Data Definition Language: Constraints

CIS-182

Constraints

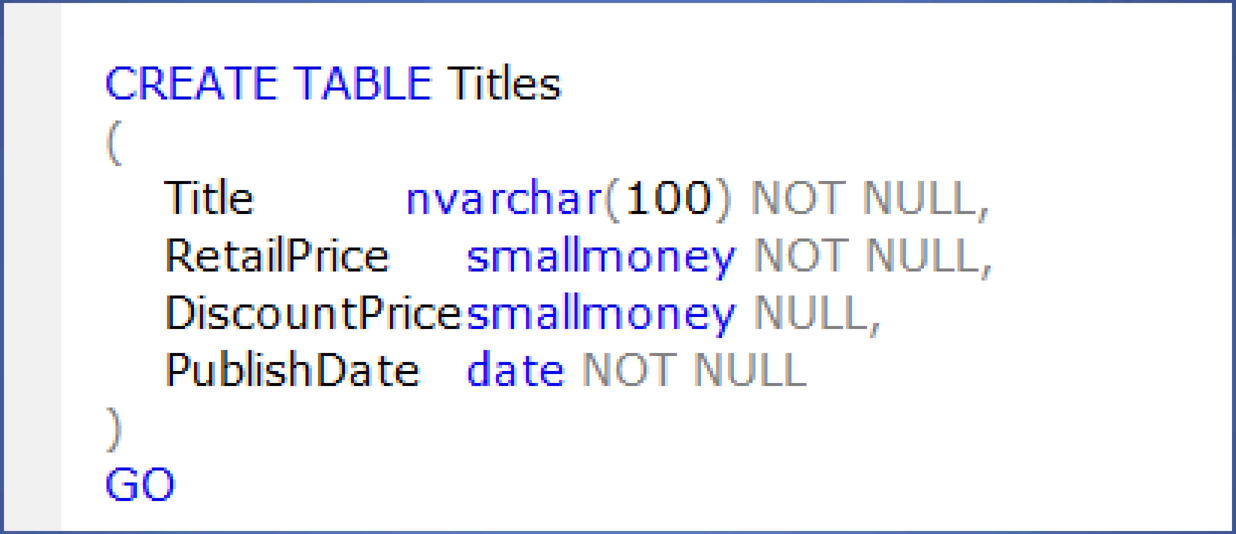
- Constraints define acceptable values
- Types of constraints
  - Field: Not Null, Check, Unique, Primary Key, Foreign Key
    - These are Domain Constraints
  - Table: Check, Unique, Primary Key, Foreign Key
    - These are Entity Constraints

Required Fields

- Required fields must be set to NOT NULL
  - Fields accept Null by default
  - Null means missing, not known

StudentID CHAR(9) NOT NULL

Required and Optional Fields



```
CREATE TABLE Titles
(
    Title          nvarchar(100) NOT NULL,
    RetailPrice    smallmoney NOT NULL,
    DiscountPrice  smallmoney NULL,
    PublishDate    date NOT NULL
)
GO
```

Check Constraints

- Check Constraint
  - Can set a range or end points
  - Can specify that value must be in a list
  - Can specify that data has a pattern
- Can test a column or table (row)
  - Domain constraint defines what will be found in column
  - Entity constraint defines what exists in a row
- A single test applied to multiple columns must be done at the table level
  - A project must have an end date after the start date

