

# AT2024 – Assignment 1: E-Commerce Database

Candidate Number: 48590

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## 1. Conceptual/E-R Modeling

### 1.1 Specialization

- **Superclass:** `Payment_methods`
- **Subclasses:** `Pcredit_debit_cards`, `Pvouchers_gift_cards`
- **Disjoint Specialization:** A `Payment_method` can belong to only one subclass.
- **Total Specialization:** Every instance of `Payment_methods` must belong to one subclass (`Pcredit_debit_cards` or `Pvouchers_gift_cards`).

### 1.2 Cardinality Assumptions

- **Customer-has-Payment\_methods:** 1 to 5 (every `Customer` must have at least one `Payment_method`, and up to five for storage constraints).
- **Customer-has-Address:** 1 to 10 (each `Customer` must have at least one `Address` and can save up to 10).
- **Customer-has-Basket:** Exactly 1 (each `Customer` has one `Basket`).
- **Customer-writes-Review:** 0 to infinite (a `Customer` may write zero or more `Reviews`).
- **Customer-places-Order:** 0 to infinite (a `Customer` may place zero or more `Orders`).
- **Basket-contains-Products:** 0 to 200 (a `Basket` can be empty or contain up to 200 `Products`).
- **Order-has-Delivery:** 0 or 1 (virtual products require no `Delivery`).

### 1.3 Use of NULL Values

- **Customer Entity:**
  - Mandatory: `Cfirst_name`, `Clast_name`
  - Optional: `Cmiddle_name`
- **Address Entity:**
  - Optional: `Abuilding_name/number`
- **Payment Methods:** Cards and vouchers are mutually exclusive and cannot both apply to the same `Order`.

- **Delivery Entity:** Nullable attributes such as `Dtrack_number` are used for optional deliveries (e.g., for virtual goods).

## 1.4 Other Adaptations

- **Address Flexibility:** A `Customer` can store multiple (up to 10) `Address` records for convenience.
- **Product Reviews:** The `Review` entity uses `Product_id` instead of `Product_name` to ensure accuracy and avoid ambiguity. The `Ranking` attribute is constrained to values between 1 and 5.
- **Derived Attributes:** Calculations such as `Subtotal`, `Total`, and `Grand Total` for `Orders` are treated as derived attributes and not stored directly in the database. They are computed during queries.
- **Delivery Status:** A predefined set of delivery statuses (`delivered`, `pending`, `cancelled`, `postponed`) ensures consistency.
- **Optional Relationships:** For digital products, `Order` may not have a corresponding `Delivery`. To represent this, the `Dtrack_number` attribute in `Delivery` can be NULL.

# 2. Relational Modeling

## 2.1 Adaptations from the Conceptual/E-R Model

- **Multivalued Attributes:**
  - Multivalued attributes such as products in `Basket` and `Order` are mapped to separate linking tables: `basket_contains` and `order_contains`. These tables capture the many-to-many relationships between `Basket/Order` and `Products`, with additional attributes like `Bquantity` and `Oquantity`.
- **Composite Attributes:**
  - Composite attributes like `Address` are decomposed into atomic attributes: `Abuilding_name_number`, `Astreet`, `Acity`, `Apostcode`, and `Acountry`.
- **Specialization:**
  - The superclass `Payment_methods` is specialized into `Pcredit_debit_cards` and `Pvouchers_gift_cards` using foreign keys (`Payment_method_id`) in the subclass tables.
- **Derived Attributes:**
  - Attributes like `Subtotal`, `Total`, and `Grand Total` for `Order` are excluded from storage and calculated dynamically during queries.

## 2.2 Views

The relational model includes the `OrderDetails` view, designed to simplify access to information about orders and their associated products without requiring complex queries on multiple tables.

- **Attributes in the View:**
  - `Odate` (Order date), `Cemail_id` (Customer email ID), `Pshort_name` (Product name), `Oquantity` (Quantity of the product in the order), `Order_number` (Order identifier), `Pproduct_number` (Product identifier)
- **Base Tables Used:**
  - **Orders:** Provides details about the order, such as the order date and customer email ID.
  - **order\_contains:** Links each order to the products it contains, along with the quantities of those products.
  - **Products:** Supplies information about the products, such as their names and unique identifiers.

