1. For each of the languages below indicate whether it is (a) decidable (a.k.a. recursive), (b) recognizable (a.k.a. recursively enumerable) but not decidable, or (c) not recognizable.

You may use the following facts:

- the language \( D = \{ w \mid M_w \text{ does not accept } w \} \) is not recognizable;
- the language \( ACCEPT = \{ (z, w) \mid z, w \in \{0, 1\}^* \text{ and } M_z \text{ accepts } w \} \) is recognizable but not decidable.

- \( L_1 = \{ (z, w) \mid M_z \text{ does not halt on input } w \} \).
- \( L_2 = \{ (z, w, n) \mid M_z \text{ accepts } w \text{ within } n \text{ steps} \} \).
- \( L_3 = \{ w \mid M_w \text{ accepts } w \} \).

2. We saw in class that the language \( ACCEPT \) is undecidable. Use a reduction to argue that the language \( L = \{ (z_1, z_2, w) \mid \text{ exactly one of } M_{z_1} \text{ and } M_{z_2} \text{ accepts } w \} \) is undecidable.

3. Can you show that \( L \) from the previous problem is not recognizable?

   Hint: The previous problem shows \( ACCEPT \) reduces to \( L \). Show that \( \overline{ACCEPT} \) reduces to \( L \) using a similar technique. Then prove and use the fact that \( ACCEPT \) is not recognizable to complete the proof.