Table Components

- Rows
- Columns
- Primary Key
- Foreign Key
- Identity Columns
- Null Values

- Data Types
  - Exact Numerics
  - Approximate Numerics
  - Date and Time
  - Character Strings
  - Unicode Character Strings
  - Binary Strings
- Data Type Conversions

Characteristics of a Table

- Similar to an Excel spreadsheet
- An object within a database to store data
- Contains one or more columns and zero or more rows
- Each column has a defined data type
- Columns can be set to allow or prevent null values

Column Name	Data Type	Allow Nulls
EmployeeId	int	☐
LastName	nvarchar(20)	☐
FirstName	nvarchar(20)	☐
Title	nvarchar(30)	☑
ReportsTo	int	☑
BirthDate	datetime	☑
HireDate	datetime	☑
Address	nvarchar(70)	☑
City	nvarchar(40)	☑
State	nvarchar(40)	☑
Country	nvarchar(40)	☑
PostalCode	nvarchar(10)	☑
Phone	nvarchar(24)	☑
Fax	nvarchar(24)	☑
Email	nvarchar(60)	☑

Primary Key

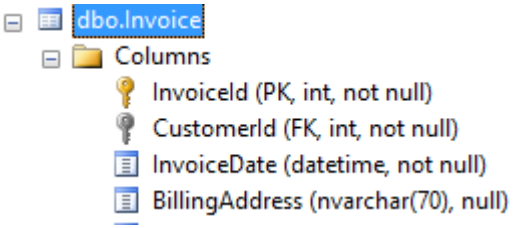
- The Primary Key is a column or set of columns that makes a record unique in a table
- When the primary key is set SQL Server will not allow a duplicate key value to be entered into the table
- It is recommended that all tables have a primary key
- An incrementing numeric column is commonly used as a primary key

	Column Name
🔑	InvoiceId
	CustomerId
	InvoiceDate
	BillingAddress
	BillingCity
	BillingState
	BillingCountry
	BillingPostalCode
	Total

	InvoiceId	CustomerId	InvoiceDate
1	1	2	2009-01-01 00:00:00.000
2	2	4	2009-01-02 00:00:00.000
3	3	8	2009-01-03 00:00:00.000
4	4	14	2009-01-06 00:00:00.000
5	5	23	2009-01-11 00:00:00.000
6	6	37	2009-01-19 00:00:00.000
7	7	38	2009-02-01 00:00:00.000
8	8	40	2009-02-01 00:00:00.000
9	9	42	2009-02-02 00:00:00.000
10	10	46	2009-02-03 00:00:00.000
11	11	52	2009-02-06 00:00:00.000
12	12	2	2009-02-11 00:00:00.000

Foreign Key

- A Foreign Key references the primary key in another table
- A table can have multiple foreign keys and the values do not have to be unique
- The value of the foreign key must exist in as a primary key in the table it references



	InvoiceId	CustomerId	InvoiceDate
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2	2	4	2009-01-02 00:00:00.000
3	3	8	2009-01-03 00:00:00.000
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5	5	23	2009-01-11 00:00:00.000
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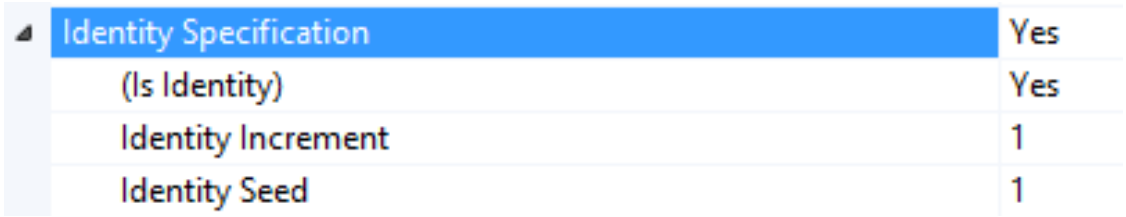
Identity Column

- An Identity Column is a numeric column that is automatically incremented when a new record is added to a table. The default increment is 1
- Identity Columns are often used as table primary keys
- You cannot manually insert into or update an identity column



NULL values

- Null is an undefined value
- Null is not the same as a blank value
- Think of Null as a question that hasn't been answered or isn't applicable

```
SELECT TOP 1000 [CustomerId]
      ,[FirstName]
      ,[LastName]
      ,[Company]
  FROM [Chinook].[dbo].[Customer]
```

	CustomerId	FirstName	LastName	Company
1	1	Luís	Gonçalves	Embraer - Empresa Brasileira
2	2	Leonie	Köhler	NULL
3	3	François	Tremblay	NULL
4	4	Bjørn	Hansen	NULL
5	5	František	Wichterlová	JetBrains s.r.o.
6	6	Helena	Holý	NULL
7	7	Astrid	Gruber	NULL
8	8	Daan	Peeters	NULL
9	9	Kara	Nielsen	NULL

Column Data Type Categories

- Exact numerics
- Approximate numerics
- Date and Time
- Character strings
- Unicode character strings
- Binary strings

Exact Numerics

- Exact number data types store numbers of varying precision. The more precise the datatype, the more space each value takes up in the database

Data Type	Definition	Example
bit	Can only contain bit values (i.e. 1 or 0)	1 or 0
int	Can only contain whole numbers	100500 -256
decimal(p,s) or numeric(p,s)	Can contain whole or decimal numbers. Total digits and decimal places must be predefined and cannot exceed 38 places	123.5 0.4561234
money	Numeric value with max 4 decimal places	1001.3400

Approximate Numerics

- Float and Real are used when the precision of a number may exceed 38 places.
- These datatypes are primarily used in mathematics where extra precision is required.

