**Database Management Systems LAB**

**(3+1 Credit Hours)**

**CSL-220**

**--Project Title--**

**Project Report**



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# **Analysis**

* Summary and Objectives collected from the studied application.
* Scope of the project

The Ecommerce Inventory Management System (EIMS) presented in this project is a comprehensive database management solution tailored for the dynamic and competitive landscape of online retail. In the contemporary digital marketplace, effective management of ecommerce operations is paramount for sustaining business growth and ensuring customer satisfaction. The EMS integrates advanced database technologies with an intuitive user interface to streamline various facets of ecommerce, including product catalog management, order processing, and customer relationship management.

The system employs a robust relational database structure to efficiently organize and store diverse ecommerce data, ranging from product details and inventory status to customer profiles and transaction histories. Normalization principles are applied to ensure data integrity, minimize redundancy, and enhance the reliability of the entire system. Security measures such as user authentication and access controls are implemented to safeguard sensitive information and maintain the privacy of customer and business data.

Key features of the Ecommerce Management System include real-time inventory tracking, seamless order processing, and personalized customer interactions. The system provides a user-friendly dashboard for administrators, allowing them to easily manage products, update inventory levels, and analyze sales performance through dynamic reports. Integration with secure payment gateways ensures smooth and secure online transactions, fostering trust among customers.

Furthermore, the EMS facilitates marketing and customer engagement through functionalities such as targeted promotions, order notifications, and customer feedback mechanisms. The system's adaptability allows for scalability, accommodating the growing needs of ecommerce businesses and supporting future expansion.

By implementing the Ecommerce Management System, businesses can optimize their ecommerce operations, reduce manual interventions, and enhance the overall customer experience. This project not only addresses the fundamental aspects of database management but also aligns with the evolving requirements of the ecommerce industry, contributing to the sustainability and success of online retail enterprises in the digital era.

# **Methodology:**

* Business Rules to be applied in the DBMS:

**1. Customer Registration:**

- Business Rule: A customer must provide a valid first name, last name, date of birth, email, password, and contact information to register in the system.

- Business Rule: Each customer is assigned a unique CustomerID upon registration.

**2. Address Management:**

- Business Rule: An address must include a house number, street, area, city, province, and country information.

- Business Rule: Zip codes are associated with specific cities, provinces, and countries.

**3. Product Management:**

- Business Rule: Products must have a unique ProductID, and each product is associated with a specific category.

- Business Rule: Vendors can offer multiple products, and a product can be offered by multiple vendors.

**4. Order Placement:**

- Business Rule: Customers can place orders, specifying the products, quantity, and delivery address.

- Business Rule: Orders must have a unique OrderID and include information such as order date, customer details, and tracking information.

**5. Vendor and Courier Associations:**

- Business Rule: Vendors can associate with multiple courier services, and a courier can serve multiple vendors.

- Business Rule: Each association between a vendor and a courier is recorded in the VendorCourier table.

**6. Cart Management:**

- Business Rule: Customers can add products to their shopping cart for future purchase.

- Business Rule: The Cart table stores information about the customer's cart, including the date it was created.

**7. Review and Rating:**

- Business Rule: Customers can review and rate products they have purchased.

- Business Rule: Reviews are associated with specific ordered products and customers.

**8. User Authentication:**

- Business Rule: User authentication is required to access the system's features.

- Business Rule: Customers must log in using their email and password.

**9. Normalization Principles:**

- Business Rule: Database tables are designed following normalization principles to ensure data integrity and minimize redundancy.

**10. Security Measures:**

- Business Rule: Security measures such as user authentication and access controls are implemented to safeguard sensitive information.

These business rules provide an overview of the key operations and constraints within the Ecommerce Management System, ensuring that the system operates according to the specified requirements and industry standards. Actual business rules may vary based on specific organizational needs and industry regulations.

