Topics in Concurrency Ch. 2 2004

(a) ~~EF~~ We assume a labelled transition system. A formula of the modal μ-calculus denotes a subset of states (those at which it is true).

$$[\![T]\!] = S \quad \text{all states}$$

$$[\![F]\!] = \emptyset \qquad [\![U]\!] = U \text{ where } U \subseteq S.$$

$$[\![A \wedge B]\!] = [\![A]\!] \cap [\![B]\!]$$

$$[\![\neg A]\!] = S \setminus [\![A]\!]$$

$$[\![\langle a\rangle A]\!] = \{ s \in S \mid \exists s'.\ s \xrightarrow{a} s' \ \& \ s' \in [\![A]\!] \}$$

$[\![\mu X . A]\!]$ is the least ~~set~~ subset $U \subseteq S$ st

$$[\![A[U/X]]\!] \subseteq U$$

(b) (i) $\nu Z . \langle c\rangle Z$ is satisfied by all states able to an infinite chain of c's

(ii) equivalence to false.

(iii) able to do a maximal chain of c's along which A always holds

(iv) A until B along a path of c's at which B holds eventually.

~~(v)~~

(v) A until B along a path of c's (B does not need to hold eventually).

(c)

$$\begin{tikzcd} p \arrow[r, bend left, "c"] & q \arrow[l, bend left, "c"] \end{tikzcd}$$

(i) No. Consider the approximants

F,

$[c]F \vee (\langle c\rangle T \wedge \langle c\rangle F) = F$

as $[c]F = F$ in the transition system and $\langle c\rangle F = F$ always. Hence all the approximants are F and the formula is always false in this transition system.

(ii) Yes. Consider the approximants.

T,

$[c]F \vee (\langle c\rangle T \wedge \langle c\rangle T) = \langle c\rangle T = T$

as $[c]F = F$ and $\langle c\rangle T$ in the transition system. Hence the assertion is always true in the transition system. ⌧