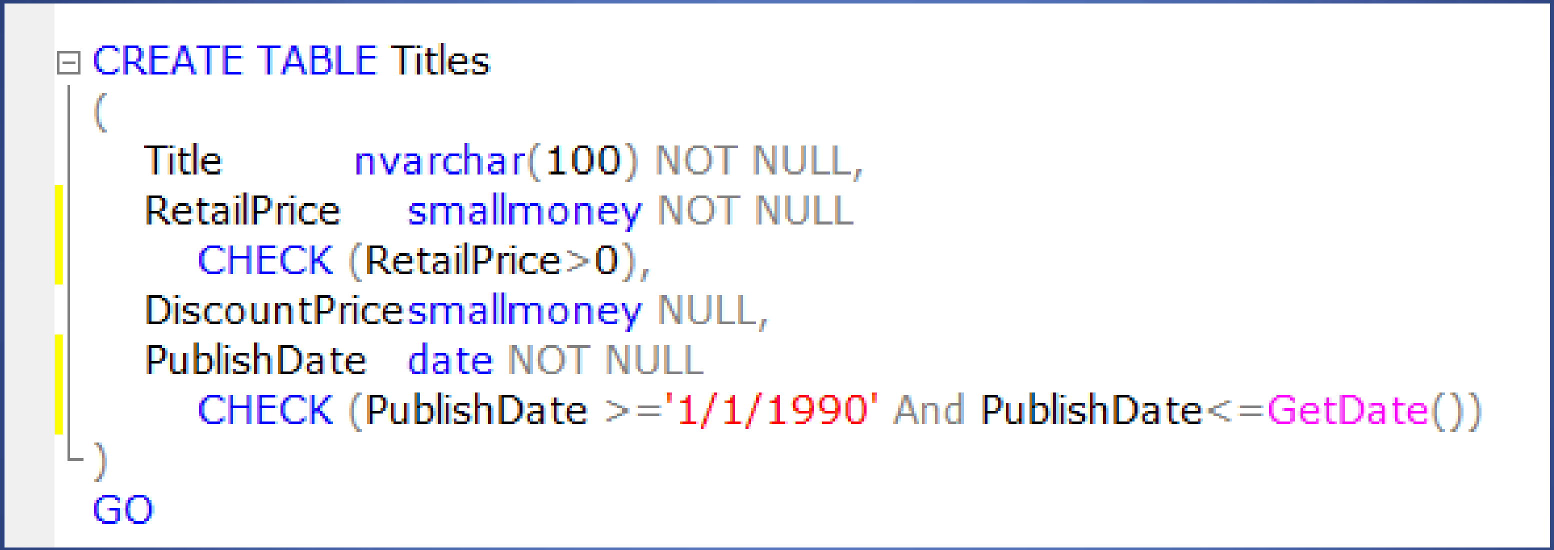
Operators

- Relational operators describe how to compare numbers, dates
  - =, >, <, <>, >=, <=
- Like compares patterns
- In tests to see if a value is in a list
- Logical
  - And, Or tie together multiple tests
  - Not generates the inverse

Ranges

- Typically used with numbers and dates
- Can test for a single endpoint
  - GPA <= 4
  - Birthday < GetDate()
- Can test for two endpoints
  - Credits Between 1 and 10
  - Credits >=1 And Credits <=10

Using Ranges



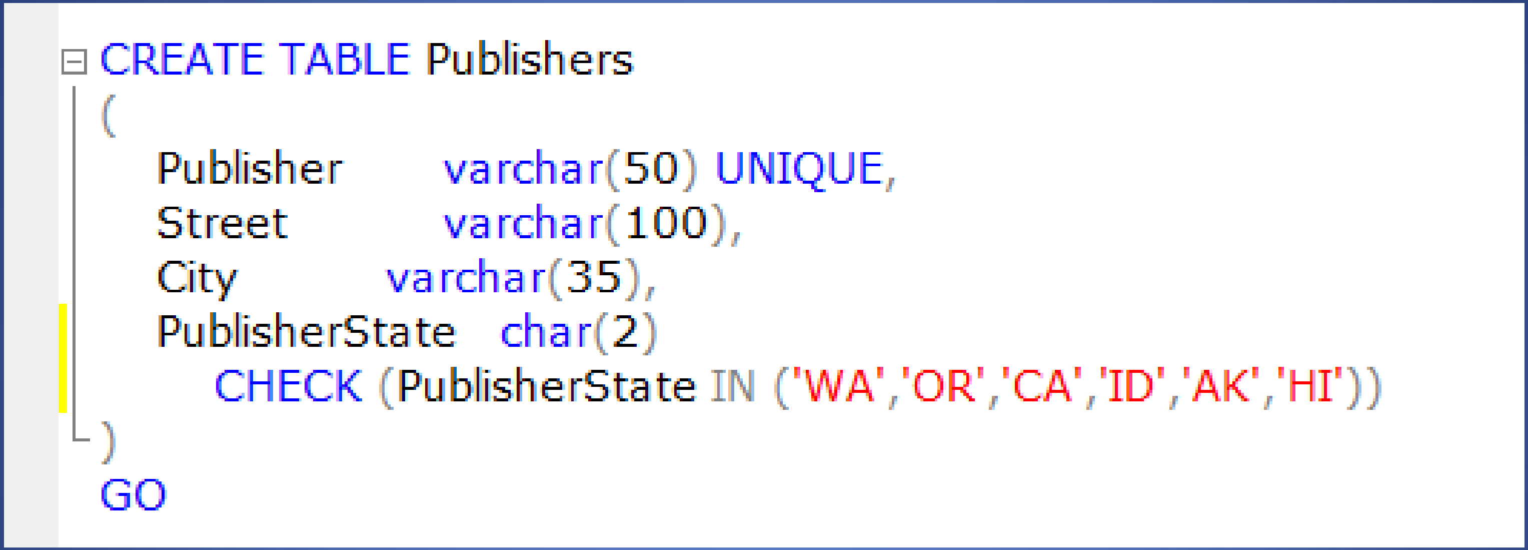
```
CREATE TABLE Titles
(
    Title          nvarchar(100) NOT NULL,
    RetailPrice      smallmoney NOT NULL
        CHECK (RetailPrice>0),
    DiscountPricesmallmoney NULL,
    PublishDate    date NOT NULL
        CHECK (PublishDate >='1/1/1990' And PublishDate<=GetDate())
)
GO
```

