

13 Temporal Logic and Model Checking (MJCG)

In the following program, called `INC`, `(*)` is a Boolean expression that evaluates non-deterministically to either true or false each time it is evaluated (different evaluations may yield different results).

```
N := 1;  
WHILE (*) DO N := N+1;  
N := 0;
```

- (a) Devise and carefully describe a state space and transition relation to model this program. [8 marks]
- (b) Devise temporal logic formulae that express properties (i), (ii) and (iii) below. In each case state which temporal logic you are using and explain whether the property is true in your model.
- (i) Every execution of `INC` terminates. [4 marks]
- (ii) Some execution of `INC` terminates. [4 marks]
- (iii) If `INC` terminates, then `N = 0` holds in the terminating state. [4 marks]