

Solution for HW4

3.7

The variables x_1, \dots, x_k have infinitely many possible settings. A Turing machine would require infinite time to try them all. But, we require that every stage in the Turing machine description be completed in a finite number of steps.

3.15 d

For any decidable language L , let M be the TM that decides it. We construct a TM M' that decides the complement of L :

“On input w :

1. Run M on w , if M accepts, *reject*; if M rejects, *accept*.”

Since M' does the opposite of whatever M does, it decides the complement of L .

3.16 d

For any two Turing-recognizable languages L_1 and L_2 , let M_1 and M_2 be the TMs that recognize them. We construct a TM M' that recognizes the intersection of L_1 and L_2 :

“On input w :

1. Run M_1 on w . If it halts and rejects, *reject*. If it accepts, go to stage 2.
2. Run M_2 on w . If it halts and rejects, *reject*. If it accepts, *accept*.”

If both of M_1 and M_2 accept w , w belongs to the intersection of L_1 and L_2 and M' will accept w after a finite number of steps.