Comparing to List

- Can specify that a value must be found in a group
- Different from a range!
  - Being in the list of 1, 2, 3, 4, 5 is different from being between 1 and 5
- Values separated by comma

  Department IN (‘CIS’,’CS’,’CNA’)

Using a List



```
CREATE TABLE Publishers
(
   Publisher       varchar(50) UNIQUE,
   Street          varchar(100),
   City         varchar(35),
   PublisherState   char(2)
      CHECK (PublisherState IN ('WA','OR','CA','ID','AK','HI'))
)
GO
```

Pattern Matching

- Used when text data has specific characteristics
  - Course number must be three numbers
  - Department must be 2 or 3 letters
- Can test for letters, numbers, other characters

Pattern Matching Syntax

- Use Like

  Department LIKE 'C__'

  This is a single underscore

- Can use wildcards
  - Single character is _ (underscore)
  - No, one or many characters is % (per cent)
- Use brackets if have options in a position

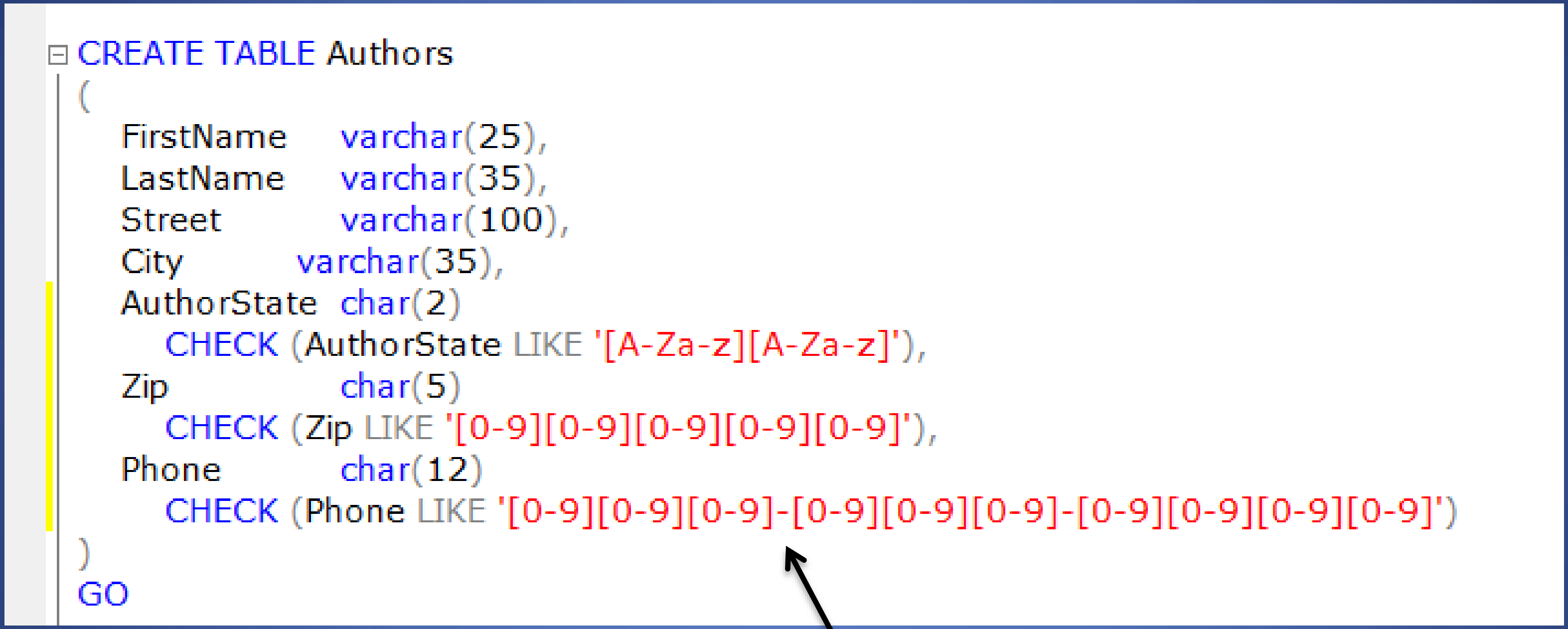
  Department LIKE '[A-Z][A-Z][A-Z][A-Z]'

