Topics in Concurrency

(a) (i) Describe the modal $\mu$-calculus and its semantics. [4 marks]

(ii) Describe how to express maximum fixed points $\nu Y.A$ in terms of minimum fixed points. [1 mark]

(b) (i) Describe an algorithm to determine whether a state in a finite-state transition system satisfies an assertion in the modal $\mu$-calculus. [4 marks]

(ii) Explain briefly why the algorithm always terminates. [3 marks]

(iii) Use the algorithm to determine whether or not the state $s$ in the labelled transition system below satisfies the assertion $[a] \nu Y.([b]T \land [b]Y)$, where $T$ stands for “true”.

(iv) Describe, without proof, the meaning of the assertion from the modal $\mu$-calculus in part (b)(iii) above. [2 marks]