Tutorial Objectives:
- to develop further understanding of detailed data modelling
- to practise normalisation (detailed data modelling) skills

Tutorial Task:
1. Provide short answers to the following questions:
   a) What are the objectives of the process of normalising data?
   b) What is meant by the term 'primary key'?
   c) What is meant by the term 'foreign key'?
   d) What is meant by the term 'candidate key'?
   e) What is meant by the term 'functional dependency'?
   f) Describe the steps required to convert an unnormalised relation to Third Normal Form relations.

2. Investigate the data in the following examples to establish all the business rules. Some clues are given in each case. Then use the steps of normalisation to fully normalise the data given. Check your answer by drawing a data structure diagram for the answer and comparing it with the expected diagram of your business rules.

   a) EMPLOYEE (EMP-NO., EMP-NAME, SALARY, (PROJ-NO, PROJ-NAME, COMPLETION-DATE))
      [Each project has a due date by which completion is expected.]

   b) EMPLOYEE (EMP-NO, EMP-NAME, EMP-LOCATION, DEPT-NO, DEPT-NAME)
      [Each employee has an office that is his/her "location"]

   c) PROGRAMMER (PROGRAMMER-ID, PROGRAMMER-NAME, (PACKAGE-NO, PACKAGE-NAME, NO-HRS-WORKED)
      [A package is a collection of programs. Several programmers may work on the same package at the same time. For costing purposes, the Department wants to know how many hours each programmer spent on each package.]

   d) PART (PART-NO, PART-DESCRIPTION, (SUPPLIER-NO, SUPPLIER-NAME, SUPPLIER-ADDRESS, PRICE))
      [The same part may be available from different suppliers at different prices.]

   e) EMPLOYEE (EMP-NO, EMP-NAME, (SKILL-CODE, SKILL-DESC), SALARY)
      [An employee's initial salary may have taken his skill levels into account but there is no direct relationship between skills and salary level.]

   f) REGION (REGION-NAME, REGION-MANAGER, LOCATION (CUST-NAME, CUST-ADDRESS))
A customer is serviced only by his local region. Any customers with multiple branches are given different customer names.

3. The data in the following table contains an example of data which is not fully normalised.
   - Use the data in the table to describe how “anomalies” can occur when data is maintained which is not in third normal form.
   - Explain the purpose of the normalisation process and why it is desirable to have normalised data. Express the data in the table below in third normal form.

<table>
<thead>
<tr>
<th>Book-no</th>
<th>Copy</th>
<th>Call-no</th>
<th>Borrower-no</th>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1256</td>
<td>3</td>
<td>102.64c</td>
<td>12345</td>
<td>Adams</td>
<td>Brighton</td>
</tr>
<tr>
<td>3297</td>
<td>1</td>
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<td>35666</td>
<td>Boyle</td>
<td>Caulfield</td>
</tr>
<tr>
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<td>785.99e</td>
<td>24287</td>
<td>Boyle</td>
<td>Frankston</td>
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<tr>
<td>1256</td>
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<td>35926</td>
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<td>Dent</td>
<td>Prahran</td>
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<tr>
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<td>229.89d</td>
<td>35926</td>
<td>Brown</td>
<td>Caulfield</td>
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</tbody>
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