  (Department must be at least two letters, with a letter or space included in last two positions)

  CourseNumber LIKE '[0-2][0-9][0-9]'

  (numbers must start with 0, 1, or 2 and be three digits)

Using Patterns



```
CREATE TABLE Authors
(
    FirstName     varchar(25),
    LastName      varchar(35),
    Street        varchar(100),
    City      varchar(35),
    AuthorState  char(2)
        CHECK (AuthorState LIKE '[A-Za-z][A-Za-z]'),
    Zip           char(5)
        CHECK (Zip LIKE '[0-9][0-9][0-9][0-9][0-9]'),
    Phone         char(12)
        CHECK (Phone LIKE '[0-9][0-9][0-9]-[0-9][0-9][0-9]-[0-9][0-9][0-9][0-9]')
)
GO
```

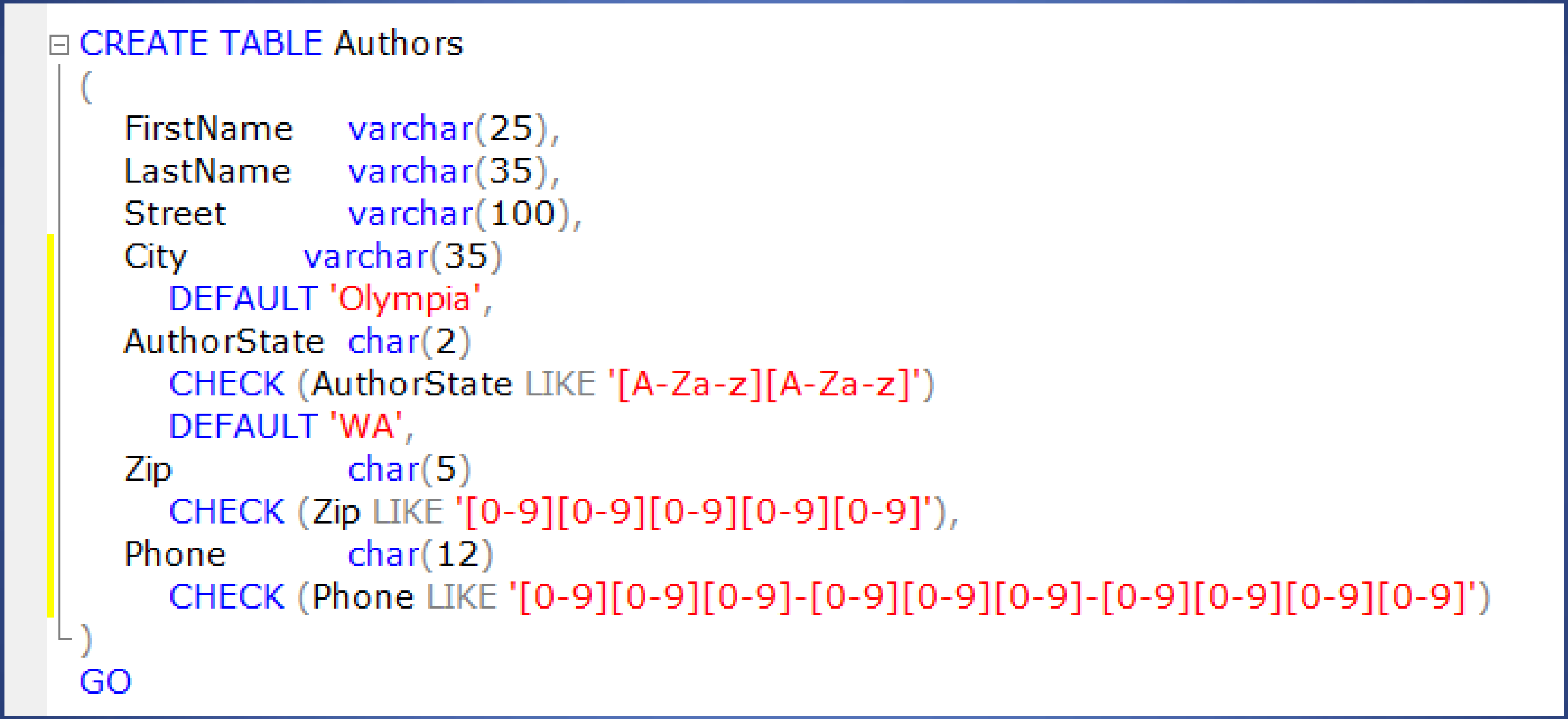
Pattern for Phone includes literals (dashes)