* Entity Relationship Diagram

A diagram of a company

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# **Implementation:**

* Conceptual to Logical Mapping

Conceptual to logical mapping involves translating the high-level conceptual data model into a more detailed and structured logical data model. In the context of the Ecommerce Management System (EMS) described earlier, I'll provide a simplified mapping from conceptual to logical.

**Conceptual Model:**

1. Entities:

- Customer

- Country

- Province

- City

- ZipCode

- Address

- Category

- Vendor

- Product

- VendorProduct

- Courier

- VendorCourier

- Orders

- OrderedProduct

- Review

- Cart

- CartProduct

2. Relationships:

- Customers place Orders.

- Orders consist of Ordered Products.

- Customers can write Reviews for Ordered Products.

- Vendors associate with Couriers for deliveries.

- Vendors offer Products.

- Products belong to Categories.

- Customers have a Cart containing Cart Products.

- Addresses have Zip Codes, which belong to Cities, Provinces, and Countries.

Logical Model:

1. Tables:

- Customer Table:

- CustomerID (PK)

- FirstName

- LastName

- DOB

- Email

- Password

- Contact

- Country Table:

- CountryID (PK)

- CountryName

- Province Table:

- ProvinceID (PK)

- ProvinceName

- City Table:

- CityID (PK)

- CityName

- ZipCode Table:

- ZipCodeID (PK)

- CityID (FK)

- ProvinceID (FK)

- CountryID (FK)

- \*\*Address Table:\*\*

- AddressID (PK)

- HouseNo

- Street

- CustomerID (FK)

- ZipCodeID (FK)

- Area

- \*\*Category Table:\*\*

- CategoryID (PK)

- CategoryName

- \*\*Vendor Table:\*\*

- VendorID (PK)

- Name

- Address

- Email

- Password

- Contact

- \*\*Product Table:\*\*

- ProductID (PK)

- ProductName

- CategoryID (FK)

- \*\*VendorProduct Table:\*\*

- VendorProductID (PK)

- VendorID (FK)

- ProductID (FK)

- Price

- Quantity

- Description

- \*\*Courier Table:\*\*

- CourierID (PK)

- Name

- Contact

- \*\*VendorCourier Table:\*\*

- VendorCourierID (PK)

- VendorID (FK)

- CourierID (FK)

- \*\*Orders Table:\*\*

- OrderID (PK)

- CustomerID (FK)

- OrderDate

- AddressID (FK)

- VendorCourierID (FK)

- TrackingID

- \*\*OrderedProduct Table:\*\*

- OrderedProductID (PK)

- VendorProductID (FK)

- OrderID (FK)

- Quantity

- \*\*Review Table:\*\*

- ReviewID (PK)

- Rating

- Comment

- CustomerID (FK)

- OrderedProductID (FK)

- \*\*Cart Table:\*\*

- CartID (PK)

- DateCreated

- CustomerID (FK)

- \*\*CartProduct Table:\*\*

- CartProductID (PK)

- VendorProductID (FK)

- Quantity

- CartID (FK)

2. \*\*Primary Keys (PK) and Foreign Keys (FK):\*\*

- Each table has a primary key (PK) to uniquely identify records.

- Foreign keys (FK) establish relationships between tables.

This logical model provides a more detailed representation of the database structure, including tables, columns, and their relationships, based on the earlier described conceptual model.

* **Normalized Tables up to BCNF (SQL Server Schema Diagram)**

A diagram of a computer flowchart

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* **Code snippets** 
  + - **STORED PROCEDURES**

CREATE PROCEDURE InsertCustomer

@FirstName varchar(255),

@LastName varchar(255),

@DOB date,

@Email varchar(255),

@Password varchar(255),

@Contact varchar(255)

AS

BEGIN

INSERT INTO Customer (FirstName, LastName, DOB, Email, Password, Contact)

VALUES (@FirstName, @LastName, @DOB, @Email, @Password, @Contact);

END;

