6.1 a) $\{S_1, S_2, S_3, S_4\}$

b) $\emptyset$

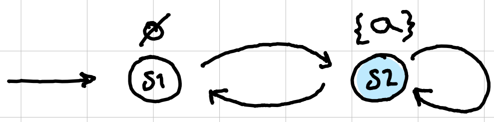
c) $\{S_1, S_2, S_3, S_4\}$

d) $\{S_1, S_2, S_3, S_4\}$

e) $\{S_1\}$

6.3 a) If $s \models \exists \Box a$, then $s \models \forall \Box a$.

Consider:



The assertion is incorrect.

b) If $s \models \forall \Box a$, then $s \models \exists \Box a$

The assertion is correct. Given $\forall \Box a$, there are infinitely many paths where $\Box a$ holds, therefore there exists a state where $\Box a$ holds.

c) If $s \models \forall \Diamond a \vee \forall \Diamond b$, then $s \models \forall \Diamond (a \vee b)$

The assertion is correct. If all paths eventually reach a, or all paths eventually reach b, or both, then all paths must eventually reach a or b. The reverse of this assertion is not correct, however.

6.4 a) Incorrect

b) Correct

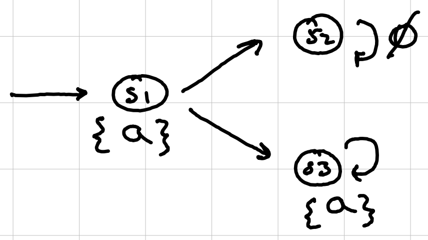
c) correct

d) correct

e) Correct.

6.15 $\Phi = \forall \Diamond (a \wedge \exists \bigcirc a)$, by removing all path quantifiers, we obtain $\varphi = \Diamond (a \wedge \bigcirc a)$

Consider:



$S_1 \models \Phi$ but $S_1 \not\models \Diamond (a \wedge \bigcirc a)$ due to the trace $\pi = S_1, S_2, \ldots$ Therefore $\Phi \not\equiv \varphi$, thus there does not exist any equivalent LTL formula for Φ.