

Name: _____

- (1) (5 points) In class and in the text, we used the following Turing machine E to enumerate a language accepted by Turing machine M . First, we determined a way of listing all strings in Σ^* – i.e., we let $\Sigma^* = \{s_1, s_2, s_3, \dots\}$:

E = “Ignore the input.

- 1 For $i = 1, 2, 3, \dots$
- 2 Run M for i steps on each input s_1, s_2, \dots, s_i
- 3 Whenever M accepts a string, print it”

Why didn’t we use the following method, which seems more intuitive?

E_{bad} = “Ignore the input.

- 1 For $i = 1, 2, 3, \dots$
- 2 Run M on input s_i
- 3 If M accepts, print s_i ”

Because M may not halt on some s_i . In this case, E_{bad} would not print out any string s_j where $j > i$ even if s_j is in $L(M)$.

- (2) (5 points) Let $L = \{0^n 1^m \mid n < m\}$. Describe a 2-tape Turing machine that decides L . You may describe the Turing machine at a high level (e.g., you may say something along the lines of move to the end of the tape).

M = “on input w

- 1. if w starts with a 1**
- 2. move right until a symbol other than 1 is encountered**
- 3. if the tape head points to \sim *accept***
- 4. else *reject***
- 5. else if the tape head does not start with a 0 *reject***
- 6. replace the 0 with X**
- 7. move right past all 0's and Y's**
- 8. if the tape head does not point to a 1 *reject***
- 9. replace the 1 with a Y**
- 10. move left past all Y's**
- 11. if the tape head points to an X**
- 12. move right once then move right past all Y's**
- 13. if the tape head does not point to a 1 *reject***
- 14. move right past all 1's**
- 15. if the tape head points to a \sim *accept***
- 16. else *reject***
- 17. else move left past all 0's**
- 18. move right 1 space**
- 19. go to line 6”**