

Week 1: Context Free Grammars

We start with some revision of sets. If you are unfamiliar with any of the notation, please ask one of the TAs.

- * 1. Write \mathbb{N} for the set of natural numbers $0, 1, 2, \dots$, and write Σ for the alphabet $\{0, 1\}$. List the elements of the following sets in any order.

- (a) $\{1, 2, 3\} \cup \{2, 4, 6\}$
- (b) $\{1, 2, 3\} \cap \{2, 4, 6\}$
- (c) $\{1, 2, 3\} \times \{2, 4, 6\}$
- (d) $\{1, 2, 3\} \setminus \{2, 4, 6\}$
- (e) $\{2m \mid m \in \mathbb{N}, 0 \leq m \leq 5\}$
- (f) $\{uu \mid u \in \Sigma^*, |u| = 2\}$
- (g) $\{u0v \mid u \in \Sigma^*, v \in \Sigma^*, |uv| = 2\}$
- (h) $\{uvw \mid u \in \Sigma, v \in \Sigma, w \in \Sigma, w \text{ is the xor of } u \text{ and } v\}$

Recall the grammar from the notes for Boolean expressions.

$$\begin{aligned} B &::= F \mid F \parallel B \\ F &::= L \mid L \&\& F \\ L &::= \text{true} \mid \text{false} \mid (B) \end{aligned}$$

- * 2. Give derivations for the following strings which are in the language of Boolean expressions.

- (a) `true && false`
- (b) `true || false && true`
- (c) `true && (false || true)`

- * 3. Give three distinct derivations for the string `true || false`.