Default Values

- Allows a standard value to be entered in a field
- Default value must satisfy data type requirements
- Can use a literal value or result of a calculation

FirstName varchar(25) DEFAULT ‘Randy’

Using Default Values



```
CREATE TABLE Authors
(
    FirstName     varchar(25),
    LastName      varchar(35),
    Street        varchar(100),
    City        varchar(35)
        DEFAULT 'Olympia',
    AuthorState  char(2)
        CHECK (AuthorState LIKE '[A-Za-z][A-Za-z]')
        DEFAULT 'WA',
    Zip           char(5)
        CHECK (Zip LIKE '[0-9][0-9][0-9][0-9][0-9]'),
    Phone         char(12)
        CHECK (Phone LIKE '[0-9][0-9][0-9]-[0-9][0-9][0-9]-[0-9][0-9][0-9][0-9]')
)
GO
```

Domain or Entity

- Most constraints can be applied to a table
  - Not part of the field definition – can remove constraint without changing field
  - A constraint involving multiple columns must be done at the table level
- Entity constraint:
  - The Discount Price must be less than the Retail Price
  - Describes what the row needs to be valid
- Domain Constraint
  - The Retail Price must be more than zero
  - Describes what the field needs to be valid

Unique Constraints

- Value entered into a field or fields must be different for each row
  - Student ID must be different for every student
  - ISBN must be different for every book

```
StudentID CHAR(9) UNIQUE
```

Primary Key Constraint

- Primary key constraint provides a way to get a single row in a table
  - May be one or more fields
    - If using multiple fields must be table-level
    - Definition of a field can only be about that field
  - Any field that is part of the primary key must have data

```
StudentID char(9) NOT NULL PRIMARY KEY
ALTER TABLE Publishers
    ADD CONSTRAINT pkPublishers
    PRIMARY KEY (PublisherID)
```

Identity

- SQL Server has a method to create an autonumber (auto-increment)
  - Only 1 identity field per table
- Specify fieldname, data type, follow with IDENTITY
  - Can optionally include the SEED and INCREMENT
    - Seed represents the starting value (defaults to 1)
    - Increment is the value to change by (defaults to 1)

CourseID INT IDENTITY

PublisherID INT Identity(101,10) PRIMARY KEY

Foreign Key Constraint

- Value in one table must have related/associated value in a second table
- Foreign key can be single or multiple columns
  - If more than one column must be done as table-level constraint

Foreign Key Syntax

CONSTRAINT fk_Name FOREIGN KEY (field list) REFERENCES TableName(field list)

- First field list is about the current table (many side)
- TableName is about the table on the one-side
- Second field list is optional if you're referring to a primary key of that second table

Working With Constraints

- Constraints can be named
  - Makes it easier to change or remove the constraint later
- If not named, SQL Server will create a name
  - Every object needs an identifier!

Using ALTER

- ALTER is used to change an existing object
  - Keeps current settings – including permissions
- DROP is used to remove an object
  - can CREATE after DROPping but would need to reset permissions

Example Constraints

- Change an existing table:

  ALTER TABLE Students

  CONSTRAINT ck_StudentID

  CHECK (StudentID LIKE ‘875-[0-9][0-9]- [0-9][0-9][0-9][0-9]’)

- Create a new table with constraint

  CREATE TABLE Courses

  (

  Department VARCHAR(3)

  CHECK (Department IN (‘CIS’,’CS’,’CNA’)

)