



1. Webber Chap. 14 Exercise 5

Show that $\{a^n b^n c^p d^q\}$ is a CFL by giving either a stack machine or a CFG for it.

$$S \rightarrow XY$$

$$X \rightarrow aXb \mid \epsilon$$

$$Y \rightarrow ZW$$

$$Z \rightarrow cZ \mid \epsilon$$

$$W \rightarrow dW \mid \epsilon$$

	read	pop	push
1	ϵ	S	XY
2	ϵ	X	AXB
3	ϵ	Y	ZW
4	ϵ	Z	CZ
5	ϵ	W	DW
6	ϵ	X	ϵ
7	ϵ	Z	ϵ
8	ϵ	W	ϵ
9	a	A	ϵ
10	b	B	ϵ
11	c	C	ϵ
12	d	D	ϵ

2. Create a grammar to generate the language $L(G) = \{a^n b^n \mid \text{where } n \text{ is positive}\}$ and write the sequence moves that a shift-reduce implementation would take to parse the string 'aaaabbbb' like in section 15.3.

$$S \rightarrow aXb$$

$$X \rightarrow aXb \mid \epsilon$$

Input	Stack	Next Move
<u>a</u> aaaabbbb\$	ϵ	shift
aa <u>a</u> abbbb\$	a	shift
aaa <u>a</u> bbbb\$	aa	shift
aaaa <u>a</u> bbbb\$	aaa	shift
aaaaa <u>b</u> bbb\$	aaaa	reduce by $X \rightarrow \epsilon$
aaaaa <u>b</u> bbb\$	Xaaaa	shift
aaaaab <u>b</u> bb\$	bXaaaa	reduce by $X \rightarrow aXb$
aaaaab <u>b</u> bb\$	Xaaa	shift
aaaaabb <u>b</u> b\$	bXaaa	reduce by $X \rightarrow aXb$
aaaaabb <u>b</u> b\$	Xaa	shift
aaaaabb <u>b</u> b\$	bXaa	reduce by $X \rightarrow aXb$
aaaaabbb <u>b</u> \$	Xa	shift
aaaaabbbb <u>\$</u>	bXa	reduce by $S \rightarrow aXb$
aaaaabbbb <u>\$</u>	S	---