

Prework 3.2a: Turing Machine Variants

Write your preliminary solutions to each problem and submit a PDF on Canvas. The names in brackets indicate the subset responsible for presenting the problem.

1. [Micah, Curtis, Todd] Suppose that M_1 is a TM that recognizes a language A_1 and M_2 is a TM that recognizes a language A_2 . How can the following TM fail to recognize the concatenation $A_1 \circ A_2$? How can you fix it? (Hint: It works fine if M_1 and M_2 are deciders.)

On input w ,

1. For each way of splitting w into two parts w_1, w_2 : Do steps 2–4.
 2. Run M_1 on w_1 .
 3. Run M_2 on w_2 .
 4. If both 2 and 3 accept, then accept w .
 5. Reject w if no acceptance is made in step 4 for any split.
2. [Connor, Levi, Andrew] How many different ways can you divide the string $abcd$ into nonempty substrings w_1, w_2, \dots, w_k , for $k \geq 1$, such that $w_1 w_2 \cdots w_k = w$? How about $abcde$? Can you describe an organized method for running through each possible division?
3. [Joshua, Allie, Ky] Let M_3 be a TM that recognizes a language B . Explain how to build a TM that recognizes B^* .
4. [David, Meghan, Ben, Grace] Suppose that M_4 is a TM that decides a language C . Describe a simple way to construct a TM that decides \overline{C} , the complement of C . Explain why this construction would not be so simple if M were just a recognizer, and not a decider.

BEGIN YOUR SOLUTIONS BELOW THIS LINE
