

Chapter 2.1 Practice

For each language below, construct a CFG generating it.

1. $\{a^i b^j \mid i = j\}$
2. $\{a^i b^j \mid i \neq j\}$
3. All strings of the form $0^a 1^b 0^c$ where $a + c = b$. Note: this language is the concatenation of 2 simpler languages.
4. $\{w \mid w \text{ contains at least two } 1s\}$
5. All binary strings with both an even number of zeros and an even number of ones.
6. Show the derivation or parse tree of the following string, aababbabb, using the grammar G:

$$S \rightarrow aSb \mid bSa \mid \epsilon$$

7. Show the derivation or parse tree of the following string, aaaaaabbbb using the grammar G:

$$S \rightarrow AB$$

$$A \rightarrow aaA \mid \epsilon$$

$$B \rightarrow Bb \mid \epsilon$$

8. Show the derivation or parse tree of the following string, 10101110, using the grammar G:

$$S \rightarrow A \mid B \mid C$$

$$A \rightarrow D10D$$

$$D \rightarrow 0D \mid 1D \mid \epsilon$$

$$B \rightarrow 0B \mid 0$$

$$C \rightarrow 1C \mid 1$$

9. Use the following CFG to parse the string, aababb:

$$R \rightarrow XRX \mid S$$

$$S \rightarrow aTb \mid bTa$$

$$T \rightarrow XTX \mid X \mid \epsilon$$

$$X \rightarrow a \mid b$$

10. Choose another string from the CFG in question 9 to parse and show the parse tree. Is this grammar ambiguous?