Computational Logic Lab

23/10/2024

Use the SMT-solver z3 to solve the following problems.

(1) Check that the following formula is a tautology:

$$(p \to q \wedge r) \to (p \to q) \wedge (p \to r) \ .$$

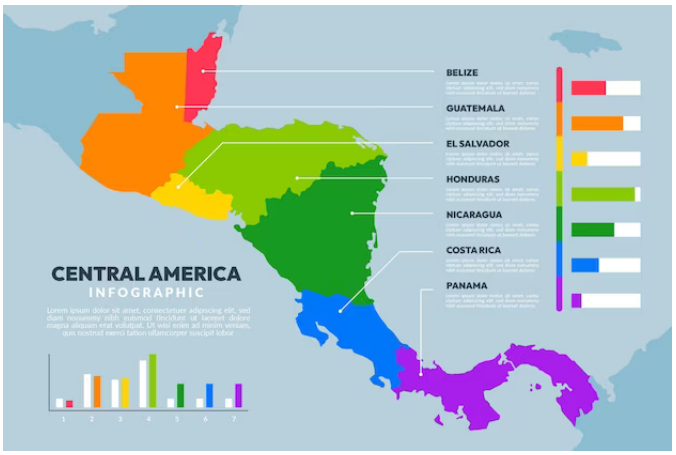
(2) Show that the following formulae are logically equivalent

$$p \vee q \to r \quad \text{and} \quad (p \to r) \wedge (q \to r) \quad .$$

(3) Check whether the following inference is correct or not:

$$\frac{\begin{array}{l}\textit{Mary goes to the party if Lucia goes.}\\ \textit{If it rains, Lucia does not go to the party.}\end{array}}{\textit{If it does not rain, Mary goes to the party.}}$$

(4) Show that three colors are sufficient to color the Central America country map.



(5) Show that three colors are not sufficient to color the South America country map.

(6) A group of friends formed by A, B, C, D, E, wants to find an accommodation in a hotel. In the hotel, only three rooms are available, all such rooms can accommodate two people. These are the friends' desiderata:

(1) A wants to share the room with either B or E;
(2) B wants to share the room with either A or C;
(3) C wants to share the room with either B or D;
(4) D wants to share the room with either C or E;
(5) E wants to share the room with either D or A.

Check whether these requirements are consistent or not. *[Hint: use propositional letters A1, A2, A3 to express that A is accommodated in room 1, 2, 3, respectively. Do the same for B, C, D, E. Then write down a formula saying that A is accommodated in exactly one room, B is accommodated in exactly one room, etc.]*