order_timestamp = sample(seq(as.POSIXct('2024/02/01')
                      ,as.POSIXct('2024/02/29'), by="day"), n, replace = TRUE),
    payment_timestamp = order_timestamp + hours(sample(1:72, n, replace = TRUE)),
    order_status = sample(c("Processing", "Shipped", "Delivered",
                            "Cancelled","Pending Payment","Out for Delivery")
                          , n, replace = TRUE),
  )

  # Augment the orders data frame with supplier_id using left_join
  orders_df <- orders_df %>%
    left_join(sampled_products_df %>% select(product_id, supplier_id)
              , by = "product_id") %>%
    select(order_id, customer_id, product_id, gift_card_id
           , payment_method, quantity, order_timestamp, payment_timestamp
           , order_status, supplier_id)

  return(orders_df)
}

# Generate orders data
orders_df <- generate_orders_data(n = 1000)

generate_shipment_ids <- function(df) {
  # Create a unique identifier for each group
```

```
  df <- df %>%
    mutate(date_only = as.Date(order_timestamp)) %>%
    group_by(customer_id, supplier_id, date_only) %>%
    mutate(shipment_group_id = cur_group_id()) %>%
    ungroup() %>%
    mutate(shipment_id = sprintf("SHIP%05d", shipment_group_id)) %>%
    select(-shipment_group_id, -date_only) # Clean up the extra columns

  df
}

# Apply the function to your data frame
orders_df <- generate_shipment_ids(orders_df)

  orders_df <- orders_df %>%
    mutate(shipment_id = if_else(order_status %in%
                                 c("Cancelled","Pending Payment"), NA_character_,
                                    as.character(shipment_id)),
           payment_method = if_else(order_status == "Pending Payment"
                                    ,NA_character_,payment_method)) %>%
    mutate(supplier_id = NULL)
```

```
#Shipment Table

  shipment_df <- orders_df %>%
    mutate(
      # Dispatch date could be the same as the order date or a day after
      dispatch_timestamp = order_timestamp + days(sample(0:1, n()
                                                         , replace = TRUE)),

      # Delivered date should be after the dispatch date;
      #here I assume delivery takes between 2 to 5 days
      delivered_timestamp = dispatch_timestamp + days(sample(2:14, n()
                                                             , replace = TRUE)),

      # Randomly assign a delivery status
      status = if_else(order_status == "Processing","Ready for Dispatch"
                       ,if_else(order_status == "Shipped","In Transit"
                      ,if_else(order_status == "Out for Delivery",order_status
                     ,if_else(order_status == "Delivered",order_status,"NA"))))
    ) %>%
    # Select only the relevant columns for the shipment table
```

```
    select(shipment_id, dispatch_timestamp, delivered_timestamp, status) %>%
    # Remove duplicate rows to ensure unique shipments
    distinct()

  shipment_df <- na.omit(shipment_df)


  shipment_df <- shipment_df %>%
    mutate(
      # Assign NA to dispatch_timestamp if status is 'Ready for Dispatch'
      dispatch_timestamp = if_else(status == "Ready for Dispatch"
                                   , NA_Date_, dispatch_timestamp),
      delivered_timestamp = if_else(status == "Ready for Dispatch"
                                    , NA_Date_, delivered_timestamp),

      # 'In Transit' status should have a dispatch date but no delivery date
      dispatch_timestamp = if_else(status == "In Transit"
                          , Sys.Date() - days(sample(1:5, 1)), dispatch_timestamp),
      delivered_timestamp = if_else(status == "In Transit"
                          , NA_Date_, delivered_timestamp),

      # 'In Transit' status should have a dispatch date but no delivery date
      dispatch_timestamp = if_else(status == "Out for Delivery"
                         , Sys.Date() - days(sample(1:5, 1)), dispatch_timestamp),
      delivered_timestamp = if_else(status == "Out for Delivery"
                         , NA_Date_, delivered_timestamp),

      # If status is 'Delivered', both dates should be in the past,
      #with delivered after dispatched
      dispatch_timestamp = if_else(status == "Delivered" &
                                     is.na(dispatch_timestamp)
                         , Sys.Date() - days(sample(6:10, 1)), dispatch_timestamp),
      delivered_timestamp = if_else(status == "Delivered"
                , dispatch_timestamp + days(sample(1:5, 1)), delivered_timestamp)
    )

write_csv(orders_df,"../datasets/ORDERS.csv")

write_csv(shipment_df,"../datasets/SHIPMENTS.csv")
```

2.2 Task 2.2: Data Import and Quality Assurance

1.CUSTOMERS

```
ingest_customer_data <- function(df) {

  my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                      , "../database/ecommerce_database_v1.db")
  # Data validation

  #email check
  valid_email <- grepl("^[a-zA-Z0-9._%+-]+@[a-zA-Z0-9.-]+\\.[a-zA-Z]{2,}$"
                       , df$email)
  df <- df[valid_email, ]

  #gender check
  valid_genders <- c("Male", "Female", "Other")
  df <- df[df$gender %in% valid_genders, ]


  # Data type checks (adjust according to your data frame)
  df$date_of_birth <- as.Date(df$date_of_birth,format = "%d/%m/%y")
  df$account_created_date <- as.Date(df$account_created_date
                                     ,format = "%d/%m/%y")
  df$premium_subscription <- as.integer(df$premium_subscription)

  # Check for null values in NOT NULL columns
  required_columns <- c("customer_id", "first_name", "date_of_birth")
  df <- df[!rowSums(is.na(df[required_columns])) > 0, ]

  # Insert validated data into the database
  for(i in 1:nrow(df)){

      #Check for duplicate records based on the primary key
   existing_ids <- dbGetQuery(my_connection
          , sprintf("SELECT customer_id FROM CUSTOMERS WHERE customer_id = '%s'"
                                ,   df$customer_id[i]))
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for customer_id: %s\n"
                  , df$customer_id[i]))
      next
    }
```

```
    insert_query <- sprintf("INSERT INTO CUSTOMERS (customer_id, first_name
    , last_name, username, gender, date_of_birth, email, phone, street_name
    , city, country, zip_code, account_created_date, premium_subscription)
    VALUES ('%s', '%s', '%s', '%s', '%s', '%s', '%s', '%s'
    , '%s', '%s', '%s', '%s', '%s', %d)",
    df$customer_id[i], df$first_name[i], df$last_name[i], df$username[i]
    , df$gender[i], df$date_of_birth[i],df$email[i], df$phone[i]
    , df$street_name[i], df$city[i], df$country[i], df$zip_code[i]
    , df$account_created_date[i], df$premium_subscription[i])
    tryCatch({
    dbExecute(my_connection, insert_query)
      cat(sprintf("Successfully inserted row: %d\n", i))
    }, error = function(e) {
      cat(sprintf("Error in inserting row: %d, Error: %s\n", i, e$message))
    })
      }

      # Close the database connection
      dbDisconnect(my_connection)
    }

for(file in customer_files) {
  df <- readr::read_csv(file)
  ingest_customer_data(df)

