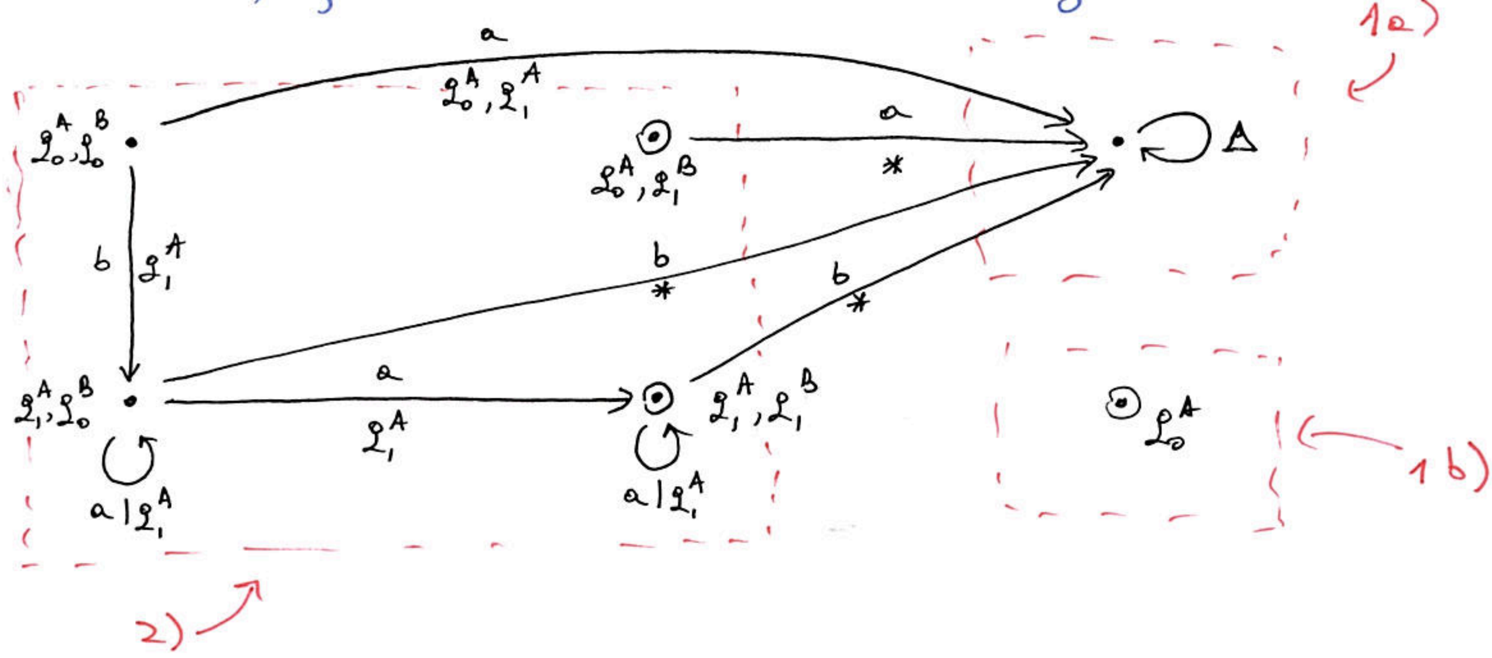
9.1. The NBAs for ba^ω and $(a+b)^* a^\omega$ are

Then, by the construction in class we get C:



9.2. The only congruence that does not hold out of the given ones is (h).

9.3 (a) $\neg((\Box p) \to ((p \wedge \neg r)\, \mathcal{U}\, \neg(\bigcirc q))) \wedge \neg(\neg p \vee \bigcirc \Diamond r)$

$$\Box p \wedge \neg((p \wedge \neg r)\, \mathcal{U}\, \neg(\bigcirc q)) \qquad\qquad p \wedge \neg \bigcirc \Diamond r$$

$$\text{false}\, \mathcal{R}\, p \qquad \neg(p \wedge \neg r)\, \mathcal{R}\, (\bigcirc q) \qquad\qquad \bigcirc \Diamond \neg r$$

$$(\neg p \vee r)\, \mathcal{R}\, (\bigcirc q)$$

(b) The proof is a structural induction over LTL which can use PL as base case. The interesting step cases go through because $\neg(\varphi\, \mathcal{U}\, \psi) \equiv \neg\varphi\, \mathcal{R}\, \neg\psi$ and $\neg \bigcirc \varphi \equiv \bigcirc \neg \varphi$.

9.4.(a) E.g. $\Box(\varphi \to \lhd \psi) \equiv \Box\neg\varphi \vee (\neg\varphi\, \mathcal{U}\, \psi)$

(b) $A \not\models AF \to \Box\Diamond a$ but $A \models SF \to \Box\Diamond a$
and $A \models WF \to \Box\Diamond a$