2. Proof concatenation under decideable languages is closed.

   Let L_1 and L_2 be decideable languages. The concatenation of languages L_1 and L_2 is the language $L_1L_2 = w$ where $w = xy$, $x \epsilon L_1$ and $y \epsilon L_2$.

   Since L_1 and L_2 are decideable there exists a TM that decides each of the languages.

   To construct a TM such that $M_{L_1L_2}$ we combine M_{L_1} with M_{L_2} and we non-deterministically move our way through string w. Since there are a finite amount of possible partitions of w into xy we can try every partition. So we split w into strings x and y and feed x into M_{L_1} and y into M_{L_2}. $M_{L_1L_2}$ accepts if both M_{L_1} and M_{L_2} accept on some partition of w.

   If there is an accepting branch, then we have found the split of the string that is in L_1L_2. If all paths reject then it is not in L_1L_2. Regardless this language is still decideable as machine $M_{L_1L_2}$ always halts.