The covering set method is a method of trying to solve the error localisation problem, which itself is a step in the editing of erroneous data. While data editing is the process of correcting erroneous data, the error localisation problem is the problem of deciding which fields to correct in an erroneous record.

The covering set method consists of two steps. The first step is the generation of new edits from the explicit edits. The second step is the finding of covering sets.

The covering set method is not necessarily successful, in the sense that the covering sets that are output are not necessarily all and only error localisation solutions. The success of the covering set method depends on the edit generation function chosen for the first step of the covering set method.

The covering set method is guaranteed to be successful if the edit generation function used in the first step has the property of covering set correctibility, which means having both error correction totality and the error correction guarantee, defined as follows. The edit generation function has error correction totality when the corresponding covering set method outputs all error localisation solutions. The edit generation function has the error correction guarantee when the corresponding covering set method outputs only the error localisation solutions.

In this thesis we have formalised the two main aspects of the covering set method in terms of classical propositional logic, for both categorical edits and arithmetic edits. The two aspects are edit generation functions and covering set correctibility.

Firstly, edit generation functions can be formalised as logical deduction functions for propositional logic. In particular, the edit generation function FH turns out to be essentially the same as propositional resolution deduction.

The second aspect of the covering set method, namely the property of covering set correctibility, turns out to be a strengthening of soundness and refutation completeness. In particular, error correction totality is a strengthening of soundness, and the error correction guarantee is a strengthening of refutation completeness.

Since the error correction guarantee and refutation completeness are related, and FH and propositional resolution are related, it is not surprising that the proofs of the error correction guarantee of FH and of the refutation completeness of propositional resolution are also related. The two proofs depend on related properties: the lifting property for the error correction guarantee of FH and the reduction property for counter-examples for propositional resolution.
The lifting property comes into play in the proof of the error correction guarantee of another function, written as $\text{FCF}_\omega$ and derived from the Field Code Forest Algorithm. Although the error correction guarantee of $\text{FCF}_\omega$ has been questioned, this thesis gives a full proof of both the error correction guarantee and error correction totality of $\text{FCF}_\omega$.

The parallel between the error correction guarantee and refutation completeness extends beyond the parallels between proofs. It extends to parallels between the problems these properties are connected to, namely the error localisation problem and the propositional satisfiability problem (SAT). In particular it extends to the solution of the two problems by a pure deduction method. In both cases, the pure deduction method succeeds when the deduction function used has special properties: in the case of error localisation the special property is covering set correctibility, while in the case of SAT the pure deduction method succeeds when the special property is refutation completeness and soundness. What is more, there are parallels between the deduction functions used to solve the two problems: two of the successful functions for error localisation, namely FH and $\text{FCF}_\omega$, are respectively essentially the same as resolution deduction and ordered resolution which are two of the successful functions for SAT.

The existence of strong parallels between the error localisation problem and SAT means that the methods of solving SAT might be able to be extended to the methods of solving the error localisation problem, or vice versa. Since there is a vast range of techniques for solving SAT, there is hope that some of those techniques could be modified for the error localisation problem.

The results described above, formalising edit generation functions and covering set correctibility in terms of propositional logic, apply equally to categorical edits and arithmetic edits. The formalisation for arithmetic edits is different from that for categorical edits, but the same results nonetheless apply. The edit generation functions can be formalised as propositional deduction functions, and covering set correctibility is a strengthening of soundness and refutation completeness. In particular, the covering set correctibility of the edit generation function $\text{FM}$ is a strengthening of Farkas’ Lemma.

There are many possible directions in which this work could be further developed:

1. The theoretical work is now almost ready to develop an implementation using propositional consequence finders.

2. The theoretical work could be extended to methods other than the pure deduction method for solving the error localisation problem.

3. The various details about arithmetic edits need to be tidied up and the work on arithmetic edits needs to be integrated with categorical edits.

4. Integer edits, which have characteristics both of arithmetic and categorical edits, could also be formalised.

5. Although this work has formalised data arranged in tables in terms of propositional logic, it could be that data arranged in relational databases could be formalised in terms of modal logic.
6. When the details of possible implementations are decided, then it will be necessary to assess their computational complexities.

This thesis has shown that there are many benefits of investigating the covering set method from the point of view of logic. Logic gives an alternative way of analysing the problem and thus potentially gives new insights. Logic also has a collection of sophisticated automated tools that could potentially be modified to use covering set correctibility for solving error localisation problems. Finally the strong parallels between propositional logic and data editing are of aesthetic appeal.