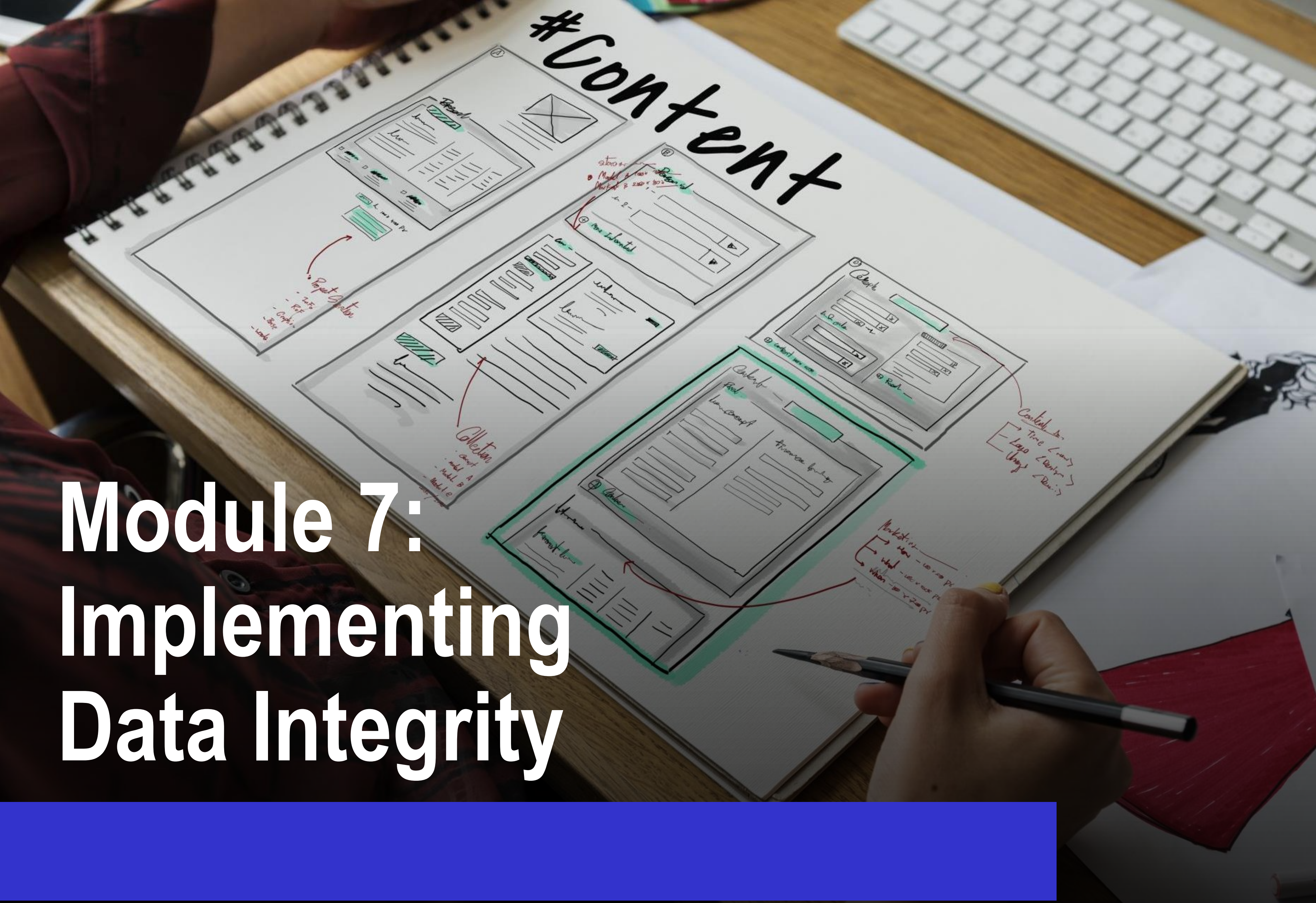
