

1. (a)  $a4222B \in \alpha$ , (b)  $a4222B \in \beta$ , (c)  $a4222B \notin \gamma$ , (d)  $a4222B \notin \delta$ , (e)  $22424CD \in \alpha$ , (f)  $22424CD \in \beta$ , (g)  $22424CD \notin \gamma$ , (h)  $22424CD \notin \delta$ , (i)  $4bcDCAba2 \notin \alpha$ , (j)  $4bcDCAba2 \notin \beta$ , (k)  $4bcDCAba2 \in \gamma$ , (l)  $4bcDCAba2 \notin \delta$ , (m)  $2 \notin \alpha$ ,  $2 \in \beta$ ,  $2 \notin \gamma$ ,  $2 \notin \delta$ ,  $3 \notin \alpha$ ,  $3 \notin \beta$ ,  $3 \notin \gamma$ ,  $3 \notin \delta$ .
2. Given: token descriptions. (a) 1 would return  $R_0$  (b) 0 (c) 1101 (d) 00100 (e) 000000 (f) 99001101678100010101030123  
 $\implies$  1)  $9 = R_0$ , 2)  $90 = R_2$  3)  $0110 = R_2$ , 4)  $16 = R_2$ , 5)  $7 = R_0$ , 6)  $81000 = R_4$ , 7)  $10101030 = R_2$ ,  
 8)  $12 = R_2$ , 9)  $3 = R_0$ , 10)  $4 = R_0$ , 11)  $5 = R_0$ , 12)  $7000 = R_4$ , 13)  $010 = R_2$ .

3.

Rules	First sets	
$A \rightarrow CD SE \epsilon$	$\{\}$	$\{a,c,d\}$
$B \rightarrow aSB AS$	$\{\}$	$\{a,c,d,e\}$
$C \rightarrow cC \epsilon$	$\{\}$	$\{c\}$
$D \rightarrow CDd \epsilon$	$\{\}$	$\{c,d\}$
$E \rightarrow eFg$	$\{\}$	$\{e\}$
$F \rightarrow Fg \epsilon$	$\{\}$	$\{g\}$

4.

Rules	First sets		Follow sets	
$A \rightarrow CD SE \epsilon$	$\{\}$	$\{a,c,d\}$	$\{\}$	$\{\$,e\}$
$B \rightarrow aSB AS$	$\{\}$	$\{a,c,d,e\}$	$\{\}$	$\{a,c,d\}$
$C \rightarrow cC \epsilon$	$\{\}$	$\{c\}$	$\{\}$	$\{\$,e\}$
$D \rightarrow DdC \epsilon$	$\{\}$	$\{c,d\}$	$\{\}$	$\{\$,a,c,d,e\}$
$E \rightarrow eFg$	$\{\}$	$\{e\}$	$\{\}$	$\{a,c,d\}$
$F \rightarrow Fg \epsilon$	$\{\}$	$\{g\}$	$\{\}$	$\{g\}$