}
```

```
my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                    , "../database/ecommerce_database_v1.db")
dbGetQuery(my_connection,"SELECT * FROM CUSTOMERS LIMIT 10;")
```

	customer_id	first_name	last_name	username	gender
1	01HQZS38KRC38NFNQR9QF1MTBZ	Poul	Jellings	pjellingsdv	Male
2	01HQZS38KT99V41AM8FFX4GZH7	Rolf	Crocket	rcrocketdw	Male
3	01HQZS38KW6A30TWWP40YR785F	Rockey	Lapwood	rlapwooddx	Male
4	01HQZS38KY9JB7X0RFWGEQESF5	Junia	Bayles	jbaylesdy	Female
5	01HQZS38M0RSRWM1K83TZFG06K	Sydney	Gillhespy	sgillhespydz	Male
6	01HQZS38M3KZFS9R4CYZ8F2QNY	Johnny	Tidbold	jtidbolde0	Male
7	01HQZS38M5ZTYQRT6KQW75RQTS	Edward	Strethill	estrethille1	Other
8	01HQZS38M7XNA31ACXPJBC78ME	Walt	Goulborne	wgoulbornee2	Male
9	01HQZS38M9XY7AN2TSG9KTAARY	Bertie	Ratter	brattere3	Male
10	01HQZS38MC1ZX8SFB5WR3V2H66	Gerianne	Meininger	gmeiningere4	Female

```
   date_of_birth                          email        phone
1     1992-12-11 pjellingsdv@reverbnation.com 277-129-0314
2     1990-04-21        rcrocketdw@uol.com.br 755-108-4849
3     1992-09-20       rlapwooddx@latimes.com 563-846-2198
4     1999-02-13          jbaylesdy@hc360.com 809-987-6451
5     1990-05-15      sgillhespydz@cdbaby.com 881-340-2239
6     1990-08-04      jtidbolde0@china.com.cn 634-193-3056
7     1998-03-14       estrethille1@goo.ne.jp 716-684-1496
8     1997-02-01         wgoulbornee2@ihg.com 285-539-0816
9     1990-11-13      brattere3@bloomberg.com 455-678-8574
10    1992-10-18       gmeiningere4@amazon.de 302-279-5654
                  street_name       city        country zip_code
1       3 Stone Corner Street   Aberdeen United Kingdom     AB39
2           547 Fordem Avenue    Glasgow United Kingdom       G4
3               97 4th Avenue  Edinburgh United Kingdom      EH9
4             3922 Vahlen Way Birmingham United Kingdom      B12
5           60256 Russell Park  Liverpool United Kingdom      L74
6              5 Huxley Center      Upton United Kingdom     DN21
7               24 Ramsey Road    Kirkton United Kingdom     KW10
8              474 Lunder Lane    Wootton United Kingdom      NN4
9  4691 Weeping Birch Parkway     London United Kingdom     SW1E
10         15 Hanover Terrace   Brampton United Kingdom     NR34
   account_created_date premium_subscription
1            2023-04-01                    0
2            2023-12-15                    0
3            2023-11-30                    0
4            2023-07-09                    0
5            2023-06-08                    1
6            2024-02-26                    1
7            2023-04-12                    0
8            2024-03-03                    1
9            2023-09-12                    1
10           2024-01-26                    1
```

2. PRODUCT_CATEGORY

```r
ingest_product_category <- function(df) {

  my_connection <- RSQLite::dbConnect(RSQLite::SQLite(), "../database/ecommerce_database_v1.

  # Check for null values in NOT NULL columns
  required_columns <- c("category_id", "cat_name")
  df <- df[!rowSums(is.na(df[required_columns])) > 0, ]
```

```
  # Insert validated data into the database
  for(i in 1:nrow(df)){
    # Check for duplicate records based on the primary key
    existing_ids <- dbGetQuery(my_connection, sprintf("SELECT category_id FROM PRODUCT_CATEG
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for category_id: %s\n", df$category_id[i]))
      next
    }

    insert_query <- sprintf("INSERT INTO PRODUCT_CATEGORY (category_id, cat_name) VALUES ('%s
                            df$category_id[i], df$cat_name[i])
    tryCatch({
      dbExecute(my_connection, insert_query)
      cat(sprintf("Successfully inserted row: %d\n", i))
    }, error = function(e) {
      cat(sprintf("Error in inserting row: %d, Error: %s\n", i, e$message))
    })
  }

    dbDisconnect(my_connection)

}

for(file in category_files) {

  df <- readr::read_csv(file)
  ingest_product_category(df)
}
```

```
my_connection <- RSQLite::dbConnect(RSQLite::SQLite(), "../database/ecommerce_database_v1.db"
dbGetQuery(my_connection,"SELECT * FROM PRODUCT_CATEGORY;")
```

	category_id	cat_name
1	01HQZSYXN5D9YD5YEVE62CZY5T	Jewelry
2	01HQZSYXN2NFNR8NP0JDJJ4EGE	Music
3	01HQZSYXN3Y1HWZHXWRT8QBN1F	Clothing
4	01HQZSYXN8GVDME3KSR2V3CWSY	Home
5	01HQZSYXN9NDEKZ0KDTXG7GWAR	Baby
6	01HQZSYXN8HS73RN25WQHFRVS9	Garden
7	01HQZSYXN69EZ5NYSTKN55ABQ6	Outdoors
8	01HQZSYXN577K9HSBRRVY2QSMT	Kids

```
9  01HQZSYXN7EQ2BMKM5RZHO274J  Automotive
10 01HQZSYXN28M6P8R3N3Y74SSF1       Books
11 01HQZSYXN6Y7B8FZAJHWOAM6PC Electronics
12 01HQZSYXN4ED4TEEOYBDZT4KX9  Industrial
13 01HQZSYXN6CG9CR3DOB1XV5PG4      Sports
14 01HQZSYXN72AVRM73YCJRXDX41      Beauty
15 01HQZSYXN5AE7QD7WTD963ZWED        Toys
16 01HQZSYXN7W4J5MDCRENEHYDFZ      Health
17 01HQZSYXN6YFDBEX24RWT2KJ9R       Games
18 01HQZSYXN8BNNSDXSQJNTGA8W1       Tools
19 01HQZSYXN4V6QHMP8859N4NF9F       Shoes
20 01HQZSYXN1A7S9BPG7EH95906T   Computers
21 01HQZSYXMXFJ85AVVPHYH23XFB     Grocery
```

```
my_connection <- RSQLite::dbConnect(RSQLite::SQLite(),
                                    "../database/ecommerce_database_v1.db")
dbGetQuery(my_connection,"SELECT * FROM PRODUCT_CATEGORY LIMIT 10;")
```