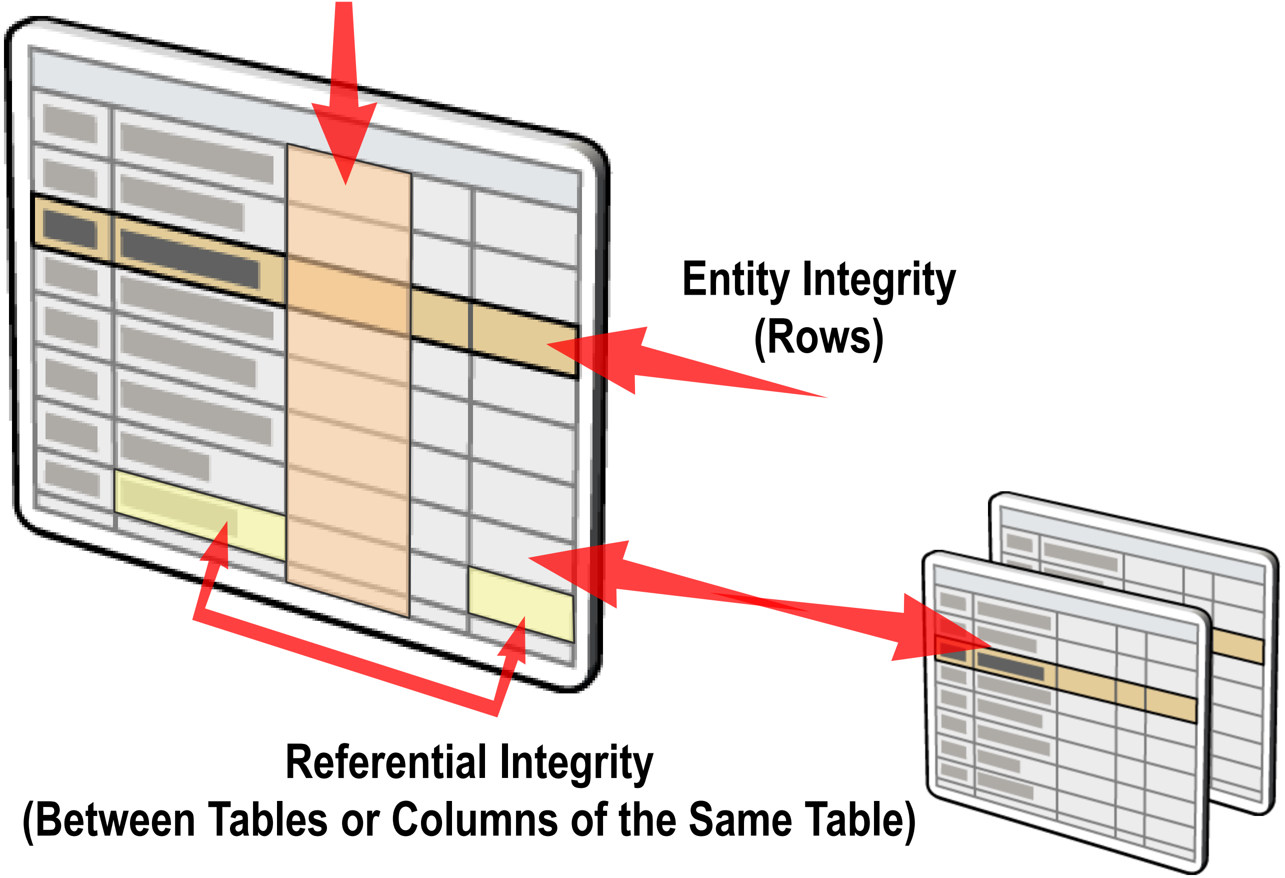


