1.

a) $L(a + b) = \{a, b\}$
b) $L(a + bc) = \{a, bc\}$
c) $L(a + b^*) = \{a, \lambda, b, bb, ..., b^n, ... \}$
d) $L(ab^* + c) = \{a, ab, abb, ..., ab^n, ..., c\}$
e) $L(ab^* + bc^*) = \{a, ab, abb, ..., ab^n, ..., b, b, bc, bcc, ..., bc^m, ...\}$
f) $L(a^*bc^* + ac) = \{..., a^nbc^m, ..., ac\}$

2.

a) $a + b + c$
b) $aa + ab + ac$
c) $ab^* + ba^*ab$
d) $a(aa)^*$ (odd number of a's)
e) $\lambda + a(bb)^*$
f) $a^* + b^* + c^*$
g) $\lambda + c^*a + bc^*$
h) $(aa)^* + b(bb)^*$
i) a^*bc^*

3.

a) $(aa + ab + ba + bb)^*$ strings of even length over {a, b}
b) $(aaa + aab + aba + abb + baa + bab + bba + bbb)^*$
c) $(a + b)^*aba(a + b)^*$ contains the substring aba
d) $b^*a(b + ab^*a)^*$ odd number of a's over {a, b}

4.

T(0, a) = 1 T(0, b) = 0
T(1, a) = 3 T(1, b) = 2
T(2, a) = 1 T(2, b) = 3
T(3, a) = 2 T(3, b) = 3
1 is the initial state and 2 and 3 are final states.

5.

b) States: 0 (start), 1 and 2(final)
T(0, a) = 2
T(1, b) = 1
T(1, c) = 2
All other transitions go to state 3.

d) States: 0 (initial), 1, 2, 3, with 1 and 2 final states.
T(0, a) = 1 T(0, c) = 2
T(1, b) = 1
All other transitions go to state 3

f) States: 0 (start), 1, 2, 3, 4, 5, with final states 1 and 3

T(0, a) = 2   T(0, b) = 1

T(1, c) = 1

T(2, a) = 4   T(2, b) = 1   T(2, c) = 3

T(4, a) = 4   T(4, b) = 1

All other transitions go to state 5

6.

$T(0, a) = \{0, 2\}$ $T(0, \lambda) = 1$

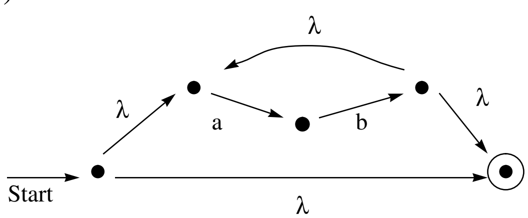
$T(1, b) = \{1, 2\}$

$T(2, a) = 3$

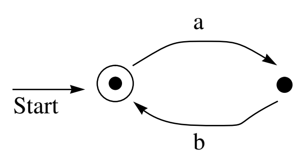
$T(3, \lambda) = 2$

7.

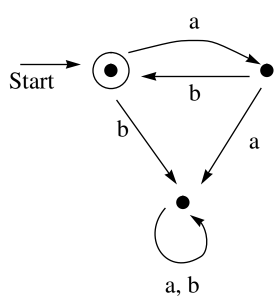
a) NFA



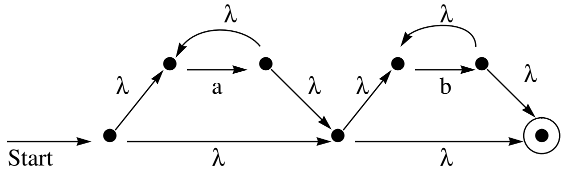
OR



DFA



b) NFA



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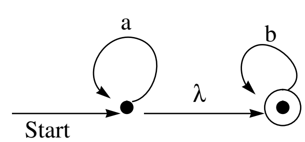
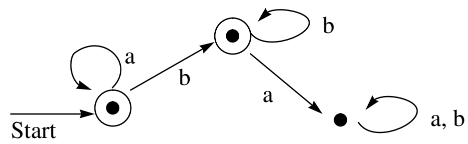
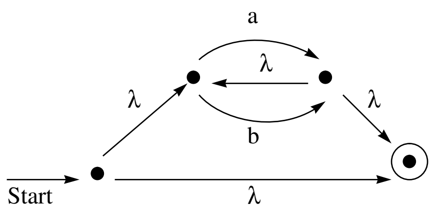


DFA

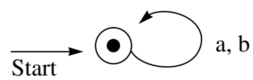


c)

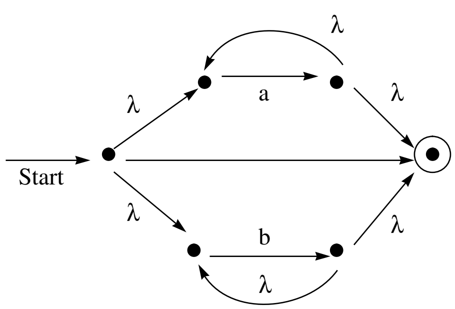
NFA



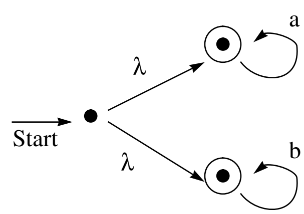
DFA



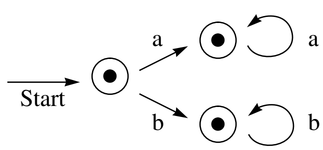
d) NFA



OR



DFA



8.

a) $W = (A \wedge B \rightarrow A)$

$W(A/T) = (T \wedge B \rightarrow T) \equiv (B \rightarrow T) \equiv T$

$W(A/F) = (F \wedge B \rightarrow F) \equiv (F \rightarrow F) \equiv T$

Therefore W is a tautology.

b) $W = A \vee B \rightarrow B$

$W(A/T) = (T \vee B \rightarrow B) \equiv (T \rightarrow B) \equiv B$

Since *W(A/T)* can be either *T* or *F* based on the truth value of *B*, *W* is a contingency.

c) $W = (A \rightarrow B) \vee ((C \rightarrow \neg B) \wedge \neg C)$

$W(B/T) = (A \rightarrow T) \vee ((C \rightarrow F) \wedge \neg C) = T \vee ((C \rightarrow F) \wedge \neg C) \equiv T$

$W(B/F) = (A \rightarrow F) \vee ((C \rightarrow T) \wedge \neg C) \equiv \neg A \vee (T \wedge \neg C) \equiv \neg A \vee \neg C$

W(B/F) is a contingency: therefore *W* is a contingency.