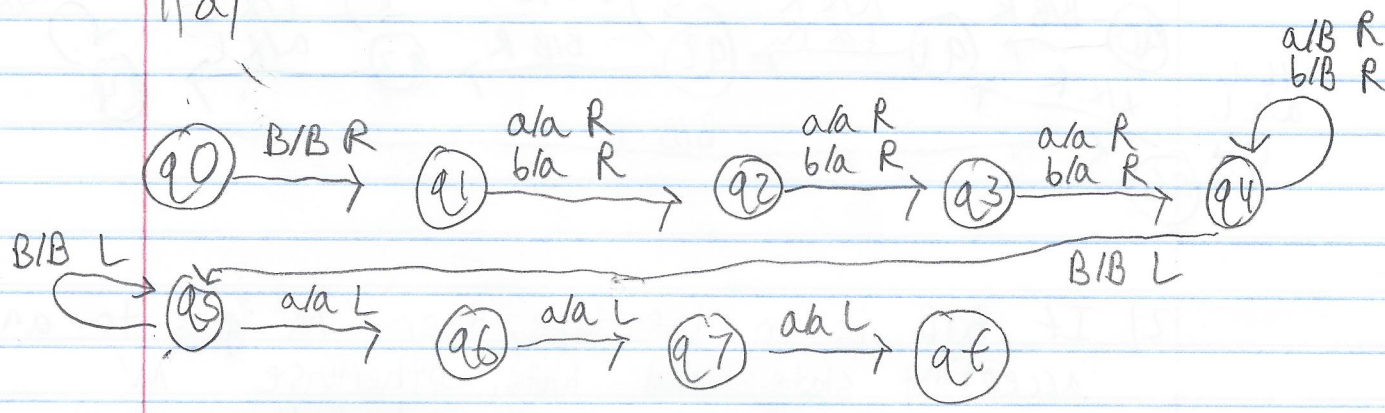
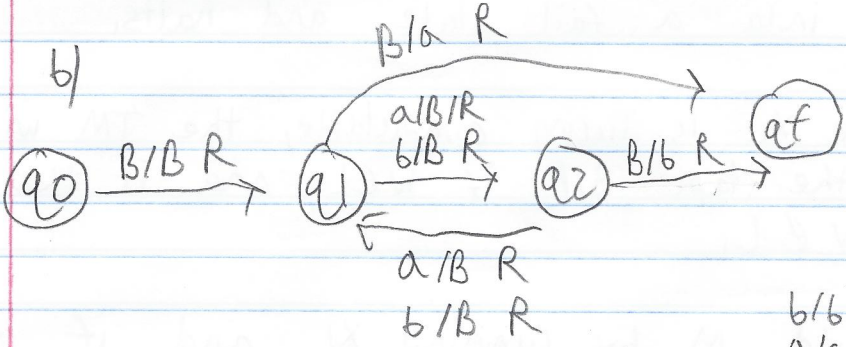
Chapter 9

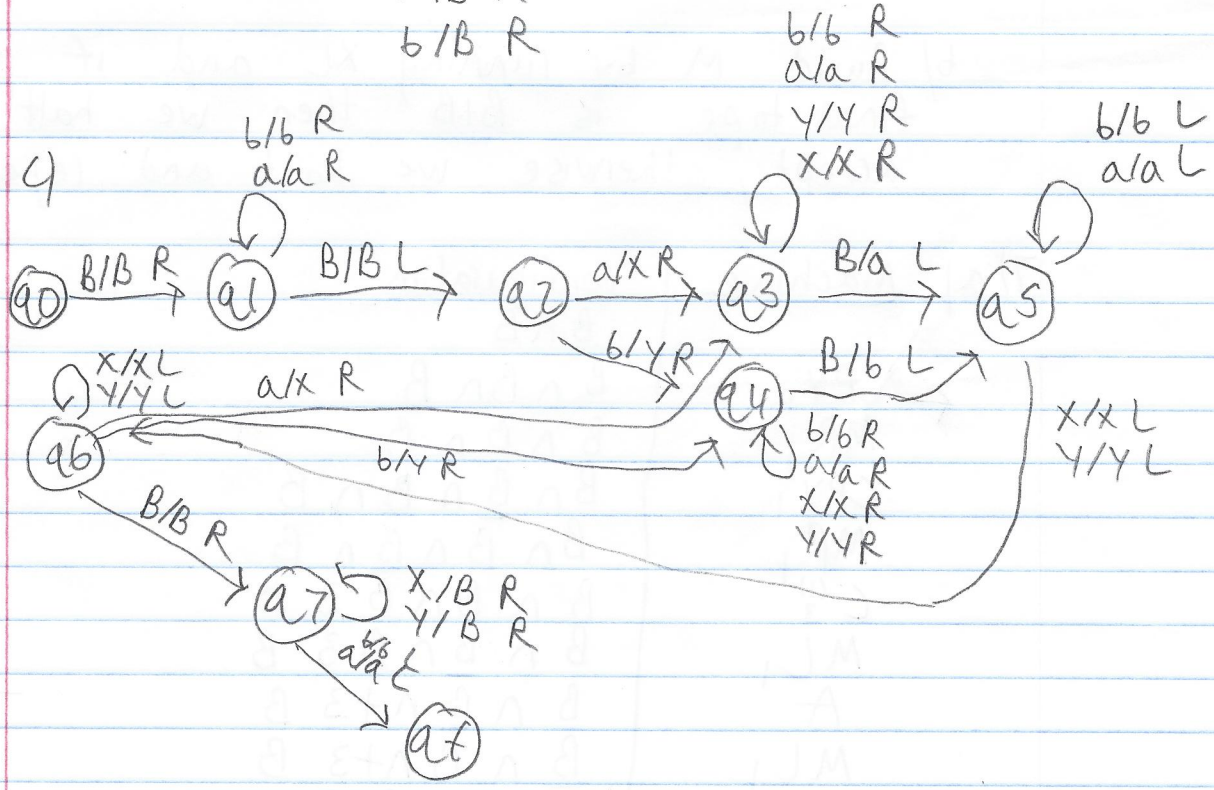
1) a)