Module 7: Implementing Data Integrity

Overview

- Types of Data Integrity
- Enforcing Data Integrity
- Defining Constraints
- Types of Constraints
- Disabling Constraints
- Using Defaults and Rules
- Deciding Which Enforcement Method to Use

Types of Data Integrity

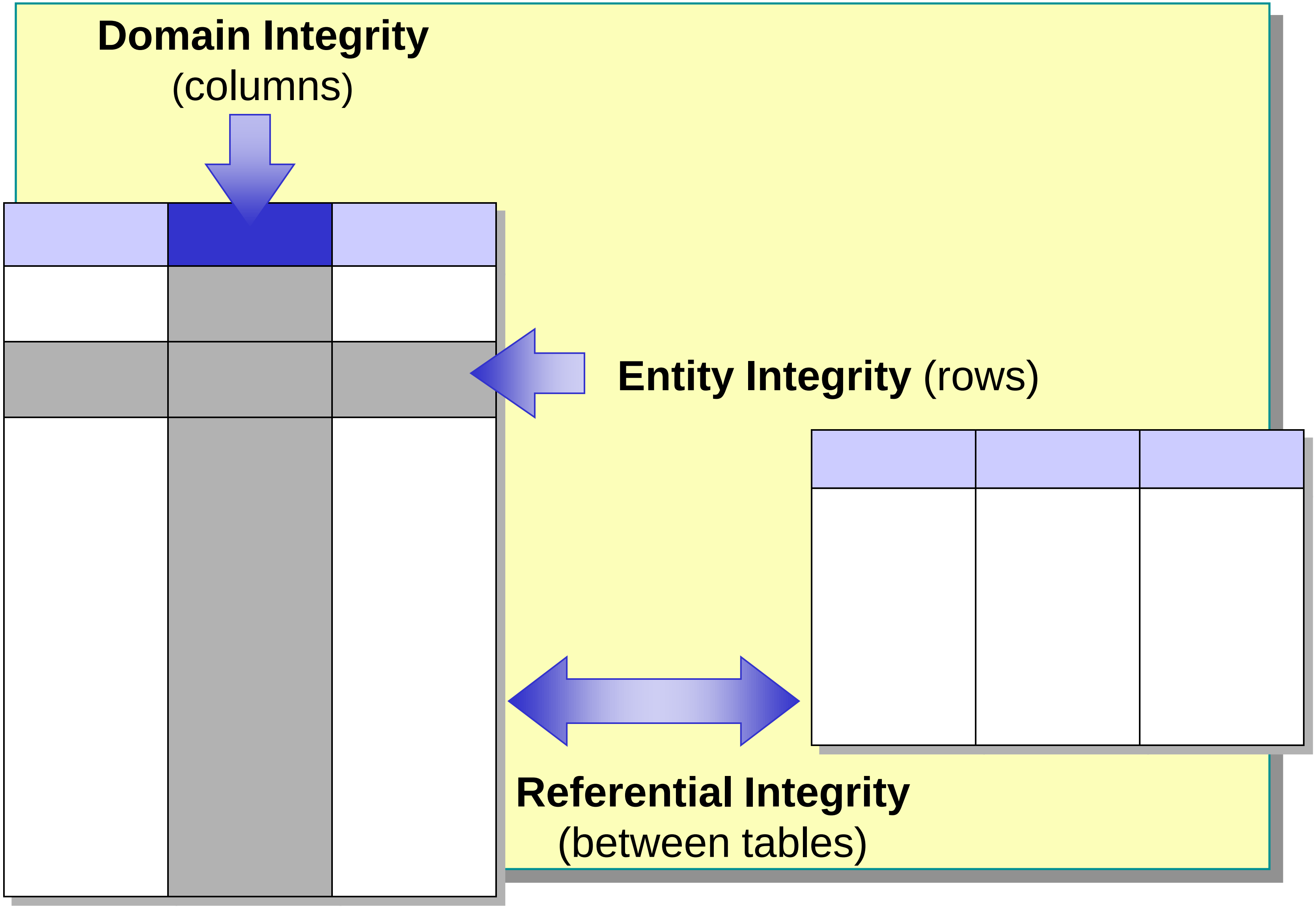


Domain Integrity
(Columns)

Entity Integrity
(Rows)

Referential Integrity
(Between Tables or Columns of the Same Table)

Types of Data Integrity



Domain Integrity (columns)

Entity Integrity (rows)

Referential Integrity (between tables)

