Languages and Machines

Ex Chap 4 (pp 140-142): 1, 7, 14, 23, 26, and optionally 32

1.

elimination of recursive start symbol:
S → S'
S' → aS' | bS' | B
B → bb | C | .\
C → cC | .\

the set of nullable variables: {B, C, S', S}
elimination of lambda rules:
S → S' | .\
S' → aS' | bS' | a | b | B
B → bb | C
C → cC | c

[ab]*(bb|c*)

7.

C(S) = {S, A, C, B}
C(A) = {A, C, B}
C(B) = {B}
C(C) = {C, B}

S → AS | A | aA | bB | C | b | cC | B
A → aA | bB | C | cC | B | b
B → bB | b
C → cC | B | bB | b

(a*c*b+)+

14.

TERM = {A, D, S}
S → AA
A → aA | a
D → dD | d

REACH = {S, A}
S → AA
A → aA | a

23.

nullable variables: {A, S}
lambda rules and start recursion eliminated:

S → S' | .\
S' → A | ABa | Ba | AbA | bA | Ab | b
A → Aa | a
B → Bb | BC
C → CB | CA | C | bB

elimination of chain rules:
C(S) = {S}
C(S') = {S, A}
C(A) = {A}
C(B) = {B}
C(C) = {C}

S → S' | .\
S' → ABa | Ba | AbA | bA | Ab | b | Aa | a
A → Aa | a
B → Bb | BC
C → CB | CA | bB

elimination of non-terminating variables:
TERM = {S', A, S}
S → S' | .\
S' → AbA | bA | Ab | b | Aa | a
A → Aa | a

elimination of unreachable variables:
REACH = {S, S', A}

separation of terminals:
S → S' | .\
S' → AB'A | B'A | AB' | b | AA' | a
A → AA' | a
B' → b
A' → a

distribution of rules that produce greater than three variables or letters (final form):
S → S' | .\
S' → AF | B'A | AB' | b | AA' | a
A → AA' | a
F → B'A
B' → b
A' → a

26.

baaa

	1	**2**	**3**	**4**
1	{B}	{Y}	{S}	0
2		{A, X, Y, S}	{S, X}	{S, X}
3			{A, X, Y, S}	{S, X}
4				{A, X, Y, S}

abaaa

	1	**2**	**3**	**4**	**5**
1	{A, X, Y, S}	{Y}	{S}	0	0
2		{B}	{Y}	{S}	0
3			{A, X, Y, S}	{S, X}	{S}
4				{A, X, Y, S}	{S, X}
5					{A, X, Y, S}

32.

G:
S → AB | BC
A → AB | a
B → AA | CB | b
C → a | b

elimination of left-recursive variables:
S → AB | BC
A → a | aD
B → AA | CB | b
C → a | b
D → AD | A

replacement of out-of-order variables:
S → AB | BC
A → a | aD
B → aA | aDA | aB | bB | b
C → a | b
D → AD | A

replacement of starting variables with terminals:
S → aB | aDB | aAC | aDAC | aBC | bBC | bC
A → a | aD
B → aA | aDA | aB | bB | b
C → a | b
D → aD | aDD | a | aD