

## Solution to Problem 20

**Problem.** Suppose that  $A, B$  are r.e. sets. If a number  $n$  appears in the  $A$ -generating algorithm at moment 3, and the complement  $-A$  is also r.e., when will the deciding algorithm tell us that  $n$  is an element of the set  $A$ ?

**Solution.** According to the lecture, we do the following:

1. First, we run the  $A$ -generating algorithm for 1 moment of time. This takes the 1st moment of time of the  $A$ -deciding algorithm.
2. Then, we run the  $(-A)$ -generating algorithm for 1 moment of time. This takes the 2nd moment of time of the  $A$ -deciding algorithm.
3. Then, we run the  $A$ -generating algorithm for 1 more moment of time. This takes the 3rd moment of time of the  $A$ -deciding algorithm.
4. Then, we run the  $(-A)$ -generating algorithm for 1 more moment of time. This takes the 4th moment of time of the  $A$ -deciding algorithm.
5. Then, we run the  $A$ -generating algorithm for 1 more moment of time. During this moment of time, the  $A$ -generating algorithm produces the desired number  $n$  (and maybe some other numbers). This computation takes the 5th moment of time of the  $A$ -deciding algorithm.

So, the  $A$ -deciding algorithm will conclude that  $n$  is in the set  $A$  at moment 5.