

### Problem

Let A and B be two disjoint languages. Say that language C **separates** A and B if disjoint co-Turing-recognizable languages are separable by some decidable language.

$$A \subseteq C \text{ and } B \subseteq \overline{C}.$$

Show that any two

### Step-by-step solution

#### Step 1 of 1

##### Given:

Two disjoint languages are supposed to be A and B. Decidable Language C is chosen so that it is use for separating A and B if  $A \subseteq C$  and  $B \subseteq \overline{C}$ . Now, according to this concept two disjoint Co-Turing recognizable languages can be separated with the help of decidable language.

##### Proof:

Consider two DFA M and N for languages A and B. O is a DFA for separator C. Here language A is assumed to the subset of C and language B is assumed to be the subset of  $\overline{C}$ . In this way C is separating A and B because C or  $\overline{C}$  is not deciding both A and B instead A is decided by C and B is decided by  $\overline{C}$ . It can be understood that C and  $\overline{C}$  both are dissimilar and deciding A and B individually.

##### Construction:

Concept can be understood in better by using following approach:

Turing Machine F = runs on input  $\langle x \rangle$  where A and B are two DFA

- Construction of DFA O is done for C. DFA O is working as a decider for language A and B.
- Run Turing Machine T on input of C. It will find the decidability capacity of O.
- If Turing machine accept the string then it is recognized and if Turing machine reject the string then it is not recognized.

##### Conclusion:

Now, if T accepts then DFA O for language C is working as a decider for language A otherwise it is working as decider for language B.

Now, it is quite easy to understand two disjoint Co-Turing recognizable languages which are separable by the use of some decidable language.

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[Comments \(8\)](#)