## 2.3 Constraints

- **Mandatory Participation:**
  - Foreign keys enforce mandatory relationships (e.g., `Orders` must reference existing `Customer` and `Payment_methods`).
- **Optional Participation:**
  - Fields like `Aaddress_id` in `Orders` and `Dtrack_number` in `Delivery` are nullable to handle cases like virtual goods or missing delivery information.
- **Cascading Actions:**
  - `ON DELETE CASCADE` ensures that dependent records (e.g., `order_contains`) are removed when a parent record (e.g., `Order`) is deleted.
- **Enum-like Constraints:**
  - Attributes like `Dstatus` (e.g., `delivered`, `postponed`, `cancelled`) are constrained to predefined values.

## 2.4 Other Adaptations

- **Default Values:**
  - Attributes like `Pis_default` (default payment method) and `Dstatus` (default `pending` for deliveries) are assigned default values for consistency.
- **Simplified Relationships:**
  - Foreign keys are nullable where relationships are optional (e.g., deliveries for virtual goods).
- **Exclusion of Redundant Data:**
  - Derived data (e.g., total amounts in orders) is not stored in tables but included in views for retrieval when necessary.

# 3. Database Creation

## 3.1 Table Creation

1. **Independent Tables:**

- **Customer**: Created first to define primary customer details.
- **Products**: Set up independently as it does not rely on other tables.
- 2. **Dependent Tables**:
  - **Payment\_methods, Basket, Orders, Reviews**: Created after their parent entities (**Customer**) to establish relationships.
- 3. **Linking Tables**:
  - **basket\_contains and order\_contains**: Handle the many-to-many relationships between **Basket/Order** and **Products**. These tables include attributes like **Bquantity** and **Oquantity** to capture quantities of products.
- 4. **Specialized Tables**:
  - **Pcredit\_debit\_cards and Pvouchers\_gift\_cards**: Subclass tables for **Payment\_methods** using specialization.
- 5. **Address Table**:
  - **Address**: Manages customer addresses, supporting up to 10 addresses per customer.

## 3.2 Constraints

- **Foreign Keys**:
  - Enforce relationships between tables, with actions like **ON DELETE CASCADE** or **ON DELETE SET NULL** to maintain data integrity during deletions.
- **Optional Relationships**:
  - Nullable fields like **Aaddress\_id** in **Orders** and **Dtrack\_number** in **Delivery** allow flexibility for cases such as virtual products.
- **Check Constraints**:
  - Ensure valid data input, e.g., positive quantities in **basket\_contains** and **order\_contains** and predefined status values (e.g., **delivered**, **pending**) in **Delivery**.

## 3.3 Order of Creation

The following order was used for table and view creation:

1. **Customer**
2. **Products**
3. **Address**
4. **Payment\_methods**
5. **Basket**
6. **basket\_contains**
7. **Orders**
8. **order\_contains**
9. **Delivery**
10. **Reviews**
11. **Return**
12. **OrderDetails View**

## 4. Data Loading

### 4.1 Data Sources

- **Synthetic Data Generation:** The data generation process is documented in the provided [chat log](#)

### 4.2 Constraints and Observations

#### 1. Customer Constraints:

- Each customer has valid `Cemail_id`, diverse names (`Cfirst_name`, `Clast_name`), and valid `Cbirthdate`.
- Customers can store up to 10 `Address` records, some of which may be identical due to shared living arrangements.
- Optional `Cmiddle_name` and invalid phone numbers (e.g., "001-189-036-3165x39833") were noted during data generation.

#### 2. Address Constraints:

- Building name/number is optional; postcodes follow a 6-character alphanumeric format.
- Addresses include common cities and countries, allowing shared addresses between customers.

#### 3. Payment Method Constraints:

- Customers may register 0–5 payment methods, with up to one set as default (`Pis_default`).
- Credit/Debit cards use 16-digit `Pcard_number`, and the cardholder name (`Pname_on_card`) can differ from the customer name.

#### 4. Product Constraints:

- Products were generated with realistic attributes and descriptions, avoiding illogical values (e.g., a 100kg bottle).
- A mix of physical and virtual products was included to cover diverse categories like `books`, `fashion`, and `electronics`.

#### 5. Basket Constraints:

- Baskets are allowed to be empty or contain up to 200 `Products`.

#### 6. Order Constraints:

- Orders were tied to valid customers and referenced in-stock products.
- Deductions (`Odeduction`) were optional and not applied to every order.
- The `Aaddress_id` attribute was removed from the `Orders` table to simplify the schema.

#### 7. Delivery Constraints:

- Delivery records referenced valid `Address` entries via `Aaddress_id`. Delivery statuses included `delivered`, `pending`, `cancelled`, and `postponed`.
- Virtual products did not require deliveries, allowing nullable `Dtrack_number`.

