1. a) Because the concepts of a conflict, a deadlock and a livelock are defined only with respect to reachable states, we focus on the reachable state space of the parallel composition of $L_1$ and $L_3$ (shown below).

b) The parallel composition of $L_1$ and $L_3$ contains two conflicts at states $(s_0, u_0)$ and $(s_0, u_1)$, respectively:

$$
\{(s_0, u_0), ((s_0, a, s_1), (u_0, a, u_2)), (-, (u_0, \tau, u_1))\}, \text{ and }
\{(s_0, u_1), ((s_0, a, s_1), (u_1, a, u_3)), ((s_0, b, s_2), (u_1, b, u_4))\}.
$$

(In the first case, the LTS $L_3$ can choose between an $a$- and a $\tau$-transition; in the second case, $L_1$ and $L_3$ can synchronise on either $a$ or $b$.)

c) The LTS $L_1 || L_3$ contains deadlocks in states $(s_0, u_4)$ and $(s_1, u_3)$, because these states have no successors.

d) Because $(s_1, u_2) \xrightarrow{\tau} (s_1, u_2) \xrightarrow{\tau^*} (s_1, u_2)$ holds, the LTS $L_1 || L_3$ has a livelock in state $(s_1, u_2)$. 
e) Because neither $L_1$ nor $L_3$ “participates” in both of the global transitions $(-, (u_0, \tau, u_1))$ (starting from the state $(s_0, u_0)$) and $((s_2, c, s_0), -)$ (starting from the state $(s_2, u_4)$), these global transitions are independent.

f) $\text{traces}(L_3) = \{a, b\}$.

g) $\text{traces}(L_1)$ is given by the regular expression \((bc)^* \cup (bc)^* a \cup (b,c)^*)\) (all words formed by tracing a path from $s_0$ to $s_0$, from $s_0$ to $s_1$, and from $s_0$ to $s_2$, respectively).

h) The LTS $L_2$ as an automaton with $\varepsilon$-transitions (all states are accepting):

Because $t_0$ is the only initial state of the automaton, the initial state of the corresponding deterministic automaton is

$$\{t \in \{t_0, t_1, t_2\} \mid t_0 \xrightarrow{\varepsilon} t\} = \{t_0, t_1\}.$$  

The (reachable state space of) the deterministic automaton built from the above automaton is thus

(note that to complement the automaton with respect to the alphabet $\Sigma_1 = \{a, b, c\}$, we have to use this alphabet already for determinisation, even though the alphabet of $L_2$ includes only the symbols $a$ and $b$).

Swapping the final and non-final states yields the automaton
i) The automaton in h) as an LTS $\mathcal{L}_2$:

The parallel composition of $L_1$ and $\mathcal{L}_2$:

Because $\emptyset$ is a final state of the automaton corresponding to the LTS $\mathcal{L}_2$, and because the state $(s_1, \emptyset)$ is reachable from the initial state of
$L_1 \parallel L_2$, it follows that $\text{traces}(L_1) \subseteq \text{traces}(L_2)$ does not hold. A path from $(s_0, \{t_0, t_1\})$ to $(s_1, \emptyset)$ can be used to find a trace of $L_1$ which is not a trace of $L_2$: for example, $a \in \text{traces}(L_1) \setminus \text{traces}(L_2)$. 