```
                  category_id   cat_name
1  01HQZSYXN5D9YD5YEVE62CZY5T    Jewelry
2  01HQZSYXN2NFNR8NPOJDJJ4EGE      Music
3  01HQZSYXN3Y1HWZHXWRT8QBN1F   Clothing
4  01HQZSYXN8GVDME3KSR2V3CWSY       Home
5  01HQZSYXN9NDEKZOKDTXG7GWAR       Baby
6  01HQZSYXN8HS73RN25WQHFRVS9     Garden
7  01HQZSYXN69EZ5NYSTKN55ABQ6   Outdoors
8  01HQZSYXN577K9HSBRRVY2QSMT       Kids
9  01HQZSYXN7EQ2BMKM5RZHO274J Automotive
10 01HQZSYXN28M6P8R3N3Y74SSF1      Books
```

SUPPLIERS

```
ingest_suppliers <- function(df) {

  my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                      , "../database/ecommerce_database_v1.db")

  # Email format validation
  valid_email <- grepl("^[a-zA-ZO-9._%+-]+@[a-zA-ZO-9.-]+\\.[a-zA-Z]{2,}$",
                       df$supplier_email)
  df <- df[valid_email, ]
```

```
  # Check for null values in NOT NULL columns
  required_columns <- c("supplier_id", "supplier_name")
  df <- df[!rowSums(is.na(df[required_columns])) > 0, ]

  for(i in 1:nrow(df)){
    # Check for duplicate records based on the primary key
    existing_supplier_ids <- dbGetQuery(my_connection, sprintf("SELECT supplier_id FROM SUPPL
    if(nrow(existing_supplier_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for supplier_id: %s\n", df$supplier_id[i]))
      next
    }

    insert_query <- sprintf("INSERT INTO SUPPLIERS (supplier_id, supplier_name, supplier_addr
                            df$supplier_id[i], df$supplier_name[i], df$supplier_address[i], d
    existing_supplier_ids <- dbGetQuery(my_connection
              , sprintf("SELECT supplier_id FROM SUPPLIERS
                        WHERE supplier_id = '%s'", df$supplier_id[i]))
    if(nrow(existing_supplier_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for supplier_id: %s\n"
                  , df$supplier_id[i]))
      next
    }

    insert_query <- sprintf("INSERT INTO SUPPLIERS (supplier_id, supplier_name,
                            supplier_address, supplier_phone, supplier_email)
                            VALUES ('%s', '%s', '%s', '%s', '%s')",
                            df$supplier_id[i], df$supplier_name[i],
                            df$supplier_address[i], df$supplier_phone[i],
                            df$supplier_email[i])
    tryCatch({
      dbExecute(my_connection, insert_query)
      cat(sprintf("Successfully inserted row: %d\n", i))
    }, error = function(e) {
      cat(sprintf("Error in inserting row: %d, Error: %s\n", i, e$message))
    })

  }
    dbDisconnect(my_connection)

}

for(file in suppliers_files) {
```

```
  df <- readr::read_csv(file)
  ingest_suppliers(df)

}
```

GIFT CARDS

```
ingest_gift_card_data <- function(df) {

  my_connection <- RSQLite::dbConnect(RSQLite::SQLite(),
                                      "../database/ecommerce_database_v1.db")

  # Validate 'gift_card_id' and 'gift_card_code' for null values
  required_columns <- c("gift_card_id", "gift_card_code", "status")
  df <- df[!rowSums(is.na(df[required_columns])) > 0, ]

  # Ensure 'detail' is an integer
  df$detail <- as.numeric(df$detail)

  # Insert validated data into the database
  for(i in 1:nrow(df)){
    # Check for duplicate records based on the primary key
    existing_ids <- dbGetQuery(my_connection, sprintf("SELECT gift_card_id FROM GIFT_CARD WH
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for gift_card_id: %s\n", df$gift_card_id[i]))
      next
    }

    insert_query <- sprintf("INSERT INTO GIFT_CARD (gift_card_id, gift_card_code, detail, sta
                            df$gift_card_id[i], df$gift_card_code[i], df$detail[i], df$status
    existing_ids <- dbGetQuery(my_connection, sprintf("SELECT gift_card_id FROM
                    GIFT_CARD WHERE gift_card_id = '%s'", df$gift_card_id[i]))
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for gift_card_id: %s\n",
                  df$gift_card_id[i]))
      next
    }

    insert_query <- sprintf("INSERT INTO GIFT_CARD (gift_card_id,
              gift_card_code, detail, status) VALUES ('%s', '%s', %f, '%s')",
          df$gift_card_id[i], df$gift_card_code[i], df$detail[i], df$status[i])
```

```
    tryCatch({
      dbExecute(my_connection, insert_query)
      cat(sprintf("Successfully inserted row: %d\n", i))
    }, error = function(e) {
      cat(sprintf("Error in inserting row: %d, Error: %s\n", i, e$message))
    })
  }
    dbDisconnect(my_connection)

}

for(file in gift_card_files) {

  df <- readr::read_csv(file)
  ingest_gift_card_data(df)

}
```

```
my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                    , "../database/ecommerce_database_v1.db")
dbGetQuery(my_connection,"SELECT * FROM GIFT_CARD;")
```

PRODUCTS

```
ingest_products <- function(df) {

  my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                      , "../database/ecommerce_database_v1.db")
  # Data type checks
  df$stock_quantity <- as.integer(df$stock_quantity)

  # Check for null values in NOT NULL columns
  required_columns <- c("product_id", "stock_quantity", "category_id", "supplier_id")
  df <- df[!rowSums(is.na(df[required_columns])) > 0, ]

  for(i in 1:nrow(df)){
    # Check for duplicate records based on the primary key and
    #foreign key constraints
    existing_product_ids <- dbGetQuery(my_connection
    , sprintf("SELECT product_id FROM PRODUCTS WHERE product_id = '%s'"
              , df$product_id[i]))
    if(nrow(existing_product_ids) > 0) {
```

```
      cat(sprintf("Skipping duplicate entry for product_id: %s\n"
                  , df$product_id[i]))
      next
    }

    # Construct and execute the insertion query

    insert_query <- sprintf("INSERT INTO PRODUCTS (product_id, product_name,
                            price, stock_quantity, category_id, supplier_id)
                            VALUES ('%s', '%s', %f, %d, '%s', '%s')",
                            df$product_id[i], df$product_name[i], df$price[i]
                  , df$stock_quantity[i], df$category_id[i], df$supplier_id[i])
    tryCatch({
      dbExecute(my_connection, insert_query)
      cat(sprintf("Successfully inserted row: %d\n", i))
    }, error = function(e) {
      cat(sprintf("Error in inserting row: %d, Error: %s\n", i, e$message))
    })
  }
    dbDisconnect(my_connection)

}

for(file in products_files) {

  df <- readr::read_csv(file)
  ingest_products(df)

}
```

```
my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                    , "../database/ecommerce_database_v1.db")
dbGetQuery(my_connection,"SELECT * FROM PRODUCTS LIMIT 10;")
```

```
      product_id                         product_name price stock_quantity
1  5116-vjq-2956             Pampers Swaddlers Diapers    25            222
2  6718-hlo-4759       Huggies Natural Care Baby Wipes    10            424
3  2985-wrf-5782    Similac Pro-Advance Infant Formula    30            229
4  4625-mrp-9938       Philips Avent Soothie Pacifiers     5            216
5  4163-cos-4183           Bumkins Waterproof SuperBib     8            419
6  6949-zmb-6593 Aden + Anais Muslin Swaddle Blankets    20            215
7  8600-uzy-9324                     Gerber Baby Socks     5            431
```