#### 8. Return Constraints:

- Return due dates were set 60 days from the start date (**Rstart\_date**), with refund totals calculated per product price.
- 9. **Review Constraints:**
  - Reviews were linked to valid products from customer orders. Review text was generated based on product context and ranking (**Rranking**).
  - **Delivery statuses:** Distributed evenly across **delivered**, **pending**, **postponed**, and **cancelled**.
  - **Return statuses:** Randomized across **completed**, **pending**, **cancelled**, and **denied**.

## 5. SQL Programming

### 5.1 Query: Customer Orders

#### Rationale:

The goal was to produce a consolidated view of customer orders, including their details and the total paid. To achieve this:

- Joined **Customer** with **Orders** and **order\_contains** tables to link customers to their orders and associated products.
- Included attributes such as customer name (**Cfirst\_name**, **Clast\_name**), email, order number (**Order\_number**), and order date (**Odate**).
- Retrieved product information (**Pshort\_name**) and calculated totals by summing up product prices multiplied by quantities (**Oquantity**) for each order.

	Customer_Email	Customer_Name	Order_Number	Order_Date	Product_List	Total_Paid
1	Cemail_id	Cfirst_name Clast_name	NULL	NULL	NULL	NULL
2	cmorris@johnson.com	Brian Ruiz	NULL	NULL	NULL	NULL
3	davistravis@webb-freeman.com	Nicole Taylor	NULL	NULL	NULL	NULL
4	ewalters@gmail.com	Eric Yang	NULL	NULL	NULL	NULL
5	jeffery77@gmail.com	Anna Murphy	NULL	NULL	NULL	NULL
6	jnewman@gmail.com	Jennifer Rodriguez	NULL	NULL	NULL	NULL
7	kimberlyjohnson@yahoo.com	Joseph Wagner	NULL	NULL	NULL	NULL
8	lewismatthew@wade-peterson.org	Carmen Wall	NULL	NULL	NULL	NULL
9	lle@yahoo.com	William Simmons	NULL	NULL	NULL	NULL
10	matthewphillips@yahoo.com	Zachary Hoffman	NULL	NULL	NULL	NULL
11	patriktracey@nichols.org	Kevin Smith	NULL	NULL	NULL	NULL
12	paul76@gmail.com	Miranda Tran	NULL	NULL	NULL	NULL
13	qthompson@yahoo.com	Amy Carter	NULL	NULL	NULL	NULL
14	randy47@henson-richardson.com	Matthew Ayers	NULL	NULL	NULL	NULL
15	rochajames@hotmail.com	Jason Brooks	NULL	NULL	NULL	NULL
16	rodriguezabigail@gmail.com	Lauren Sanders	NULL	NULL	NULL	NULL
17	sabrina88@gmail.com	Antonio Sanchez	NULL	NULL	NULL	NULL
18	strongamanda@gay-flowers.com	Ronald Fowler	NULL	NULL	NULL	NULL
19	tanyathompson@rivera-benton.info	Joshua Bass	NULL	NULL	NULL	NULL
20	timothyboyle@hotmail.com	John Solls	NULL	NULL	NULL	NULL
21	xhoffman@gmail.com	Eric Harmon	NULL	NULL	NULL	NULL
22	jason57@yahoo.com	Zachary Watts	1	2023-09-25	Men's T-shirt, Laptop	2814.42
23	ramirezolanda@hotmail.com	Ashley Schroeder	2	2023-11-21	Coffee Table, Cooking 101, Fresh Apples, Men's T-shirt	638.77
24	andreamiller@lee.com	Michael Johnson	3	2023-02-27	Coffee Table, Cooking 101	314.67
25	andreamiller@lee.com	Michael Johnson	4	2023-05-09	Laptop, Men's T-shirt, Blender, Organic Honey	2958.29
26	andreamiller@lee.com	Michael Johnson	5	2023-05-16	Fresh Apples, Organic Honey, The Great Gatsby	42.53
27	andreamiller@lee.com	Michael Johnson	6	2023-04-04	Laptop, Cooking 101, Fresh Apples	1344.99
28	andreamiller@lee.com	Michael Johnson	7	2023-12-11	Smartphone, Fresh Apples, Cooking 101, Organic Honey	697.98
29	darrell34@hancock.com	Brian Fletcher	8	2023-09-14	The Great Gatsby, Men's T-shirt, Organic Honey, Cooking ...	205.55
30	darrell34@hancock.com	Brian Fletcher	9	2023-04-09	Fresh Apples, Cooking 101	114.27
31	christopherkim@robbins-wang.com	Patricia Garcia	10	2023-05-18	Smartphone, Women's Dress, Men's T-shirt	1959.56
32	christopherkim@robbins-wang.com	Patricia Garcia	11	2023-06-11	Smartphone, Laptop, Women's Dress, Smartphone	7185.54

