1. Consider the following three LTSs $L_1$, $L_2$, and $L_3$:

$L_1 : \quad \Sigma_1 = \{a, b, c\} \quad \quad \quad L_2 : \quad \Sigma_2 = \{b, c\} \quad \quad \quad L_3 : \quad \Sigma_3 = \{a, b\}$

a) Compute the parallel composition $L = L_1 \parallel L_3$.

b) Does $L = L_1 \parallel L_3$ contain any conflicts? If it does, please give a list consisting of triples $(v, t, t')$, where: $v$ is a global states of $L$ where a conflict occurs and $t, t'$ are a pair of global transitions of $L_1 \parallel L_3$ which are in conflict in $v$.

c) Does $L = L_1 \parallel L_3$ contain any deadlock? If it does, please give a list of global states of $L$ which are deadlocks.

d) Does $L = L_1 \parallel L_3$ contain any livelocks? If it does, please give a list of global state of $L$ in which a livelock exists.
e) Does $L = L_1 \parallel L_3$ contain a pair of independent transitions? If it does, give two global transitions which are independent.

f) Give $\text{traces}(L_3)$ as a list of sequences over $\Sigma_3$.

g) Give $\text{traces}(L_1)$ as a regular expression.

h) Give a deterministic finite automaton accepting $\Sigma_1^* \setminus \text{traces}(L_2)$.

i) Check whether $\text{traces}(L_1) \subseteq \text{traces}(L_2)$ using the automaton constructed in the previous step. If not, give a word in $\text{traces}(L_1) \setminus \text{traces}(L_2)$.