```
8  1345-epw-6525  Nuby Mittens with Teething Surfaces     7            162
9  4488-xnr-2917            Hudson Baby Hooded Towels    12            122
10 7706-sdc-6511        Spasilk Soft Terry Washcloths     8            140
                  category_id                supplier_id
1  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHR3Z0C3RDD0QYFT566
2  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHZ74ZQCSDXCS7CBVAC
3  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHX81N7E24DA6H2H5DW
4  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHF5YHQ7PBD8T11XRG1
5  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHWKK9ACW7KQ58MHMZ1
6  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHWKK9ACW7KQ58MHMZ1
7  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHZ74ZQCSDXCS7CBVAC
8  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHR3Z0C3RDD0QYFT566
9  01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CJ0MY496XC7CYHNBGTJ
10 01HQZSYXN9NDEKZ0KDTXG7GWAR 01HQZS3CHSG3EB7GENNYD7YQ2K
```

ORDER

```
ingest_orders <- function(df) {

  my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                      , "../database/ecommerce_database_v1.db")

  # Essential columns for validation
  required_columns <- c("order_id", "order_status", "quantity")
  df <- df[!rowSums(is.na(df[required_columns])) > 0, ]

  for(i in 1:nrow(df)) {
    # Check for duplicate order_id
    existing_ids <- dbGetQuery(my_connection, sprintf("SELECT order_id FROM ORDERS WHERE orde
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for order_id: %s\n", df$order_id[i]))
    existing_ids <- dbGetQuery(my_connection
                  , sprintf("SELECT order_id FROM ORDERS WHERE order_id = '%s'"
                            , df$order_id[i]))
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for order_id: %s\n"
                  , df$order_id[i]))
      next
    }

    # Data validation for quantity
    if(!is.numeric(df$quantity[i]) || df$quantity[i] <= 0) {
```

```
      cat(sprintf("Skipping entry due to invalid quantity for order_id: %s\n", df$order_id[i]

      cat(sprintf("Skipping entry due to invalid quantity for order_id: %s\n"
                  , df$order_id[i]))
      next
    }

    # Insert validated data into the database
    insert_query <- sprintf("INSERT INTO ORDERS (order_id, customer_id,
                            product_id, shipment_id, gift_card_id, payment_method,
                            quantity, order_timestamp, payment_timestamp,
                            order_status) VALUES ('%s', '%s', '%s', '%s', '%s',
                            '%s', %d, '%s', '%s', '%s')",
                            df$order_id[i], df$customer_id[i], df$product_id[i],
                            df$shipment_id[i], df$gift_card_id[i],
                            df$payment_method[i], df$quantity[i],
                            df$order_timestamp[i],
                            df$payment_timestamp[i], df$order_status[i])
    tryCatch({
      dbExecute(my_connection, insert_query)
      cat(sprintf("Successfully inserted row: %d\n", i))
    }, error = function(e) {
      cat(sprintf("Error in inserting row: %d, Error: %s\n", i, e$message))
    })
  }
    dbDisconnect(my_connection)

}}


# Assume orders_df is your DataFrame containing orders data
ingest_orders(orders_df)
```

```
my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                    , "../database/ecommerce_database_v1.db")
dbGetQuery(my_connection,"SELECT * FROM ORDERS LIMIT 10;")
```

```
   order_id                customer_id    product_id
1  ORD-0001 01HQZS38YDTF2DBFZMBDXF6WZ6 3672-agb-8683
2  ORD-0002 01HQZS3A94XFFP2XQZ3P67369X 8612-swk-4072
3  ORD-0003 01HQZS39J8GEMSNSKB3GK13V5Z 8162-ohs-2848
```

```
4  ORD-0004 01HQZS38QJBCBRXYQCFV4SN48Q 0239-sss-2251
5  ORD-0005 01HQZS39QSCH1MS4VMMD5Y6XPP 6643-jgq-7681
6  ORD-0006 01HQZS39FG5QBNT1QE1GE1RWWP 1439-jfo-9022
7  ORD-0007 01HQZS39HKBGAEMPSZC1KEJ5MA 2985-wrf-5782
8  ORD-0008 01HQZS39FVYFWSK9DP5DE94NX0 6265-dqm-3061
9  ORD-0009 01HQZS38QJBCBRXYQCFV4SN48Q 1619-lcu-9571
10 ORD-0010 01HQZS38VF3SMDQQ3S5ZVR8865 1619-lcu-9571
                          gift_card_id payment_method quantity order_timestamp
1  3014edd1-7db0-4e6e-b19d-5bc9ff355b9c          PayPal        4      2024-02-01
2  fa8f2b6f-ffe4-4dbe-bd5e-1421b5ce15e4              NA        1      2024-02-05
3  15ab6b33-e9db-485e-b0bd-b51fb10e9ae7       Gift Card        3      2024-02-02
4  623c535f-602f-48e6-a5a7-a5802586c06b       Gift Card        1      2024-02-19
5  a8308354-588c-4f16-b299-a5b5aa589095     Credit Card        1      2024-02-20
6  b9b821ad-27f0-436c-925c-0a9156494a18     Credit Card        4      2024-02-01
7  e6940482-ce67-4558-b807-abcd736db07e      Debit Card        5      2024-02-17
8  2ae5c52e-6622-45d4-8ae0-7ea774992504              NA        3      2024-02-04
9  19fff31f-57b0-4f45-a083-c311054077ce     Credit Card        1      2024-02-22
10 98684120-6826-459f-b36a-0d42963599e4     Credit Card        5      2024-02-04
     payment_timestamp     order_status shipment_id
1  2024-02-02 18:00:00          Shipped   SHIP00295
2  2024-02-05 03:00:00  Pending Payment          NA
3  2024-02-03 04:00:00       Processing   SHIP00496
4  2024-02-19 09:00:00        Delivered   SHIP00130
5  2024-02-21 23:00:00 Out for Delivery   SHIP00643
6  2024-02-03 13:00:00          Shipped   SHIP00420
7  2024-02-19 05:00:00        Cancelled          NA
8  2024-02-05 03:00:00  Pending Payment          NA
9  2024-02-23 04:00:00        Cancelled          NA
10 2024-02-06 01:00:00        Delivered   SHIP00235
```

SHIPMENTS

```r
ingest_shipment_data <- function(df) {

  my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                      , "../database/ecommerce_database_v1.db")
  # Validate 'shipment_id' and 'status' for null values
  required_columns <- c("shipment_id", "status")
  df <- df[!rowSums(is.na(df[required_columns])) > 0, ]