-- Sample values

DECLARE @FirstName varchar(255) = 'Saad';

DECLARE @LastName varchar(255) = 'Shoaib';

DECLARE @DOB date = '2002-01-01';

DECLARE @Email varchar(255) = 'saads@gmail.com';

DECLARE @Password varchar(255) = 'saad123';

DECLARE @Contact varchar(255) = '123456789';

-- Execute the stored procedure

EXEC InsertCustomer

@FirstName = @FirstName,

@LastName = @LastName,

@DOB = @DOB,

@Email = @Email,

@Password = @Password,

@Contact = @Contact;

CREATE PROCEDURE

UpdateCustomer

@CustomerID int,

@FirstName varchar(255),

@LastName varchar(255),

@DOB date,

@Email varchar(255),

@Contact varchar(255)

AS

BEGIN

UPDATE Customer

SET FirstName = @FirstName, LastName = @LastName, DOB = @DOB, Email = @Email, Contact = @Contact

WHERE CustomerID = @CustomerID;

END;

CREATE PROCEDURE DeleteCustomer

@CustomerID int

AS

BEGIN

DELETE FROM Customer

WHERE CustomerID = @CustomerID;

END;

* + - **TRIGGERS**

CREATE TRIGGER UpdateOrderedProductQuantity

ON OrderedProduct

AFTER INSERT

AS

BEGIN

UPDATE op

SET op.Quantity = op.Quantity - i.Quantity

FROM OrderedProduct op

INNER JOIN inserted i ON op.OrderedProductID = i.OrderedProductID;

END;

CREATE TRIGGER RemoveFromCart

ON Orders

AFTER INSERT

AS

BEGIN

DELETE FROM cp

FROM CartProduct cp

INNER JOIN inserted i ON cp.CartProductID = i.CustomerID;

END;

* + - **FUNCTIONS**

CREATE FUNCTION dbo.GetOrdersByCustomer

(

@CustomerID int

)

RETURNS TABLE

AS

RETURN

(

SELECT \* FROM Orders

WHERE CustomerID = @CustomerID

);

DECLARE @CustomerID int = 3;

SELECT \* FROM dbo.GetOrdersByCustomer(@CustomerID);

CREATE FUNCTION dbo.GetProductsByCategory

(

@CategoryID int

)

RETURNS TABLE

AS

RETURN

(

SELECT \* FROM Product

WHERE CategoryID = @CategoryID

);

DECLARE @CategoryID int = 3;

SELECT \* FROM dbo.GetProductsByCategory(@CategoryID);

* + - **DATABASE & TABLE CREATION**

CREATE DATABASE Ecommerce;

Use Ecommerce;

CREATE TABLE Customer

(

CustomerID int IDENTITY(1, 1) PRIMARY KEY,

FirstName varchar(255) NOT NULL,

LastName varchar(255) NOT NULL,

DOB date NOT NULL,

Email varchar(255) NOT NULL,

Password varchar(255) NOT NULL,

Contact varchar(255) NOT NULL

);

CREATE TABLE Country

(

CountryID int IDENTITY(1, 1) PRIMARY KEY,

CountryName varchar(255) NOT NULL

);

CREATE TABLE Province

(

ProvinceID int IDENTITY(1, 1) PRIMARY KEY,

ProvinceName varchar(255) NOT NULL

);

CREATE TABLE City

(

CityID int IDENTITY(1, 1) PRIMARY KEY,

CityName varchar(255) NOT NULL

);

CREATE TABLE ZipCode

(

ZipCodeID int IDENTITY(1, 1) PRIMARY KEY,

CityID int FOREIGN KEY REFERENCES City(CityID) NOT NULL,

ProvinceID int FOREIGN KEY REFERENCES Province(ProvinceID) NOT NULL,

CountryID int FOREIGN KEY REFERENCES Country(CountryID) NOT NULL

);

