T-61.231 Principles of Pattern Recognition

Exercise 9: 25.11.2002

1. Language $L = \{a^n b | n = 1, 2, \ldots\}$.
   a) Form a grammar, which produces L.
   b) Form a parser to the grammar in 1 a). Check, that your parser parses string a^2b but not string ba.

2. Machine parts shown in Figure 1 have primitives a, c and e. Does the following grammar accept these parts. $S \rightarrow GQ, S \rightarrow QG, G \rightarrow EH, H \rightarrow AIA, I \rightarrow CJC, J \rightarrow ACA, Q \rightarrow ER, R \rightarrow CAC, A \rightarrow a, C \rightarrow c, E \rightarrow e$.

3. A chromosome classifier is based on a syntactic method. The border line of the chromosome illustrated in Figure 2 is composed of certain line segments called a,b,c ja d. Thus, the entire border line can be represented as a string: $\{babcbabdbabcbabd\}$. Will the following grammar accept this chromosome? What if the border line is coded by choosing some other point as a starting point?

$$G = (V_T, V_N, P, S),$$
$$V_T = \{a, b, c, d\}$$
$$V_N = \{S, \mathit{Armpair}, \mathit{Leftarm}, \mathit{Rightarm}, \mathit{Arm}, \mathit{Side}\}$$
$$P = \{S \rightarrow \mathit{Armpair}, \mathit{Armpair}$$
$$\mathit{Armpair} \rightarrow \mathit{Armpair}, \mathit{Side}$$
$$\mathit{Armpair} \rightarrow \mathit{Arm}, \mathit{Rightarm}$$
$$\mathit{Armpair} \rightarrow \mathit{Leftarm}, \mathit{Arm}$$
$$\mathit{Rightarm} \rightarrow c, \mathit{Arm}$$
$$\mathit{Leftarm} \rightarrow \mathit{Arm}, c$$
$$\mathit{Arm} \rightarrow b, \mathit{Arm}$$
$$\mathit{Arm} \rightarrow \mathit{Arm}, b$$
$$\mathit{Side} \rightarrow b, \mathit{Side}$$
$$\mathit{Side} \rightarrow \mathit{Side}, b$$
$$\mathit{Arm} \rightarrow a$$
$$\mathit{Side} \rightarrow b$$
$$\mathit{Side} \rightarrow d\}$$

   A comma (',') between two symbols is just a separator.

4. Develop an attributed graph to characters 22, 25 and 39 shown in Figure 3. Form also the corresponding adjacency matrices. Are the graphs isomorphic?

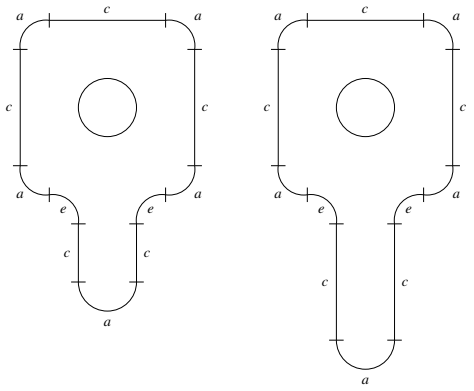


Figure 1: Machine parts

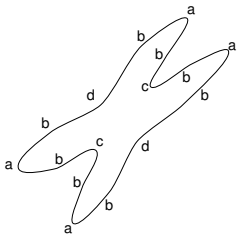
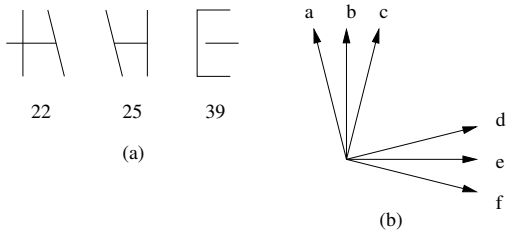


Figure 2: A chromosome



Code	Description	Diagram
u	Above/Underneath	
v	Bend	or
w	Junction	or
x	Intersection	
y	Near to (gap)	or or
z	On the left/right	

(c)

Figure 3: (a) Characters, (b) primitives, and (c) relations between primitives