  # Insert validated data into the database
```

```
  for(i in 1:nrow(df)){
    # Check for duplicate records based on the primary key
    existing_ids <- dbGetQuery(my_connection, sprintf("SELECT shipment_id FROM SHIPMENT WHERE
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for shipment_id: %s\n", df$shipment_id[i]))
      next
    }

    insert_query <- sprintf("INSERT INTO SHIPMENT (shipment_id, dispatch_timestamp, delivered
                            df$shipment_id[i], df$dispatch_timestamp[i], df$delivered_timesta

    existing_ids <- dbGetQuery(my_connection
        , sprintf("SELECT shipment_id FROM SHIPMENT WHERE shipment_id = '%s'",
                  df$shipment_id[i]))
    if(nrow(existing_ids) > 0) {
      cat(sprintf("Skipping duplicate entry for shipment_id: %s\n"
                  , df$shipment_id[i]))
      next
    }

    insert_query <- sprintf("INSERT INTO SHIPMENT (shipment_id,
                        dispatch_timestamp, delivered_timestamp, status)
                        VALUES ('%s', '%s', '%s', '%s')",
                            df$shipment_id[i], df$dispatch_timestamp[i]
                            , df$delivered_timestamp[i], df$status[i])
    tryCatch({
      dbExecute(my_connection, insert_query)
      cat(sprintf("Successfully inserted row: %d\n", i))
    }, error = function(e) {
      cat(sprintf("Error in inserting row: %d, Error: %s\n", i, e$message))
    })
  }
    dbDisconnect(my_connection)

}

ingest_shipment_data(shipment_df)
```

```
my_connection <- RSQLite::dbConnect(RSQLite::SQLite()
                                    , "../database/ecommerce_database_v1.db")
dbGetQuery(my_connection,"SELECT * FROM SHIPMENT LIMIT 10;")
```

```
   shipment_id dispatch_timestamp delivered_timestamp             status
1    SHIP00295         2024-03-14                 NA         In Transit
2    SHIP00496                 NA                 NA Ready for Dispatch
3    SHIP00130         2024-02-20         2024-03-02          Delivered
4    SHIP00643         2024-03-10                 NA   Out for Delivery
5    SHIP00420         2024-03-14                 NA         In Transit
6    SHIP00235         2024-02-04         2024-02-16          Delivered
7    SHIP00887         2024-03-14                 NA         In Transit
8    SHIP00904         2024-03-14                 NA         In Transit
9    SHIP00658         2024-03-14                 NA         In Transit
10   SHIP00900         2024-03-14                 NA         In Transit
```

2.2.1 Check Referential Integrity

ORDERS customer_id check

```
dbGetQuery(my_connection,
           "SELECT
              DISTINCT o.customer_id as customer_id,
              c.customer_id as customer_id,
              first_name ||' '|| last_name as customer_name
           FROM ORDERS as o
           LEFT JOIN CUSTOMERS as c ON c.customer_id = o.customer_id
           WHERE c.customer_id is NULL
           ;")
```

```
[1] customer_id   customer_id   customer_name
<0 rows> (or 0-length row.names)
```

product_id check

```
dbGetQuery(my_connection,
           "SELECT
              DISTINCT o.product_id as product_id,
              p.product_id as product_id,
              product_name as product_name
           FROM ORDERS as o
           LEFT JOIN PRODUCTS as p ON o.product_id = p.product_id
           WHERE p.product_id is NULL
           ;")
```

```
     product_id product_id product_name
1 1727-bev-6294       <NA>         <NA>
2 4420-lwz-5789       <NA>         <NA>
3 7528-dit-1763       <NA>         <NA>
4 0986-ymb-9060       <NA>         <NA>
5 0228-vgx-5140       <NA>         <NA>
```

gift_card_id

```
dbGetQuery(my_connection,
           "SELECT
              DISTINCT o.gift_card_id as gif_card_id,
              g.gift_card_id,
              gift_card_code
           FROM ORDERS as o
           LEFT JOIN GIFT_CARD as g ON g.gift_card_id = o.gift_card_id
           WHERE o.gift_card_id is NULL
           ;")
```

```
[1] gif_card_id    gift_card_id   gift_card_code
<0 rows> (or 0-length row.names)
```

shipment_id

```
dbGetQuery(my_connection,
           "SELECT
              DISTINCT o.shipment_id as x,
              s.shipment_id
           FROM ORDERS as o
           LEFT JOIN SHIPMENT as s ON s.shipment_id = o.shipment_id
           WHERE o.shipment_id is NULL
           ORDER BY o.shipment_id
           ;")
```

```
[1] x           shipment_id
<0 rows> (or 0-length row.names)
```

PRODUCTS supplier_id

```
dbGetQuery(my_connection,
           "SELECT
              DISTINCT p.supplier_id,
              s.supplier_id as a,
              s.supplier_name
           FROM PRODUCTS as p
           LEFT JOIN SUPPLIERS as s ON p.supplier_id = s.supplier_id
           WHERE s.supplier_id is NULL
           ORDER BY p.supplier_id
           ;")
```

```
                 supplier_id    a supplier_name
1 01HQZS3CJJMZ8VE8FSFV12394Q <NA>          <NA>
2 01HQZS3CJSA14X7CFXR9GN7HJJ <NA>          <NA>
3 01HQZS3CK7TNQY984CRWZ2YWYH <NA>          <NA>
4 01HQZS3CP6J1E2W3K754ED8TSV <NA>          <NA>
5 01HQZS3CWAANK3HMDV7OKFNRTE <NA>          <NA>
6 01HQZS3CZ808EDV2QSZ7EC6RGQ <NA>          <NA>
7 01HQZS3D2JCXJ0GKKPY6JT5RMM <NA>          <NA>
```

category_id

```
dbGetQuery(my_connection,
           "SELECT
              DISTINCT p.category_id,
              c.category_id as c,
              cat_name
           FROM PRODUCTS as p
           LEFT JOIN PRODUCT_CATEGORY as c ON c.category_id = p.category_id
           WHERE p.category_id is NULL
           ORDER BY p.category_id
           ;")
```