33	christopherkim@robbins-wang.com	Patricia Garcia	12	2023-11-27	Organic Honey, Fresh Apples, Cooking 101	123.6
34	christopherkim@robbins-wang.com	Patricia Garcia	13	2023-05-31	Smartphone, Blender, The Great Gatsby, Blender	3571.85
35	allenjohn@warren.net	Catherine Martinez	14	2023-02-08	Men's T-shirt, Blender	99.9
36	allenjohn@warren.net	Catherine Martinez	15	2023-12-19	Women's Dress, Coffee Table	658.55
37	allenjohn@warren.net	Catherine Martinez	16	2023-02-21	Women's Dress, Laptop, Women's Dress	1606.93
38	gainesthomas@mccormick.com	Mary Colon	17	2023-07-31	Coffee Table, Fresh Apples, Cooking 101, Women's Dress, ...	1119.87
39	bstokes@gmail.com	Jennifer Young	18	2023-12-20	Coffee Table	533.82
40	bstokes@gmail.com	Jennifer Young	19	2023-07-04	Smartphone, Cooking 101	1165.0
41	bstokes@gmail.com	Jennifer Young	20	2023-07-05	The Great Gatsby, Laptop, Organic Honey	4735.19
42	walkerbreanna@pena.biz	Mary Santos	21	2023-09-07	Fresh Apples	15.02
43	walkerbreanna@pena.biz	Mary Santos	22	2023-10-17	Fresh Apples	11.62
44	walkerbreanna@pena.biz	Mary Santos	23	2023-05-25	Women's Dress	124.13
45	walkerbreanna@pena.biz	Mary Santos	24	2023-09-30	Coffee Table, Cooking 101, The Great Gatsby, Coffee Table, ...	3241.34
46	hansonolivia@gmail.com	James Newman	25	2023-02-07	Organic Honey, Fresh Apples, Women's Dress, Organic ...	393.87
47	hansonolivia@gmail.com	James Newman	26	2023-11-16	The Great Gatsby, The Great Gatsby	102.48
48	omurphy@gmail.com	Traci Gonzalez	27	2023-09-30	The Great Gatsby, Smartphone	2245.71
49	omurphy@gmail.com	Traci Gonzalez	28	2023-04-07	Women's Dress, Blender	218.2
50	omurphy@gmail.com	Traci Gonzalez	29	2023-03-07	Fresh Apples, Laptop, Cooking 101	1637.14
51	omurphy@gmail.com	Traci Gonzalez	30	2023-08-06	Blender, Smartphone	1485.36
52	omurphy@gmail.com	Traci Gonzalez	31	2023-03-05	Men's T-shirt, Fresh Apples, Fresh Apples, Organic Honey	113.49
53	robert99@barber.com	Jennifer Rocha	32	2023-02-17	Coffee Table, Blender, Blender, Coffee Table	533.38
54	robert99@barber.com	Jennifer Rocha	33	2023-06-12	Coffee Table, Blender	870.65
55	robert99@barber.com	Jennifer Rocha	34	2023-09-18	Organic Honey, The Great Gatsby, Blender, The Great Gatsby	133.83
56	robert99@barber.com	Jennifer Rocha	35	2023-02-03	Coffee Table, Men's T-shirt, Blender	941.74
57	robert99@barber.com	Jennifer Rocha	36	2023-01-09	Organic Honey, Cooking 101, Women's Dress	160.37
58	beverlywatts@yahoo.com	Paul Spears	37	2023-11-02	Women's Dress, Smartphone	1433.43
59	cookmaurice@mckay.info	Christopher Wilson	38	2023-07-06	Blender, Fresh Apples	90.54
60	cookmaurice@mckay.info	Christopher Wilson	39	2023-11-17	Blender, Men's T-shirt, Women's Dress	339.87
61	simpsonedward@davis.net	Shane Smith	40	2023-03-15	Women's Dress, Laptop, Blender, Smartphone	4280.4
62	novakwalter@gmail.com	Jennifer Tucker	41	2023-10-02	Cooking 101, Smartphone, Men's T-shirt, The Great Gatsby...	2017.44
63	novakwalter@gmail.com	Jennifer Tucker	42	2023-11-11	Cooking 101, Fresh Apples, Women's Dress, Organic Honey	181.7



