Example Exam Introduction to Formal Methods (2IF80)

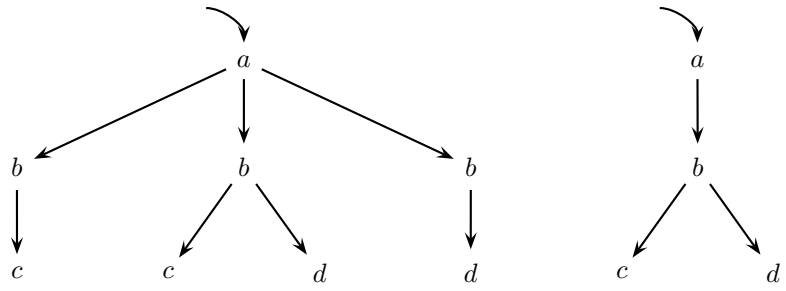
June 2005

Items	1(a)	1(b)	2(a)	2(b)	3(a)	3(b)
Points	15	15	10	30	20	10

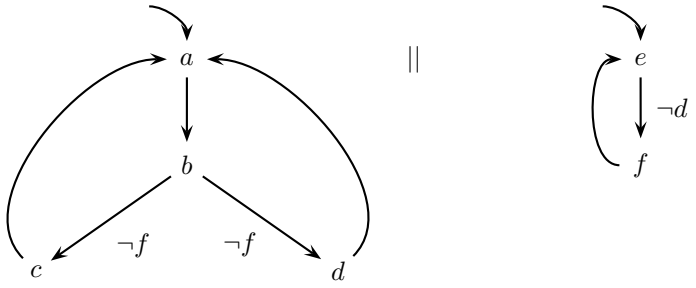
Exercise 1 Consider the two systems given as pictures below.

(a). Give a CTL formula that distinguishes between the systems in the sense that the formula is true in the starting state of one of them but not in the starting state of the other. a, b, c and d are propositions, true in the states where they are present. Argue that no such formula can be written in LTL.

(b). Interpret the pictures in terms of actions: an action follows another action if an arrow leads to it from that action. The actions to which the start-arrow points should be interpreted as the firts actions. Give two process algebra terms that describe the two models. Argue whether or not the terms are trace equivalent and/or failure equivalent.



Exercise 2 Consider the following system consisting of two parallel processes. The propositions $a, b, ...$ are true iff control is at that place in the system. Assertions on the transitions are to be interpreted as guards: a transition can only be made if the guard is true.



(a). Draw the model $\mathcal{M}$ for this system.

(b). Show by model checking, using the labelling algorithm (as in the Huth/Ryan handouts), for each of the following formulas whether or not it holds in the initial state of $\mathcal{M}$:

(i) EFf;

(ii) $AG\neg(c \wedge f)$;

(iii) $AG\neg(d \wedge f)$.

NB To get the formulas into a form that can be treated by the labelling algorithm, you may have to rewrite them. NB Indicate, in $\mathcal{M}$, the steps in the application of the labelling algorithm, i.e., provide the labelling with subformulas and the order in which these are added.

Exercise 3 Consider the system of Exercise 2 again.

(a). Explain why AFc does not hold;

(b). Formulate a fairness condition that ensures that AFc holds.

Exercise 4 Assess the formalism for proving Hoare style OO-properties as described by Huizing, i.e.:

(a). fill out the matrix;

(b). place the approach in the V's model of development.

Each of the entries in the matrix and the positioning in the V's should be briefly explained. (In total the length of the explanations should amount to half a page minimum, one page maximum.)

Mark: (points total)/10