Features of relational databases

Unit 18 Database Design
Extended Diploma in ICT
Entities

- An entity is a thing or object of importance about which we will store data.
- Examples are:
  - Car, Student, Product, Transaction, Tax payer
- An entity normally has one table in the database
Attribute

- An attribute describes a property of the entity.
- For the entity Car, the attributes could be:
  - VIN (vehicle identification number)
  - Colour
  - Engine size
  - Fuel type
- An attribute is a column in the table and the value of the attribute is stored in the field in the column.
### Tables

<table>
<thead>
<tr>
<th>Entity</th>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tblCAR</td>
<td>VIN</td>
<td>1M8GDM9A8KP042788</td>
</tr>
<tr>
<td></td>
<td>Colour</td>
<td>Blue</td>
</tr>
<tr>
<td></td>
<td>Engine Size</td>
<td>1499</td>
</tr>
<tr>
<td></td>
<td>Fuel Type</td>
<td>Petrol</td>
</tr>
</tbody>
</table>
Data types – MS Access

• Short text (default)
  • Use for text or combinations of text and numbers, such as addresses, or for numbers that do not require calculations, such as phone numbers, part numbers, or postal codes.
  • Stores up to 255 characters. The FieldSize property controls the maximum number of characters that can be entered.

• Long text
  • Use for lengthy text and numbers, such as notes or descriptions.
  • Stores up to 65,536 characters.

• Number
  • Use for data to be included in mathematical calculations, except calculations involving money (use Currency type).
  • Use for foreign keys if the original key (i.e. Primary key in the home table) is autonumber
  • Stores 1, 2, 4, or 8 bytes. The FieldSize property defines the specific Number type.
Data types – MS Access

- **Date/Time**
  - Use for dates and times.
  - Scroll down to format and choose appropriate option.
  - Stores 8 bytes.

- **Currency**
  - Use for currency values and to prevent rounding off during calculations.
  - Stores 8 bytes.

- **AutoNumber**
  - Use for unique sequential (incrementing by 1) such as a primary key, or random numbers that are automatically inserted when a record is added.
  - Stores 4 bytes.
Data types – MS Access

• **Yes/No**
  - Use for data that can be only one of two possible values, such as Yes/No, True/False, On/Off. Null values are not allowed.
  - Appears as check boxes:
  - Stores 1 bit.

• **OLE Object**
  - Use for OLE objects (such as Microsoft Word documents, Microsoft Excel spreadsheets, pictures, sounds, or other binary data) that were created in other programs using the OLE protocol.
  - Stores up to 1 gigabyte (limited by disk space).

• **Hyperlink**
  - Use for hyperlinks. A hyperlink can be a UNC path or a URL.
  - Stores up to 64,000 characters
The relationship between tables is defined by keys

A primary key is an attribute which uniquely identifies each record in a table

Tables can be linked by foreign key

A foreign key is the key in one table which is the primary key in the related table
Keys

<table>
<thead>
<tr>
<th>ID</th>
<th>Initial</th>
<th>Surname</th>
<th>Title</th>
<th>Address</th>
<th>Postcode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>Smith</td>
<td>Mrs</td>
<td>4 High St, Hereford</td>
<td>HR1 1ZX</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
<td>Miles</td>
<td>Mr</td>
<td>72 Castle Road, Ledbury</td>
<td>HR7 AA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DogID</th>
<th>Dog Name</th>
<th>Gender</th>
<th>DOB</th>
<th>Breed</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ant</td>
<td>M</td>
<td>21/08/02</td>
<td>Alsatian</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Dec</td>
<td>M</td>
<td>21/08/02</td>
<td>Alsatian</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Jordan</td>
<td>F</td>
<td>08/08/04</td>
<td>Terrier</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Rooney</td>
<td>M</td>
<td>23/10/05</td>
<td>Poodle</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Fang</td>
<td>M</td>
<td>14/03/07</td>
<td>Chihuahua</td>
<td>2</td>
</tr>
</tbody>
</table>
Setting up relationships
Setting up relationships

Database tools;
Relationships
link Primary key to foreign key
Referential integrity

- The value of a foreign key must be a value of the primary key in the related table
- When all the values match in all the tables, then the database has referential integrity
Referential integrity - rules

• Must be enforced

1. Cannot add a record to a table (tbl2) unless the foreign key to be used already exists as a primary key in the other table (tbl1).
2. If a record is deleted for a primary key in tbl1 then all corresponding records with that foreign key must be deleted in tbl2.
3. If the primary key for a record in tbl1 is altered then all the corresponding records in tbl2 must be changed.
Validation

- Validation controls the entry of data into the database. (design view, field properties)
- A validation mask can be set to capitalise all names, for instance
  - To force the first letter of a name to a capital
  - Input mask: >L<????????????????
  - Where:
    - > makes what follows uppercase
    - L requires a letter
    - < makes what follows lower case
    - ? Letters are optional (digits not allowed)
  - So wiLliAms becomes Williams
Validation

• Rules can be used on data entry to check if the data is valid
  • Date of birth should be before today
  • Validation Rule: < Date()
  • Validation Text: Enter a date prior to today
  • The text will be shown if the date entered is today or in the future.

![Validation Rules Table]

<table>
<thead>
<tr>
<th>Format</th>
<th>Input Mask</th>
<th>Caption</th>
<th>Default Value</th>
<th>Validation Rule</th>
<th>Validation Text</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;Date()</td>
<td>DOB must be before today.</td>
</tr>
</tbody>
</table>

![Image of Validation Rules Table]
Assessment (Criteria P1)

• Prepare a presentation (up to 10 slides) which explains:
  • How business information can be represented using entities and attributes
  • How entities can be related to each other using primary and foreign keys
  • What is meant by referential integrity
  • How data can be validated when entered into a database
• Provide examples
Assessment (Criteria M1)

• Extend your presentation (up to 8 more slides) and explain:
  • How referential integrity is set in a database
  • What errors are detected when referential integrity is set
  • How these errors can be corrected
  • How data can be recovered from multiple tables by the use of the primary and foreign keys

• Provide examples. Submit to L3U18A1