Consider a $3 \times 3$ array of 9 switches

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1 2 3
4 5 6
7 8 9
```

Suppose each switch $1, 2, \ldots, 9$ can be either on or off, and that toggling any switch will automatically toggle all its immediate neighbours. For example, toggling switch 5 will also toggle switches 2, 4, 6 and 8, and toggling switch 6 will also toggle switches 3, 5 and 9.

(a) Devise (i) a state space and (ii) transition relation to represent the behaviour of the array of switches. [4 + 6 marks]

(b) You are given the problem of getting from an initial state in which even numbered switches are on and odd numbered switches are off, to a final state in which all the switches are off.

Write down predicates on your state space that characterise the (i) initial and (ii) final states. [2 + 2 marks]

(c) Explain how you might use a model checker to find a sequence of switches to toggle to get from the initial to final state. [6 marks]

You are not expected actually to solve the problem, but only to explain how to represent it in terms of model checking.