63	novakwalter@gmail.com	Jennifer Tucker	42	2023-11-11	Cooking 101, Fresh Apples, Women's Dress, Organic Honey	181.7
64	novakwalter@gmail.com	Jennifer Tucker	43	2023-12-04	Blender	175.36
65	novakwalter@gmail.com	Jennifer Tucker	44	2023-11-11	Laptop, Blender	1761.92
66	daviessamantha@hotmail.com	Michelle Miller	45	2023-03-09	Laptop, Laptop, Cooking 101	6422.24
67	daviessamantha@hotmail.com	Michelle Miller	46	2023-11-20	Women's Dress, Smartphone	834.69
68	daviessamantha@hotmail.com	Michelle Miller	47	2023-05-02	Laptop, Coffee Table, Blender	3549.5
69	daviessamantha@hotmail.com	Michelle Miller	48	2023-08-20	Coffee Table, Women's Dress, Men's T-shirt	1008.97
70	andreaagarza@smith.com	Carolyn Lambert	49	2023-04-06	Women's Dress, Fresh Apples, The Great Gatsby, ...	2533.62
71	andreaagarza@smith.com	Carolyn Lambert	50	2023-02-02	Men's T-shirt	44.72
72	andreaagarza@smith.com	Carolyn Lambert	51	2023-04-27	Organic Honey	54.21
73	juliaolson@ford.com	Shawn Bailey	52	2023-08-12	Women's Dress, Smartphone, Fresh Apples, Women's Dres...	1475.15
74	juliaolson@ford.com	Shawn Bailey	53	2023-09-27	Laptop, Women's Dress, Blender, Men's T-shirt, Laptop	11038.37
75	juliaolson@ford.com	Shawn Bailey	54	2023-02-21	Men's T-shirt, The Great Gatsby, Fresh Apples, Women's ...	354.04
76	kendra66@yahoo.com	Cynthia Bradley	55	2023-08-28	Smartphone, Laptop, The Great Gatsby	5055.36
77	kendra66@yahoo.com	Cynthia Bradley	56	2023-04-17	Laptop	4766.7
78	kendra66@yahoo.com	Cynthia Bradley	57	2023-03-15	Men's T-shirt, Smartphone	826.46
79	kendra66@yahoo.com	Cynthia Bradley	58	2023-08-03	Cooking 101, Cooking 101	65.36
80	richard53@gmail.com	Julie Shields	59	2023-07-25	Laptop, Women's Dress, Fresh Apples, Women's Dress, The ...	3738.5
81	richard53@gmail.com	Julie Shields	60	2023-09-24	Smartphone	2170.95
82	richard53@gmail.com	Julie Shields	61	2023-04-29	Men's T-shirt	134.16
83	aprilalvarez@hotmail.com	Jeffery Fuller	62	2023-06-24	Blender	72.52
84	aprilalvarez@hotmail.com	Jeffery Fuller	63	2023-11-17	Blender, Laptop, Women's Dress, Laptop, Smartphone	11792.21
85	deborahdominguez@yahoo.com	Cassandra Guzman	64	2023-05-04	Smartphone, The Great Gatsby, Blender, Smartphone	2672.11
86	deborahdominguez@yahoo.com	Cassandra Guzman	65	2023-05-09	Laptop, The Great Gatsby, Blender	1239.08
87	deborahdominguez@yahoo.com	Cassandra Guzman	66	2023-10-27	Coffee Table, Women's Dress, Organic Honey	1012.71
88	deborahdominguez@yahoo.com	Cassandra Guzman	67	2023-11-07	Organic Honey, Blender, Organic Honey, Blender	370.25
89	deborahdominguez@yahoo.com	Cassandra Guzman	68	2023-08-03	Organic Honey, Smartphone, The Great Gatsby, Blender, ...	2684.09
90	josemunoz@clark.com	Angela Harris	69	2023-11-18	Smartphone	3411.0
91	marshallcarly@hotmail.com	Molly Martin	70	2023-06-30	Laptop, Women's Dress, The Great Gatsby, Cooking 101	3567.46
92	marshallcarly@hotmail.com	Molly Martin	71	2023-06-16	Fresh Apples, Smartphone	745.28
93	marshallcarly@hotmail.com	Molly Martin	72	2023-07-25	Men's T-shirt, Cooking 101	74.72
94	alyssa17@gmail.com	Kenneth Gutierrez	73	2023-06-06	The Great Gatsby	31.5