```
[1] category_id c           cat_name
<0 rows> (or 0-length row.names)
```

3 Part 3: Data Pipeline Generation

3.1 Task 3.1: GitHub Repository and Workflow Setup

3.2 Task 3.2: GitHub Actions for Continuous Integration

4 Part 4: Data Analysis and Reporting with Quarto in R

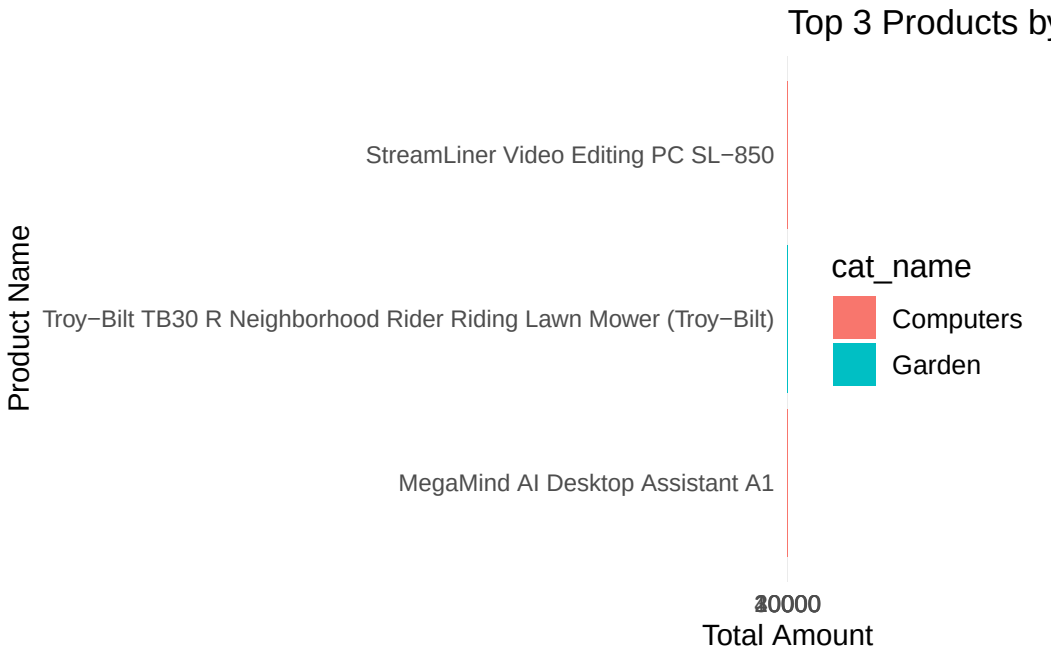
4.1 Task 4.1: Advanced Data Analysis in R

4.2 Task 4.2: Comprehensive Reporting with Quarto

1. Top 10 Products - Overall (Quantity)
2. Top 5 Categories (Quantity)
3. Top 3 Products across categories (Total Amount)

```
# Join orders with products to get category information
orders_with_category <- orders_df %>%
  inner_join(products_df, by = "product_id")

# Calculate total amount for each product
product_amounts <- orders_with_category %>%
  group_by(category_id, product_id, product_name) %>%
  summarise(total_amount = sum(quantity * price, na.rm = TRUE)) %>%
  ungroup()

# Join with category_df to get category names
product_amounts_with_category_name <- product_amounts %>%
  inner_join(category_df, by = "category_id")

# Get overall top 3 products
top_3_products <- product_amounts_with_category_name %>%
  arrange(desc(total_amount)) %>%
  slice_max(total_amount, n = 3) %>%
  ungroup()

# Plot using ggplot2
ggplot(top_3_products, aes(x = reorder(product_name, total_amount)
                           , y = total_amount, fill = cat_name)) +
  geom_bar(stat = "identity", position = position_dodge()) +
  coord_flip() +
```

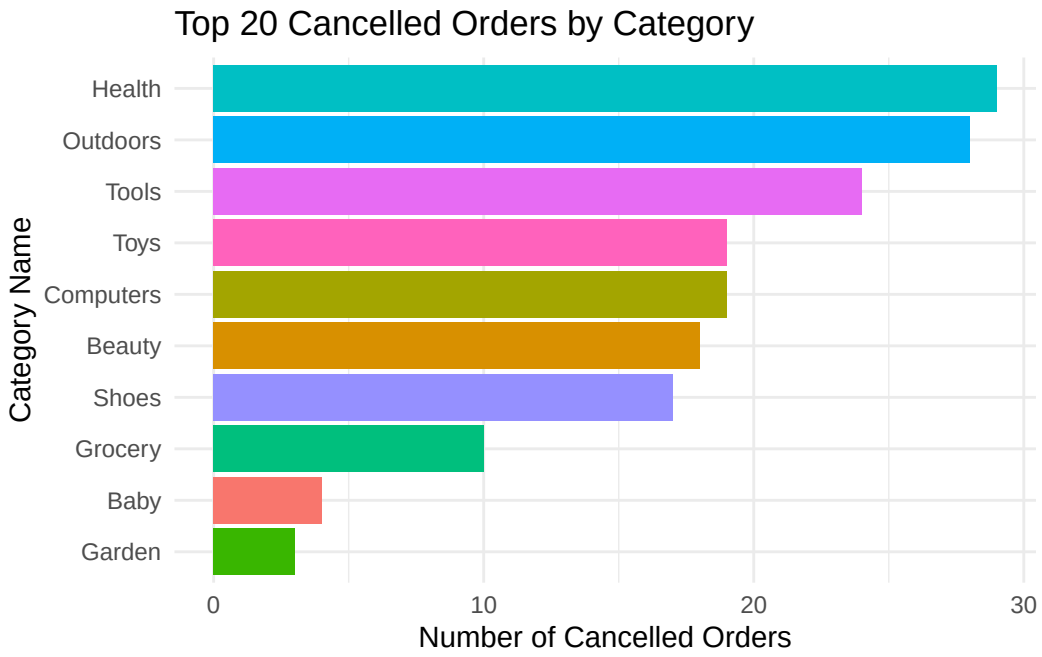
```
  labs(title = "Top 3 Products by Total Amount",
       x = "Product Name",
       y = "Total Amount") +
  theme_minimal() +
  theme(legend.title = element_text(size = 12),
        legend.text = element_text(size = 10))
```



4. Average delivery time for orders across top 5 delivery suppliers
5. Top 20 Average Spending across customers
6. Top 20 cancelled orders for which category

```
# Join orders with products and then with categories to get category information
orders_with_categories <- orders_df %>%
  inner_join(products_df, by = "product_id") %>%
  inner_join(category_df, by = "category_id")

# Filter for cancelled orders and count by category
cancelled_orders_by_category <- orders_with_categories %>%
  filter(order_status == "Cancelled") %>%
  count(cat_name) %>%
  arrange(desc(n)) %>%
```

```
  top_n(20, n)

# Visualization
ggplot(cancelled_orders_by_category,
       aes(x = reorder(cat_name, n), y = n, fill = cat_name)) +
  geom_bar(stat = "identity") +
  coord_flip() +
  labs(title = "Top 20 Cancelled Orders by Category",
       x = "Category Name",
       y = "Number of Cancelled Orders") +
  theme_minimal() +
  theme(legend.position = "none")
```



7. Average number of orders across time
8. Scatter plot for revenue across quantity; color by category

SQL version 1. Top 10 Products - Overall (Quantity)

```
dbGetQuery(my_connection,
           "SELECT
              ORDERS.product_id,
              product_name,
              count(quantity) as total_purchase
```

```
            FROM ORDERS
            JOIN PRODUCTS ON ORDERS.product_id = PRODUCTS.product_id
            WHERE lower(order_status) in ('shipped','delivered')
            GROUP BY ORDERS.product_id,product_name
            ORDER BY total_purchase desc
            LIMIT 10
            ;")
```

