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. After that, we run the A-generating algorithm for 1 more moment of time – 5th moment of time of the original A-generating algorithm. 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.