Enforcing Data Integrity

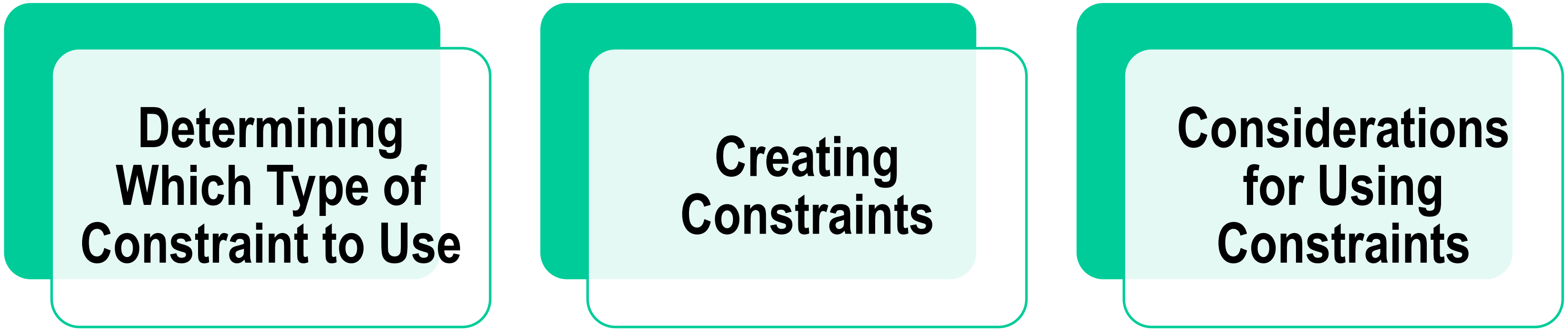
Declarative Data Integrity

- Criteria defined in object definitions
- SQL Server enforces automatically
- Implement by using constraints, defaults, and rules

Procedural Data Integrity

- Criteria defined in script
- Script enforces
- Implement by using triggers and stored procedures

Defining Constraints



Determining Which Type of Constraint to Use

Creating Constraints

Considerations for Using Constraints

Determining Which Type of Constraint to Use

Integrity type	Constraint type	Description
Domain	DEFAULT	Specifies default value for column
	CHECK	Specifies allowed value for column
	FOREIGN KEY	Specifies column in which values must exist
	NULL	Specifies whether NULL is permitted
Entity	PRIMARY KEY	Identifies each row uniquely
	UNIQUE	Prevents duplication of nonprimary keys
Referential	FOREIGN KEY	Defines columns whose value must match the primary key of this table
	CHECK	Specifies the allowed value for a column based on the contents of another column

Creating Constraints

- **Use CREATE TABLE or ALTER TABLE**
- **Can Add Constraints to a Table with Existing Data**
- **Can Place Constraints on Single or Multiple Columns**
  - Single column, called column-level constraint
  - Multiple columns, called table-level constraint

Considerations for Using Constraints

- Can Be Changed Without Recreating a Table
- Require Error-Checking in Applications and Transactions
- Verify Existing Data

Types of Constraints

- DEFAULT Constraints
- CHECK Constraints
- PRIMARY KEY Constraints
- UNIQUE Constraints
- FOREIGN KEY Constraints
- Cascading Referential Integrity

DEFAULT Constraints

- Apply Only to INSERT Statements
- Only One DEFAULT Constraint Per Column
- Cannot Be Used with IDENTITY Property or rowversion Data Type
- Allow Some System-supplied Values

```
USE Northwind
ALTER TABLE dbo.Customers
ADD
CONSTRAINT DF_contactname DEFAULT 'UNKNOWN'
FOR ContactName
```

CHECK Constraints

- **Are Used with INSERT and UPDATE Statements**
- **Can Reference Other Columns in the Same Table**
- **Cannot:**
  - Be used with the **rowversion** data type
  - Contain subqueries

```
USE Northwind
ALTER TABLE dbo.Employees
ADD
CONSTRAINT CK_birthdate
CHECK (BirthDate > '01-01-1900' AND BirthDate <
getdate())
```