```
      product_id                                    product_name total_purchase
1  1332-xzt-9401     Garmin inReach Mini Satellite Communicator              8
2  3044-bpk-9266                    ProEdit Graphic Tablet 10x6              8
3  4202-vwa-5608        SweetSensation Stevia Natural Sweetener              7
4  0642-hvp-7060                        Sally Hansen Miracle Gel             6
5  1619-lcu-9571                   PaceSetter Marathon Shoes P2              6
6  1698-rbf-6951                                    Air Purifier             6
7  2030-xxz-9133             Heroic Optimus Prime Action Figure             6
8  2179-kqi-1903    The Art of Shaving Sandalwood Shaving Cream              6
9  2901-cyy-6826 Jack Black Double-Duty Face Moisturizer SPF 20              6
10 5317-rjn-1652   Corona Extendable Handle Cultivator (Corona)              6
```

2. Top 5 Categories (Quantity)

```
dbGetQuery(my_connection,
           "SELECT
              cat_name as category,
              count(quantity) as total_purchase
           FROM ORDERS
           JOIN PRODUCTS ON ORDERS.product_id = PRODUCTS.product_id
           JOIN PRODUCT_CATEGORY ON PRODUCTS.category_id = PRODUCT_CATEGORY.category_id
           WHERE lower(order_status) in ('shipped','delivered')
           GROUP BY cat_name
           ORDER by total_purchase desc
           LIMIT 5
           ;")
```

```
   category total_purchase
1    Beauty             52
2      Toys             51
3    Garden             42
4     Tools             38
5 Computers             34
```

3. Top 3 Products across categories (Total Amount)

```
dbGetQuery(my_connection,
           "WITH product AS (
              SELECT
                p.product_id,
                pc.cat_name,
                p.product_name
              FROM PRODUCTS as p
              JOIN PRODUCT_CATEGORY as pc ON pc.category_id = p.category_id
            ),
            order_amount AS (
              SELECT
                o.product_id AS product_id,
                SUM(o.quantity * p.price) AS total_amount
              FROM ORDERS as o
              JOIN PRODUCTS as p ON o.product_id = p.product_id
              WHERE LOWER(o.order_status) IN ('shipped', 'delivered')
              GROUP BY o.product_id
            ),
            rnk AS (
              SELECT
                pr.cat_name,
                pr.product_name,
                oa.total_amount,
                ROW_NUMBER() OVER (PARTITION BY pr.cat_name ORDER BY oa.total_amount DESC) AS
              FROM order_amount as oa
              JOIN product as pr ON oa.product_id = pr.product_id
            )
            SELECT
              cat_name,
              product_name,
              total_amount
            FROM rnk
            WHERE rnk IN (1,2,3);")
```

```
    cat_name
1       Baby
2       Baby
3       Baby
4     Beauty
5     Beauty
```

6	Beauty
7	Computers
8	Computers
9	Computers
10	Garden
11	Garden
12	Garden
13	Grocery
14	Grocery
15	Grocery
16	Health
17	Health
18	Health
19	Outdoors
20	Outdoors
21	Outdoors
22	Shoes
23	Shoes
24	Shoes
25	Tools
26	Tools
27	Tools
28	Toys
29	Toys
30	Toys

	product_name
1	Nanit Plus Smart Baby Monitor and Wall Mount
2	Similac Pro-Advance Infant Formula
3	Summer Infant Pacifier Thermometer
4	Clarisonic Mia Smart 3-in-1 Connected Sonic Beauty Device
5	Sol de Janeiro Brazilian Bum Bum Cream
6	Anastasia Beverly Hills Modern Renaissance Eyeshadow Palette
7	InfinityPad Tablet 12.9" Pro
8	CodeMaster Development Laptop C9
9	QuantumLeap Desktop Q7 Pro
10	Traeger Pro 575 Wood Pellet Grill (Traeger)
11	Greenworks Pro 80V Cordless Backpack Leaf Blower (Greenworks)
12	John Deere D105 17.5-HP Automatic 42-in Riding Lawn Mower (John Deere)
13	SweetSensation Stevia Natural Sweetener
14	SmoothSerenity Almond Butter
15	PureDelight Chocolate Ice Cream
16	Air Purifier
17	Nicotine Gum for Smoking Cessation

18		Blood Glucose Monitoring Kit
19		Garmin inReach Mini Satellite Communicator
20		Kelty Discovery 4 Tent
21		Garmin GPSMAP 64st Handheld GPS
22		PaceSetter Marathon Shoes P2
23		BreezeBlock Breathable Loafers B4
24		SilentStep Ballet Flats Silence
25		SmartSaw Table Saw T6
26		DiamondCut Tile Cutter D700
27		HammerHead Demolition Hammer H900
28		Rival Prometheus MXVIII-20K
29		Cozy Cottage Starter Home
30		Mini App-Enabled Programmable Robot Ball

	total_amount
1	2000
2	210
3	120
4	1500
5	480
6	440
7	11200
8	5600
9	5400
10	7000
11	3500
12	3000
13	84
14	60
15	48
16	1200
17	320
18	300
19	5500
20	3400
21	3300
22	1250
23	660
24	650
25	5500
26	4500
27	2400
28	1330
29	770

```
30          560
```

4. Average delivery time for orders across top 5 delivery suppliers

```
dbGetQuery(my_connection,
           "SELECT
               sup.supplier_id,
               sup.supplier_name AS supplier_name,
               AVG(julianday(s.delivered_timestamp) - julianday(s.dispatch_timestamp)) AS del
           FROM SHIPMENT AS s
           JOIN ORDERS AS o ON o.shipment_id = s.shipment_id
           JOIN PRODUCTS AS p ON p.product_id = o.product_id
           JOIN SUPPLIERS AS sup ON sup.supplier_id = p.supplier_id
           WHERE LOWER(s.status) = 'delivered'
           GROUP BY sup.supplier_id, sup.supplier_name
           ORDER BY delivery_time DESC, supplier_name
           LIMIT 5;")
```

```
                supplier_id                supplier_name delivery_time
1 01HQZS3CJY4RW5H1ZH25Q61R02             Denesik and Sons            14
2 01HQZS3CYJHCZX4E4PBXJ5BK60                 Prohaska Inc            14
3 01HQZS3CJNFSXMG8NJMDPX406D Lindgren, Corkery and Brekke            13
4 01HQZS3CYHRVE31WXCT9E3XRXN            Pollich-Gulgowski            12
5 01HQZS3CYE3EZPVB9W9YFE3072                   Rippin Inc            12
```

5. Top 20 Average Spending across customers