95	alyssa17@gmail.com	Kenneth Gutierrez	74	2023-11-15	Fresh Apples, Coffee Table	328.94
96	hsmith@yahoo.com	Luke Moore	75	2023-06-22	Organic Honey, Laptop	3370.94
97	hsmith@yahoo.com	Luke Moore	76	2023-10-25	Men's T-shirt, Blender, The Great Gatsby, Coffee Table, ...	1184.82
98	hsmith@yahoo.com	Luke Moore	77	2023-04-12	Blender, Men's T-shirt, Blender, Cooking 101, Blender	395.01
99	hsmith@yahoo.com	Luke Moore	78	2023-02-23	Coffee Table, Women's Dress, Cooking 101	658.43
100	sgillespie@yahoo.com	Michael Lewis	79	2023-12-08	Cooking 101, Laptop	2504.2
101	sgillespie@yahoo.com	Michael Lewis	80	2023-11-28	Cooking 101, Fresh Apples, Cooking 101	97.78
102	lindafuller@cohen.net	Robert Andersen	81	2023-07-31	Blender, Blender, Men's T-shirt, Laptop, Organic Honey	2166.96
103	lindafuller@cohen.net	Robert Andersen	82	2023-07-09	Laptop, The Great Gatsby	4786.07
104	lindafuller@cohen.net	Robert Andersen	83	2023-06-14	Cooking 101, Blender	142.52
105	lindafuller@cohen.net	Robert Andersen	84	2023-10-02	Men's T-shirt, Coffee Table, Cooking 101, Organic Honey, ...	1513.02
106	lindafuller@cohen.net	Robert Andersen	85	2023-08-24	Organic Honey, Cooking 101, Coffee Table, The Great Gatsby	968.06
107	ramirezbryan@yahoo.com	Diane Valdez	86	2023-02-02	Women's Dress, Blender, Blender	572.21
108	ramirezbryan@yahoo.com	Diane Valdez	87	2023-08-09	Smartphone, Coffee Table, Blender, The Great Gatsby	4124.44
109	ramirezbryan@yahoo.com	Diane Valdez	88	2023-04-30	Women's Dress, Laptop, Cooking 101, Cooking 101	2002.64
110	ramirezbryan@yahoo.com	Diane Valdez	89	2023-10-28	Cooking 101	35.55

## 5.2 Query: Customers with Basket Items

### Rationale:

This query identifies customers with active items in their baskets to help target marketing efforts. The solution involved:

- Filtering customers with non-empty baskets by joining **Basket** and **basket\_contains** tables.
- Included customer attributes such as email (**Cemail\_id**), name, birthday (**Cbirthdate**), and gift card balances from **Pvouchers\_gift\_cards**.
- Retrieved product details from the **Products** table for basket contents and displayed quantities (**Bquantity**).