PRIMARY KEY Constraints

- Only One PRIMARY KEY Constraint Per Table
- Values Must Be Unique
- Null Values Are Not Allowed
- Creates a Unique Index on Specified Columns

```
USE Northwind
ALTER TABLE dbo.Customers
ADD
CONSTRAINT PK_Customers
  PRIMARY KEY NONCLUSTERED (CustomerID)
```

UNIQUE Constraints

- Allow One Null Value
- Allow Multiple UNIQUE Constraints on a Table
- Defined with One or More Columns
- Enforced with a Unique Index

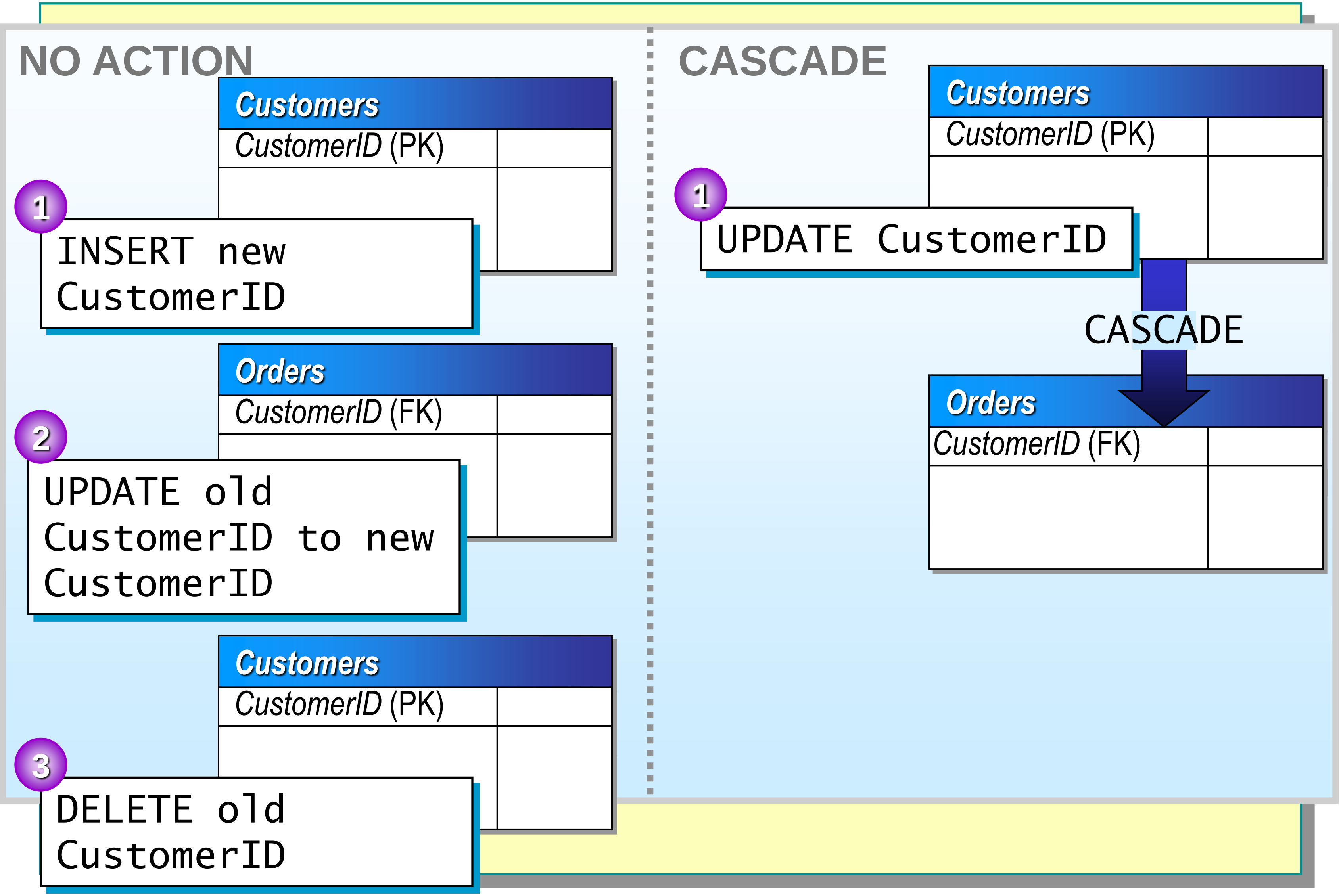
```
USE Northwind
ALTER TABLE dbo.Suppliers
ADD
CONSTRAINT U_CompanyName
  UNIQUE NONCLUSTERED (CompanyName)
```