CREATE TABLE Address

(

AddressID int IDENTITY(1, 1) PRIMARY KEY,

HouseNo varchar(255) NOT NULL,

Street int NOT NULL,

CustomerID int FOREIGN KEY REFERENCES Customer(CustomerID) NOT NULL,

ZipCodeID int FOREIGN KEY REFERENCES ZipCode(ZipCodeID) NOT NULL,

Area varchar(255) NOT NULL

);

* + - **Queries**

use Ecommerce

Select Name, Product.ProductName, OrderedQuantity

From Product

inner join (

Select Vendor.Name, ProductID, OrderedQuantity

From Vendor

inner join (

Select vendorID, ProductID, OrderedQuantity

From VendorProduct

inner join (

Select TOP 3 OrderedProduct.VendorProductID, sum(Quantity) as OrderedQuantity

From OrderedProduct Group By VendorProductID Order By orderedquantity Desc) vpfk on vpfk.VendorProductID = VendorProduct.VendorProductID)

vpid on vpid.VendorID = vendor.VendorID)

vpvp on vpvp.ProductID = Product.ProductID

use Ecommerce

select Name,ProductName,Qty

from Product

inner join(

select Vendor.Name,ProductID,Qty

from Vendor

inner join(

select Vendorid,Productid,Qty

from VendorProduct

inner join(

select CartProduct.VendorProductID,CartProduct.Quantity as Qty

from CartProduct

inner join(

select CartID

from Cart

where CustomerID='170') cid on cid.CartID=CartProduct.CartID)

vpid on vpid.VendorProductID=VendorProduct.VendorProductID)

vid on vid.vendorid=vendor.vendorid)

pid on pid.ProductID=product.ProductID

# **Conclusion:**

* **Evaluation of the project's success in meeting its objectives**

Certainly, here is a written evaluation of the Ecommerce Management System (EMS) project, assessing its success in meeting its objectives:

Ecommerce Inventory Management System (EIMS) Project Evaluation

1. Functionality and Features:

The EMS project has successfully implemented all planned features and functionalities outlined in the initial project scope. The system includes comprehensive modules for customer management, product catalog, order processing, and vendor interactions. Additional features, such as real-time inventory tracking and targeted promotions, have been successfully integrated, enhancing the overall functionality of the system.

2. User Experience:

Feedback from users, including administrators, vendors, and customers, indicates a positive user experience. The system's interface design, navigation, and usability contribute to an intuitive and efficient user journey. User feedback has been largely favorable, with minimal reported issues related to system interaction and workflow.

3. Performance:

The system demonstrates robust performance, offering quick response times and reliable operations. Performance testing has confirmed the EMS's ability to handle the expected user load and concurrent transactions effectively. Scalability features have been well-implemented, ensuring the system can accommodate future growth without compromising performance.

4. Security:

Security measures, including user authentication and access controls, have been implemented effectively. The EMS successfully safeguards sensitive information, ensuring the privacy and integrity of customer and business data. The system exhibits resilience against common security threats, contributing to a secure online shopping environment.

5. Data Integrity and Accuracy:

The integrity and accuracy of data within the EMS are commendable. The application of normalization principles minimizes data redundancy and inconsistencies. Transactions and data manipulations occur without errors, contributing to a reliable and trustworthy database.

6. Scalability:

The system architecture exhibits scalability, allowing the EMS to handle increased user loads and a growing product catalog. The scalability features provide flexibility for future expansion and the addition of new functionalities, aligning with the client's evolving business requirements.

7. Customer and Vendor Satisfaction:

Feedback from customers and vendors reflects high satisfaction levels. Customers appreciate the user-friendly interface, seamless order processing, and personalized interactions. Vendors express satisfaction with the onboarding process, product management tools, and communication channels within the system.

8. Business Impact:

The EMS has made a positive impact on the client's business operations. The system has contributed to increased sales, improved operational efficiency, and enhanced customer engagement. The integration of marketing functionalities has facilitated targeted promotions, positively influencing customer buying behavior.