	Customer_Email	Customer_Name	Birthday	Gift_Card_Balance	Basket_Products
1	allenjohnn@warren.net	Catherine Martinez	2002-02-13	57.53	Blender (x3)
2	alysa17@gmail.com	Kenneth Gutierrez	1980-04-10	348.54	Cooking 101 (x3), Coffee Table (x1), Coffee Table (x5), Organic Honey (x5), Blender (x5)
3	andreamiller@lee.com	Michael Johnson	1974-03-16	NULL	Women's Dress (x3), The Great Gatsby (x2), Smartphone (x5), Organic Honey (x4)
4	bstokes@gmail.com	Jennifer Young	1970-04-17	NULL	Women's Dress (x5)
5	christopherkim@robbins-wang.com	Patricia Garcia	1995-03-06	224.45	Fresh Apples (x2), Laptop (x4), Men's T-shirt (x2), The Great Gatsby (x4), Coffee Table (x4)
6	cmorris@johnson.com	Brian Ruiz	1976-04-05	76.25	Blender (x2), Laptop (x5), The Great Gatsby (x5), Women's Dress (x5)
7	cookmaurice@mkay.info	Christopher Wilson	1998-03-14	356.02	Laptop (x4), Blender (x4), Blender (x1), Blender (x1)
8	darrell34@hancock.com	Brian Fletcher	1980-06-08	320.74	Organic Honey (x3)
9	daviesamantha@hotmail.com	Michelle Miller	1998-07-08	231.12	Women's Dress (x5), Organic Honey (x2)
10	davistravis@webb-freeman.com	Nicole Taylor	2000-09-16	276.38	Cooking 101 (x4), Women's Dress (x1), Organic Honey (x5)
11	deborahdominguez@yahoo.com	Cassandra Guzman	1987-01-08	357.52	Organic Honey (x1)
12	ewalters@gmail.com	Eric Yang	1971-06-05	232.27	Cooking 101 (x5), Laptop (x2)
13	gainesthomas@mcormick.com	Mary Colon	1996-06-07	NULL	The Great Gatsby (x5), Laptop (x2), Women's Dress (x2), The Great Gatsby (x1)
14	hsmith@yahoo.com	Luke Moore	1984-02-25	NULL	Laptop (x2), Laptop (x2)
15	jason57@yahoo.com	Zachary Watts	1971-02-14	246.68	Coffee Table (x2), Women's Dress (x3), Organic Honey (x5)
16	jeffery77@gmail.com	Anna Murphy	1994-10-06	NULL	Cooking 101 (x4), Coffee Table (x5), Blender (x5), Men's T-shirt (x4), Blender (x5)
17	jnewman@gmail.com	Jennifer Rodriguez	2004-09-04	156.73	The Great Gatsby (x4)
18	josemunoz@clark.com	Angela Harris	1998-09-16	313.78	The Great Gatsby (x3), Fresh Apples (x2), Women's Dress (x1)
19	kendra66@yahoo.com	Cynthia Bradley	1997-04-29	236.5	Coffee Table (x2), The Great Gatsby (x4), Coffee Table (x5), Women's Dress (x2), Organic Honey (x5)
20	lindafuller@cohen.net	Robert Andersen	1979-06-19	146.02	Organic Honey (x5), Organic Honey (x5)
21	lle@yahoo.com	William Simmons	1979-11-21	NULL	Men's T-shirt (x5), Cooking 101 (x1)
22	marshallcarly@hotmail.com	Molly Martin	2004-06-19	448.98	Blender (x1), The Great Gatsby (x1)
23	novakwalter@gmail.com	Jennifer Tucker	1974-07-13	52.52	Laptop (x2), Women's Dress (x5), Women's Dress (x3), Women's Dress (x5), Laptop (x1)
24	omurphy@gmail.com	Traci Gonzalez	1987-01-16	237.06	Laptop (x1), The Great Gatsby (x2)
25	patricktracey@nichols.org	Kevin Smith	1996-06-27	49.73	Coffee Table (x1), Coffee Table (x4), Blender (x5), Blender (x2)
26	paul76@gmail.com	Miranda Tran	2001-08-09	179.4	Women's Dress (x2), Laptop (x3), Blender (x2)
27	qthompson@yahoo.com	Amy Carter	1986-02-07	NULL	The Great Gatsby (x2), Organic Honey (x4)
28	ramirezylanda@hotmail.com	Ashley Schroeder	2000-05-10	126.92	Coffee Table (x3)
29	randy47@henson-richardson.com	Matthew Ayers	1982-06-21	231.44	Smartphone (x2), Men's T-shirt (x4), Women's Dress (x3)
30	richard53@gmail.com	Julie Shields	1993-12-17	201.63	Blender (x4), Women's Dress (x4), Blender (x2)
31	robert99@barber.com	Jennifer Rocha	1997-01-30	NULL	Coffee Table (x2), Cooking 101 (x5), Women's Dress (x3), Blender (x1)
32	rochajames@hotmail.com	Jason Brooks	1976-12-22	NULL	Women's Dress (x1), The Great Gatsby (x4), Cooking 101 (x1), Organic Honey (x5)
33	rodriguezabigail@gmail.com	Lauren Sanders	1971-12-13	142.42	Cooking 101 (x4), Blender (x1)
34	sabrina88@gmail.com	Antonio Sanchez	1973-07-31	NULL	Men's T-shirt (x4), Fresh Apples (x3), Laptop (x4)
35	simpsonedward@davis.net	Shane Smith	1995-11-25	405.13	Blender (x2), Blender (x5), Fresh Apples (x1), Organic Honey (x4), Coffee Table (x1)
36	tanyathompson@rivera-benton.info	Joshua Bass	2004-04-01	280.23	Fresh Apples (x4), Women's Dress (x2)
37	timothyboyle@hotmail.com	John Solis	1985-12-08	217.53	Blender (x2), Laptop (x3)
38	walkerbreanna@pena.biz	Mary Santos	2001-04-26	201.87	The Great Gatsby (x5)

## 5.3 Query: Top Products in Each Category

### Rationale:

This query identifies the top two best-selling products in each category to prioritize inventory and marketing. To solve it:

- Joined **order\_contains** with **Products** to access product sales and category details.
- Used aggregate functions to calculate total sales for each product.
- Applied a **RANK()** window function to rank products within each category based on sales.