FOREIGN KEY Constraints

- Must Reference a PRIMARY KEY or UNIQUE Constraint
- Provide Single or Multicolumn Referential Integrity
- Do Not Automatically Create Indexes
- Users Must Have SELECT or REFERENCES Permissions on Referenced Tables
- Use Only REFERENCES Clause Within Same Table

```
USE Northwind
ALTER TABLE dbo.Orders
ADD CONSTRAINT FK_Orders_Customers
  FOREIGN KEY (CustomerID)
  REFERENCES dbo.Customers(CustomerID)
```

Cascading Referential Integrity



NO ACTION

Customers

CustomerID (PK)

1 INSERT new CustomerID

Orders

CustomerID (FK)

2 UPDATE old CustomerID to new CustomerID

Customers

CustomerID (PK)

3 DELETE old CustomerID

CASCADE

Customers

CustomerID (PK)

1 UPDATE CustomerID

CASCADE

Orders

CustomerID (FK)

Disabling Constraints

1

Disabling Constraint Checking on Existing Data

2

Disabling Constraint Checking When Loading New Data

Disabling Constraint Checking on Existing Data

- Applies to CHECK and FOREIGN KEY Constraints
- Use WITH NOCHECK Option When Adding a New Constraint
- Use if Existing Data Will Not Change
- Can Change Existing Data Before Adding Constraints

```
USE Northwind
ALTER TABLE dbo.Employees
WITH NOCHECK
  ADD CONSTRAINT FK_Employees_Employees
  FOREIGN KEY (ReportsTo)
  REFERENCES dbo.Employees(EmployeeID)
```

Disabling Constraint Checking When Loading New Data

- **Applies to CHECK and FOREIGN KEY Constraints**
- **Use When:**
  - Data conforms to constraints
  - You load new data that does not conform to constraints

```
USE Northwind
ALTER TABLE dbo.Employees
NOCHECK
  CONSTRAINT FK_Employees_Employees
```

Using Defaults and Rules

- **As Independent Objects They:**
  - Are defined once
  - Can be bound to one or more columns or user-defined data types

```
CREATE DEFAULT phone_no_default
  AS '(000)000-0000'
GO
EXEC sp_bindefault phone_no_default,
  'Customers.Phone'
```

```
CREATE RULE regioncode_rule
  AS @regioncode IN ('IA', 'IL', 'KS', 'MO')
GO
EXEC sp_bindrule regioncode_rule,
  'Customers.Region'
```

