Module Title: INFORMATICS 1 - COMPUTATION AND LOGIC
Exam Diet (Dec/April/Aug): August 2009
 Brief notes on answers:

1. *(p and (q or r)) or (p and not(q and r))* simplifies to *p*.

   The truth table below shows that the truth values for both expressions are the same.

p	q	r	1 (q or r)	(q and r)	2 not(q and r)	3 (p and 1)	4 (p and 2)	(3 or 4)
t	t	t	t	t	f	t	f	t
t	t	f	t	f	t	t	t	t
t	f	t	t	f	t	t	t	t
f	t	t	t	f	t	f	f	f
f	t	f	t	f	t	f	f	f
t	f	f	f	f	t	f	t	t
f	f	t	t	f	t	f	f	f
f	f	f	f	f	t	f	f	f

2. The truth table below demonstrates that *p xor q* is equivalent to *(p or q) and (q →
   not(p))*.

p	q	p xor q	not(p)	p or q	q → not(p)	(p or q) and (q → not(p))
t	t	f	f	t	f	f
t	f	t	f	t	t	t
f	t	t	t	t	t	t
f	f	f	t	f	t	f

3. The steps of conversion are:

   - [a, (a and b) → c, (d or e) → b, a → e]
   - [a, not(a and b) or c, (d or e) → b, a → e]
   - [a, not(a and b) or c, d → b, e → b, a → e]
   - [a, not(a and b) or c, not(d) or b, not(e) or b, a → e]
   - [a, not(a and b) or c, not(d) or b, not(e) or b, not(a) or e]
   - [a, not(a) or not(b) or c, not(d) or b, not(e) or b, not(a) or e]
   - [[a], [not(a), not(b), c], [not(d), b], [not(e), b], [not(a), e]]

4. One possible FSM is given below:
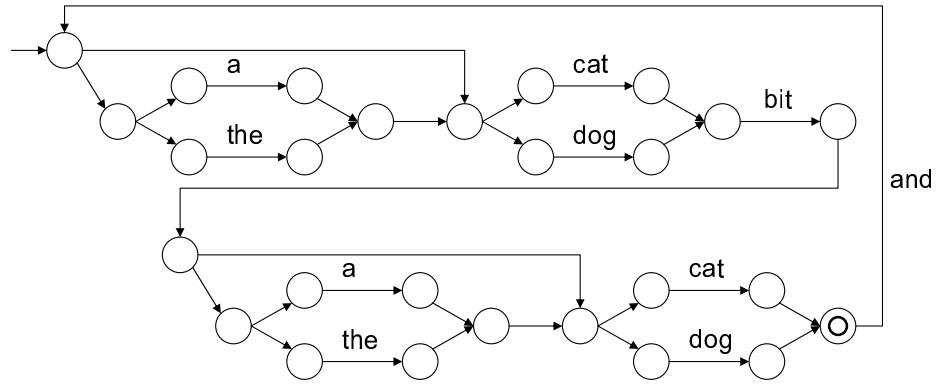
5. (a) An appropriate proof is given below, where "a" is an electrical fault; "b" is low fuel pressure and "c" is engine failure.
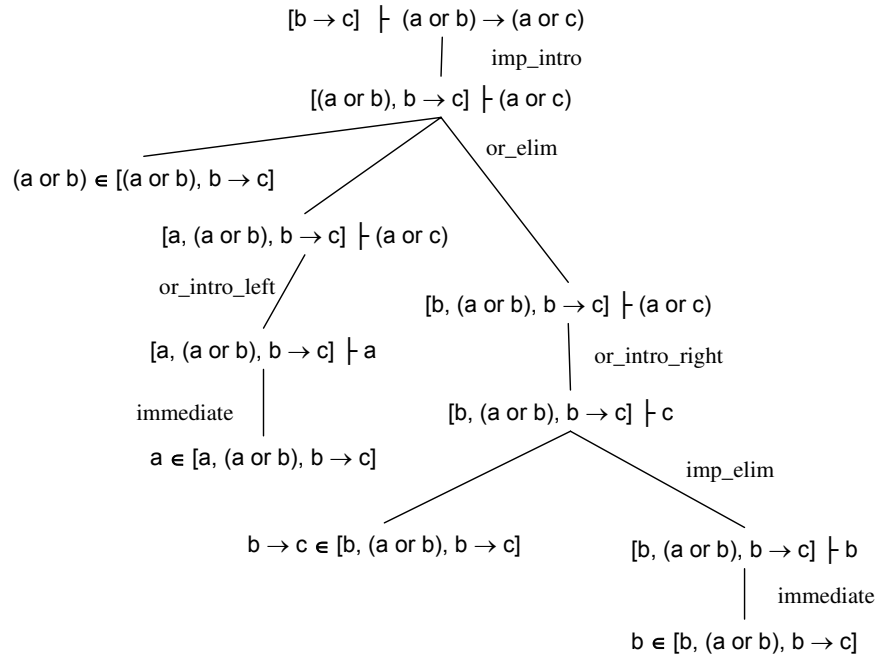
(b) A complete proof system permits all valid proofs so this observation tells us that our system is incomplete. A sound proof system permits no invalid proofs; this observation tells us nothing directly about the soundness of our system.

6. (a) One possible FSM is given below:
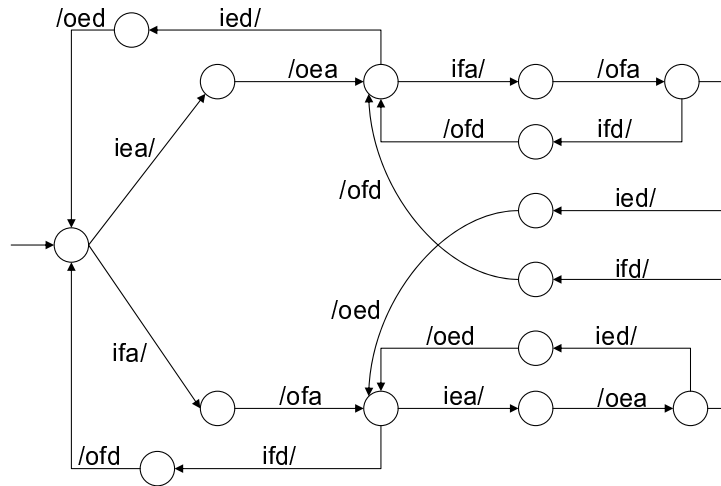
iea = input signal from electrical monitor to activate warning
ifa = input signal from fuel monitor to activate warning
ied = input signal from electrical monitor to deactivate warning
ifd = input signal from electrical monitor to deactivate warning
oea = output signal to activate electrical fault warning light
ofa = output signal to activate fuel pump warning light
oed = output signal to deactivate electrical fault warning light
ofd = output signal to deactivate fuel pump warning light

(b) Students should demonstrate that each of the requirements is satisfiable by show-
ing appropriate traces through the FSM (where positive evidence of a behaviour
is necessary) or showing that no trace exists (where it is necessary to demonstrate
absence of a behaviour).

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