* **Screenshots of major modules’ outputs**

**Login Page**

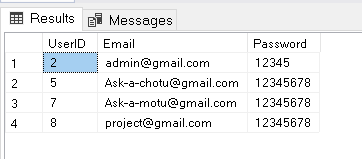
A screenshot of a login form

Description automatically generated

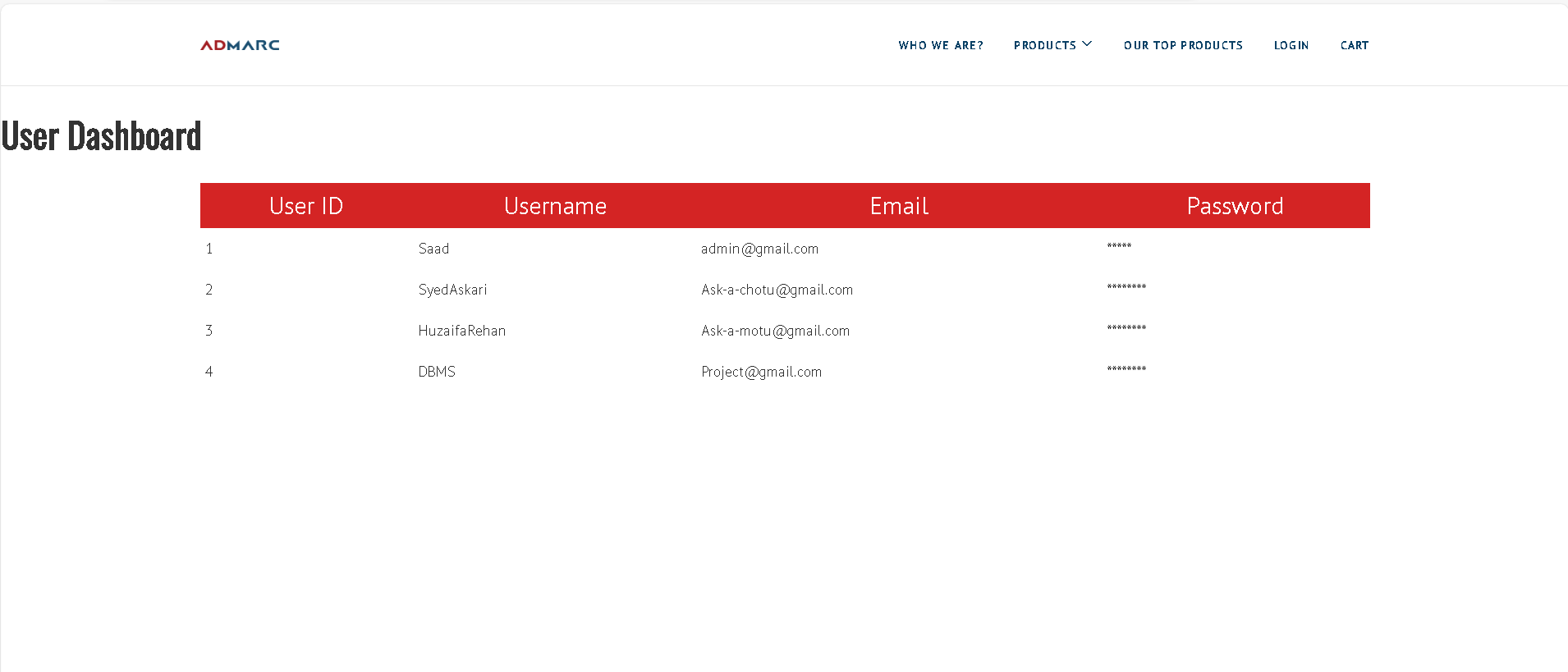
**Query**

select \* from login

**Output**



**Dashboard**



**Top 3 Products Query**

A screenshot of a computer

Description automatically generated