- Filtered to retrieve the top two products for each category.

	Category	Product_Name	Product_ID	Total_Sales
1	Books	Cooking 101	79	15
2	Books	Cooking 101	85	10
3	Electronics	Smartphone	99	17
4	Electronics	Laptop	33	9
5	Fashion	Women's Dress	36	13
6	Fashion	Women's Dress	19	12
7	Groceries	Fresh Apples	26	15
8	Groceries	Organic Honey	3	10
9	Home & Kitchen	Blender	69	14
10	Home & Kitchen	Blender	92	12

## 5.4 Query: Month-over-Month Sales Growth

### Rationale:

The aim was to compute the percentage change in sales month-over-month, considering refunded items. The steps included:

- Extracted year and month from `Odate` for grouping.
- Calculated total sales for each month by summing product prices, adjusted for refunded items (using `Return` and `order_contains` tables).
- Used `LAG()` window function to fetch the previous month's sales for each group.
- Computed the growth rate as a percentage difference between current and previous month's sales.

Year	Month	Total_Sales	Sales_Growth
2023	01	160.37	NULL
2023	02	5519.89	3341.97
2023	03	13279.73	140.58
2023	04	11563.8	-12.92
2023	05	22368.6	93.44
2023	06	12418.95	-44.48
2023	07	17876.85	43.95
2023	08	14182.7	-20.66
2023	09	21865.19	54.17
2023	10	5775.16	-73.59
2023	11	21406.64	270.67
2023	12	4569.91	-78.65

## 6. Database Consistency

### Rationale: Ensuring Stock Availability Before Order Placement

The trigger `check_product_stock` ensures that customers cannot order more units of a product than are available in stock. The purpose is to maintain database consistency by preventing stock depletion beyond what is available.

#### Trigger Logic:

1. The trigger is defined as `BEFORE INSERT` on the `order_contains` table to validate product stock before the order is added.
2. For each row, the trigger:
  - Compares the new order quantity (`NEW.Quantity`) with the available stock (`Pstock_count`) in the `Product` table.
  - If the order quantity exceeds the stock, the trigger raises an error and aborts the transaction.

#### Error Handling:

- An error message, **"Error: Insufficient stock for the product"**, is returned when the stock is insufficient, preventing the insert operation.

#### i) Query That Passes the Trigger (Normal Situation, No Errors)

-- Example: a product with ID 31 has a stock count of 178.

```

1  INSERT INTO order_contains (Oorder_number, Pproduct_number, Oquantity)
2  VALUES (1, 31, 5);
3

```

Execution finished without errors.  
 Result: query executed successfully. Took 1ms, 1 rows affected  
 At line 1:  
 INSERT INTO order\_contains (Oorder\_number, Pproduct\_number, Oquantity)  
 VALUES (1, 31, 5);

-- Passes because the stock (178) is greater than the requested quantity (5).

## (ii) Query That Violates the Trigger (Error Fires)

-- Example: a product with ID 31 has a stock count of 178.

```

1  INSERT INTO order_contains (Oorder_number, Pproduct_number, Oquantity)
2  VALUES (5, 31, 180);
3

```

Execution finished with errors.  
 Result: Error: Insufficient stock for the product.  
 At line 1:  
 INSERT INTO order\_contains (Oorder\_number, Pproduct\_number, Oquantity)  
 VALUES (5, 31, 180);

-- Fails because the stock (178) is less than the requested quantity (180).

## Generative AI Use Statement Format for use in Assessments

(i) what tool(s) were used  
 I used Chat GPT.

(ii) any content produced by an AI tool

In question 4, Chat GPT generated synthetic data for me. all the synthetic data was generated by an AI under my prompt.

(iii) the prompts used to generate the content

I couldn't turn chat into pdf, but this link contains all our conversations:

<https://chatgpt.com/share/673bd7fd-97b0-8012-ac0b-55535e57ec34>

(iv) how the results from the AI were incorporated into your submitted work.

In addition to Question 4, the data that the AI provided me was the basis for questions 5 and 6. The SQL I wrote to run the solution are built on this data.

**Bibliography:**

OpenAI. (2023). ChatGPT (Nov 19 version) [Large language model].

<https://chat.openai.com/chat>.