```
dbGetQuery(my_connection,
           "SELECT
              o.customer_id as customer_id,
              c.first_name ||' '|| c.last_name as customer_name,
              AVG(p.price*o.quantity) as avg_amount,
              SUM(p.price*o.quantity) as total_amount
            FROM ORDERS as o
            JOIN CUSTOMERS as c ON o.customer_id = c.customer_id
            JOIN PRODUCTS as p ON p.product_id = o.product_id
            WHERE LOWER(o.order_status) IN ('shipped', 'delivered')
            GROUP BY o.customer_id,customer_name
            ORDER BY avg_amount DESC
            limit 20
           ;")
```

	customer_id	customer_name	avg_amount	total_amount
1	01HQZS3A9FDVME30PNFFYH6R8C	Gabi Boate	2050.0000	4100
2	01HQZS38Z1611MHPEVXD917JDG	Irving Andress	1400.0000	1400
3	01HQZS39EB5YNBV1PD9967KY2A	Hanny Bauldrey	1215.3333	3646
4	01HQZS38QMTJM3XDR1PFVMVP7E	Godart Dineen	1209.0000	2418
5	01HQZS39GBJFTQR2QXVZS9XRBA	Bailey Pittman	1206.6667	3620
6	01HQZS39M3H7N6N722B2BBSRQK	Demetrius Boich	1094.0000	2188
7	01HQZS38QBHKKG8ZDHQ9QRVGF6	Hilary Iffe	1075.0000	2150
8	01HQZS38X6AS3MVQ7D55XBCRWH	Odetta Dollard	1001.3333	3004
9	01HQZS39FVYFWSK9DP5DE94NX0	Godiva Jerams	980.0000	2940
10	01HQZS39J8GEMSNSKB3GK13V5Z	Cleon Chisnell	866.6667	2600
11	01HQZS38YPVZX3J6Z86F4NAVX1	Karine Gemmell	857.5000	3430
12	01HQZS39GM9C0QGNDK9SHT99JV	Tiffani Trenaman	800.0000	1600
13	01HQZS38WEDQXH6AW7MBAW6TFZ	Lloyd Veschambes	706.6667	2120
14	01HQZS39E2TD51HG6C9GR61971	Danella Littlechild	674.4000	3372
15	01HQZS38WXVF9XHHTQG073DC8B	Carmelle Bendelow	630.0000	1260
16	01HQZS38M7XNA31ACXPJBC78ME	Walt Goulborne	553.3333	1660
17	01HQZS3AEMVA4ZZ1KB41AH6K9V	Valene Syphas	546.6667	1640
18	01HQZS39FG5QBNT1QE1GE1RWWP	Batholomew Barday	513.7500	4110
19	01HQZS38NZVWXGQADGH4ZHC5SW	Karie Feaver	458.0000	2290
20	01HQZS3A9VKRFVQ5TAGRPWPPNW	Tiff Mainland	438.8000	2194

6. Top 20 cancelled orders for which category

```
dbGetQuery(my_connection,
           "SELECT
              cat_name,
              COUNT(o.quantity) as total_cancelled
            FROM ORDERS as o
            JOIN PRODUCTS as p ON p.product_id = o.product_id
            JOIN PRODUCT_CATEGORY as pc on pc.category_id = p.category_id
            WHERE LOWER(order_status) = 'cancelled'
            GROUP BY cat_name
            ORDER BY total_cancelled DESC
           ;")
```

	cat_name	total_cancelled
1	Toys	27
2	Beauty	24
3	Tools	22
4	Garden	22
5	Outdoors	21

```
6    Grocery             16
7  Computers             12
8     Health             11
9      Shoes              8
10      Baby              3
```

7. Average number of orders across time

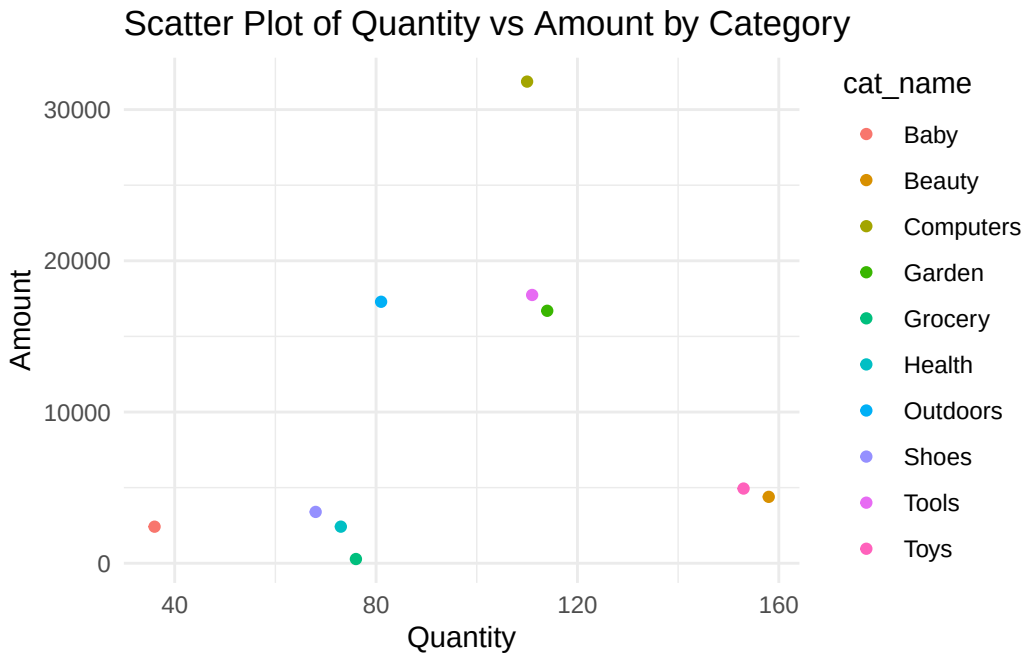
```
dbGetQuery(my_connection,
           "SELECT
              order_timestamp as date,
              SUM(o.quantity) as total_order
            FROM ORDERS as o
            WHERE LOWER(order_status) IN ('shipped', 'delivered')
            GROUP BY order_timestamp
            ORDER BY date
           ;")
```

```
         date total_order
1  2024-02-01          58
2  2024-02-02          24
3  2024-02-03          24
4  2024-02-04          50
5  2024-02-05          27
6  2024-02-06          46
7  2024-02-07          46
8  2024-02-08          31
9  2024-02-09          35
10 2024-02-10          19
11 2024-02-11          28
12 2024-02-12          40
13 2024-02-13          28
14 2024-02-14          52
15 2024-02-15          17
16 2024-02-16          34
17 2024-02-17          47
18 2024-02-18          29
19 2024-02-19          29
20 2024-02-20          23
21 2024-02-21          11
22 2024-02-22          34
23 2024-02-23          41
```

```
24 2024-02-24          48
25 2024-02-25          32
26 2024-02-26          29
27 2024-02-27          41
28 2024-02-28          62
29 2024-02-29          24
```

8. Scatter plot for revenue across quantity; color by category

```
revenue_quantity <- dbGetQuery(my_connection,
           "SELECT
              cat_name,
              SUM(o.quantity) as quantity,
              SUM(p.price * o.quantity) as amount
             FROM ORDERS as o
             JOIN PRODUCTS as p ON p.product_id = o.product_id
             JOIN PRODUCT_CATEGORY as pc on pc.category_id = p.category_id
             WHERE LOWER(order_status) IN ('shipped', 'delivered')
             GROUP BY cat_name
           ;")

ggplot(revenue_quantity, aes(x = quantity, y = amount, color = cat_name)) +
  geom_point() +
  theme_minimal() +
  labs(title = "Scatter Plot of Quantity vs Amount by Category",
       x = "Quantity",
       y = "Amount") +
  theme(legend.position = "right")
```




```
dbDisconnect(my_connection)
```