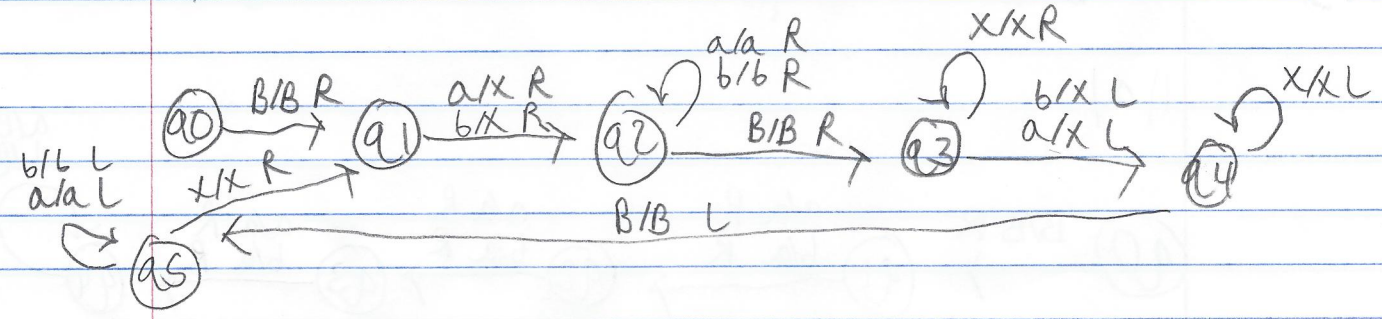
b)



c)



2/



2/ If BIB is on the tape, then M' goes to an accepting state and halts, otherwise M' goes into a fail state and halts.

4/ a/ Since X_L is Turing computable, the TM will halt with the tape BIB if $w \in L$, and it the tape is BOB $w \notin L$.

b/ Build M by running X_L and if the final tape is BIB then we halt and accept, otherwise we halt and reject.

7/ a/

Machine	Configuration
	$\underline{B} \wedge B$
CPY_1	$\underline{B} \wedge B \wedge B$
MR_1	$B \wedge \underline{B} \wedge B$
CPY_1	$B \wedge \underline{B} \wedge B \wedge B$
MR_1	$B \wedge B \wedge \underline{B} \wedge B$
$C_3^{(1)}$	$B \wedge B \wedge \underline{B}\ 3\ B$
ML_1	$B \wedge \underline{B} \wedge B\ 3\ B$
A	$B \wedge \underline{B} \wedge +3\ B$
ML_1	$\underline{B} \wedge B \wedge +3\ B$
A	$\underline{B}\ 2 \wedge +3\ B$

16/ a) $= add(mult(id(n), id(n)), add(id(n), id(n)))$
$= add(mult(n, n), add(n, n))$
$add(n \cdot n, n+n)$
$n^2 + 2n$

b) $p_1^{(2)} \circ (s \circ p_1^{(2)}, e \circ p_2^{(2)}) (a, b)$
$p_1^{(2)} \circ (s \circ p_1^{(2)}(a,b), e \circ p_2^{(2)}(a,b))$
$p_1^{(2)} \circ (s \circ a, e \circ b)$
$p_1^{(2)} \circ (a+1, e(b))$
$a+1$

c) $mult \circ (c_2^{(3)}, add \circ (p_1^{(3)}, s \circ p_2^{(3)})) (a, b, c)$
$mult \circ (c_2^{(3)}(a,b,c), add \circ (p_1^{(3)}, s \circ p_2^{(3)})(a,b,c))$
$mult \circ (2, add \circ (p_1^{(3)}(a,b,c), s \circ p_2^{(3)}(a,b,c)))$
$mult \circ (2, add \circ (a, s \circ b))$
$mult \circ (2, add \circ (a, s(b)))$
$mult \circ (2, a + s(b))$
$2 * (a+b+1)$

d) $mult \circ (mult \circ (p_1^{(1)}, p_1^{(1)}), p_1^{(1)}) (a)$
$mult \circ (mult \circ (p_1^{(1)}, p_1^{(1)})(a), p_1^{(1)}(a))$
$mult \circ (mult \circ (p_1^{(1)}(a), p_1^{(1)}(a)), p_1^{(1)}(a))$
$mult \circ (mult \circ ((a), (a)), (a))$
$mult \circ (a^2, (a))$
a^3