Deciding Which Enforcement Method to Use

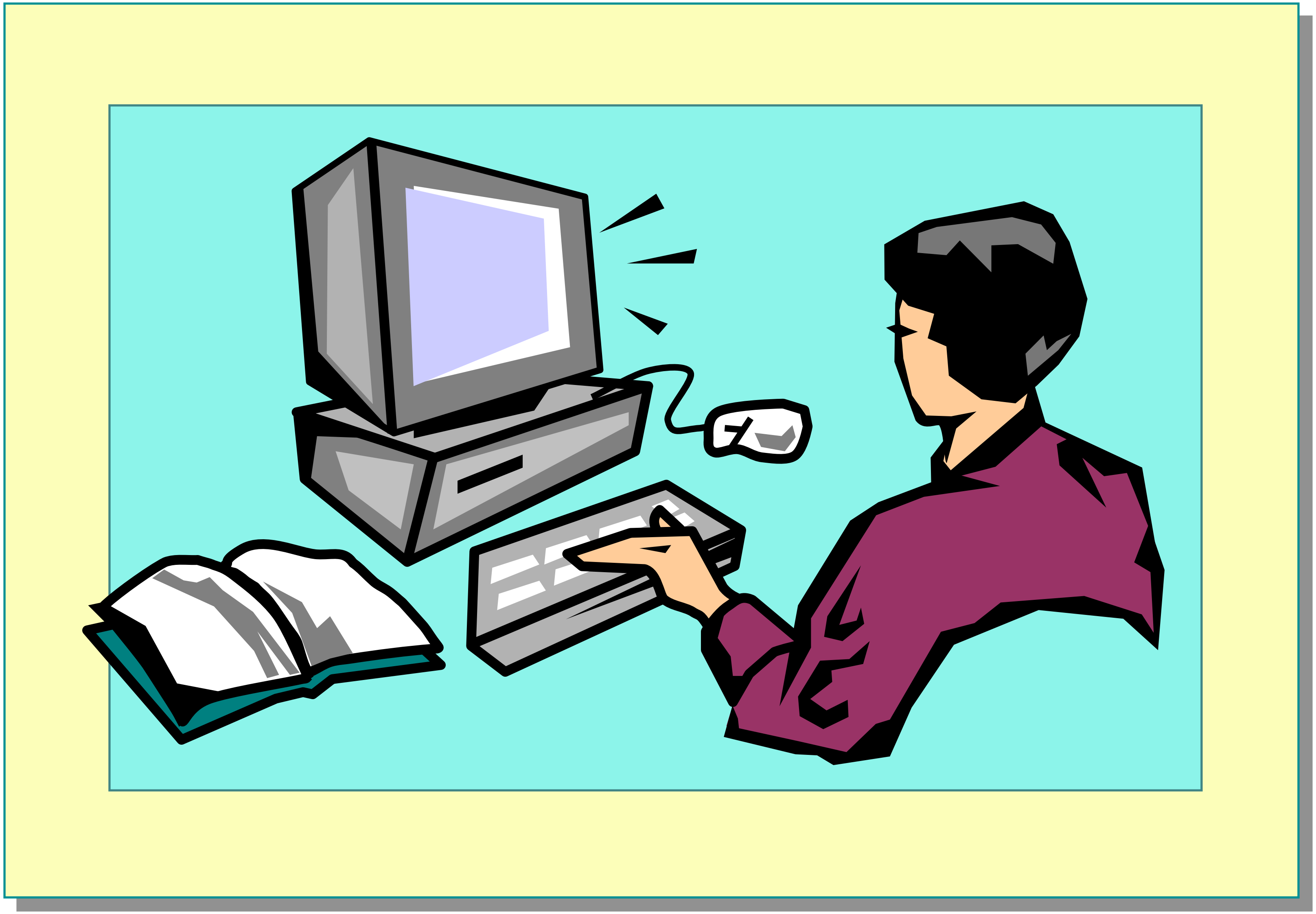
Data integrity components	Functionality	Performance costs	Before or after modification
Constraints	Medium	Low	Before
Defaults and rules	Low	Low	Before
Triggers	High	Medium-High	After
Data types, Null/Not Null	Low	Low	Before

Recommended Practices

☑ Use Constraints Because They Are ANSI-compliant

☑ Use Cascading Referential Integrity Instead of Triggers

Lab A: Implementing Data Integrity



Review

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- Enforcing Data Integrity
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- Types of Constraints
- Disabling Constraints
- Using Defaults and Rules
- Deciding Which Enforcement Method to Use

Module References

- **Primary and Foreign Key Constraints - https://docs.microsoft.com/en-us/sql/relational-databases/tables/primary-and-foreign-key-constraints?view=sql-server-ver15**

- **Unique Constraints and Check Constraints - https://docs.microsoft.com/en-us/sql/relational-databases/tables/unique-constraints-and-check-constraints?view=sql-server-ver15**

- **Oracle Database Online Documentation - https://docs.oracle.com/database/121/https://docs.oracle.com/cd/A91034_01/DOC/index.htm**

- **How MySQL Deals with Constraints - https://dev.mysql.com/doc/refman/8.0/en/constraints.html**