12 Topics in Concurrency (JMH)

(a) Define when a relation $R$ is a (strong) bisimulation and define bisimilarity. [3 marks]

(b) Let the pure CCS processes $P$ and $Q$ be

$$ P \overset{\text{def}}{=} a.Q \quad Q \overset{\text{def}}{=} b.P $$

(i) Show that: $a.b.P + b.a.Q \sim P + Q$ [4 marks]

(ii) Use the local model checking algorithm to show that

$$ P \vdash \nu X((\cdot)T \land [\cdot]X) $$

reduces to true [4 marks]

(iii) Given that $a.(b.nil + Q) \vdash \nu X((\cdot)T \land [\cdot]X)$ reduces to false, are $P$ and $a.(b.nil + Q)$ bisimilar? State carefully but do not prove any results upon which your answer relies. [3 marks]

(c) Explain how bisimilarity $\sim$ is a greatest fixed point. State carefully but do not prove any results upon which your answer relies. [6 marks]