Data Type	Definition	Example
float	Used for numbers that exceed 38 digits. May not return an exact value.	1.79E+308
real	Similar to float but has a smaller range.	3.40E+38

Date and Time

- Date and time data types can store a date, a time, or both

Data Type	Definition	Example
date	Stores a date	12-25-2015
time	Stores time to the 100th nano second	11:45:59:999999999
datetime	Stores date and time to the hundredth second.	12-25-2015 11:45:59:999
datetime2	Same as datetime but more precise and greater range.	12-25-9915 11:45:59:9999999

Character Strings

- Use character strings for storing standard alphanumeric data special characters
- This generally includes all the characters you will find on an American keyboard

Data Type	Definition	Use
Char(n)	Stores character data as a fixed length up to 8,000 bytes. Includes trailing spaces	Best for character data with a fixed width like zip codes
Varchar(n)	Stores character data as a variable up to 8,000 bytes	Best for character data that may vary in length
Varchar(max)	Stores character data up to 2 GB	Best for very large amounts of character data like an essay

Unicode Character Strings

- Use Unicode character when you may be storing characters special characters or foreign languages (e.g. Chinese)
- Unicode characters take up twice as much space in the database as standard characters

Data Type	Definition	Use
nchar(n)	Stores character data as a fixed length up to 4,000 bytes. Includes trailing spaces	Best for foreign character data with a fixed width
nvarchar(n)	Stores character data as a variable up to 4,000 bytes	Best for foreign character data that may vary in length
nvarchar(max)	Stores character data up to 2 GB	Best for very large amounts of character data

Binary Strings

- Binary strings are used to store data such as encrypted passwords, entire documents and images.
- Number and string values converted to binary format cannot be viewed in the query result window unless they are converted back to there original type.

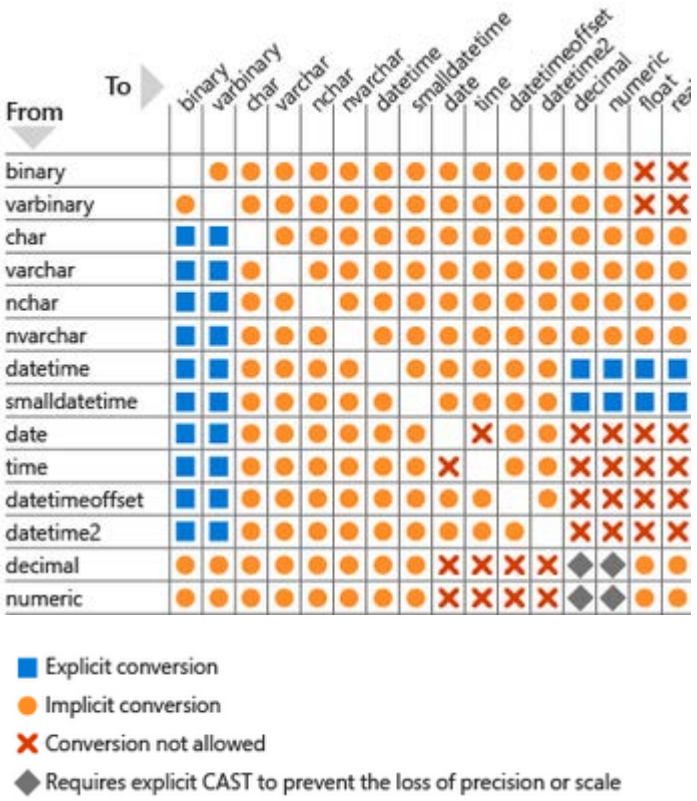
Data Type	Definition	Use
binary(n)	Stores binary data as a fixed length up to 8,000 bytes.	Best for binary data with a fixed width
varbinary(n)	Stores character data as a variable up to 4,000 bytes	Best for binary data that may vary in length
varbinary(max)	Stores character data up to 2 GB	Best for storing objects like Word documents or Images

Other Data Types

- There are other SQL Server data types we will not be covering in this class
- Go to https://msdn.microsoft.com/en-us/library/ms187752.aspx for a complete list of available data types

Data Type Conversions

- Data must be of the same datatype if you wish to compare them to one another
- Implicit Conversion is when SQL Server can convert the datatypes without any prompting
- Explicit Conversion is when a CAST or CONVERT function must be used to convert the datatype



View full chart at:
https://msdn.microsoft.com/en-us/library/ms191530.aspx

Summary

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- Columns
- Primary Key
- Foreign Key
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- Null Values

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