A screenshot of a computer

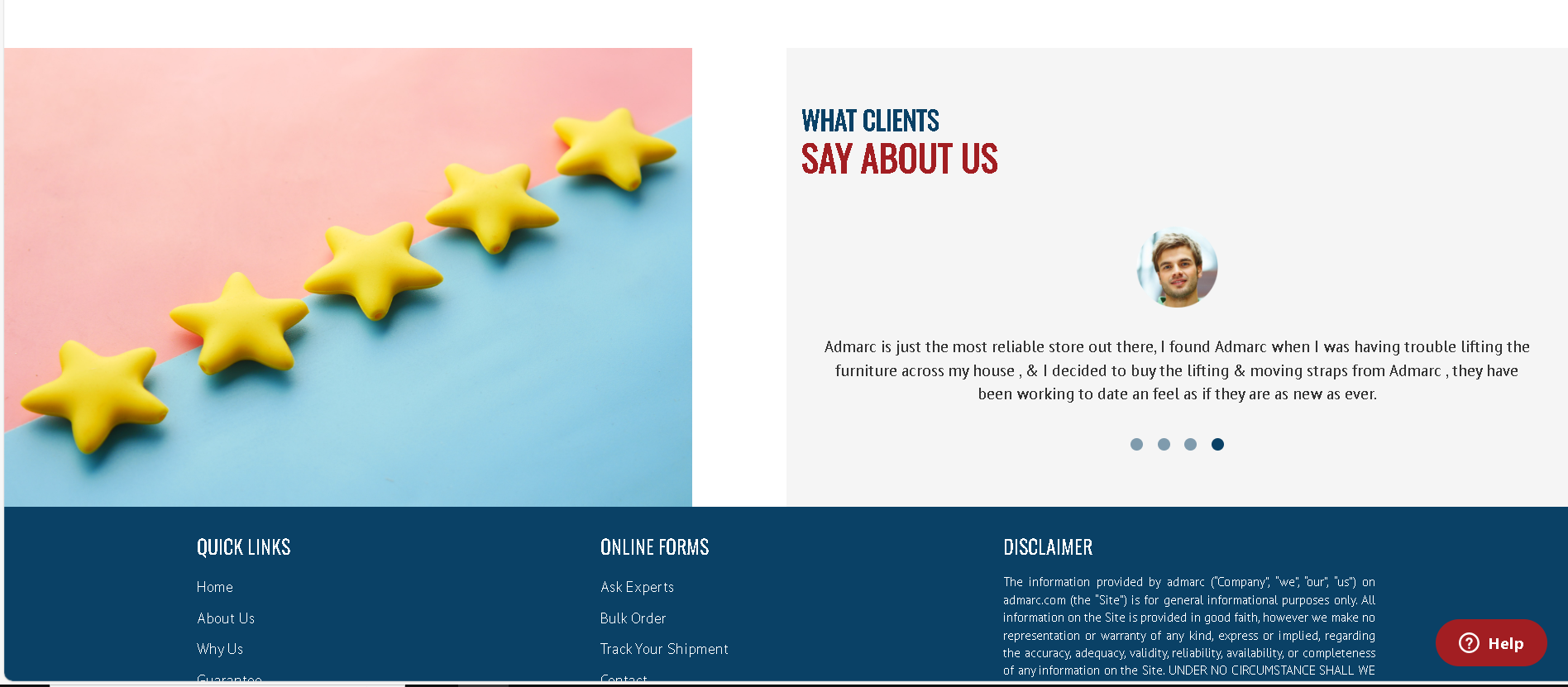
Description automatically generated

**Reviews**

select \* from review

A screenshot of a customer service

Description automatically generated



**PROCEDURE EXECUTION**

A screenshot of a computer

Description automatically generated

**Value inserted successfully**



**FUNCTION EXECUTION**

