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

$L_1 : \quad \Sigma_1 = \{a, b, c\}$

$L_2 : \quad \Sigma_2 = \{b, c\}$

$L_3 : \quad \Sigma_3 = \{a, b\}$

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 state 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 deadlocks? 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 a global state of $L$ in which a livelock exists.
e) Does \( L = L_1 \| L_3 \) contain a pair of independent transitions? If it does, give two global transitions which are independent.

f) Give \( traces(L_3) \) as a list of sequences over \( \Sigma_3 \).

g) Give \( traces(L_1) \) as a regular expression.

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

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