

On Computations with Integer Division

Bettina Just
Friedhelm Meyer Auf Der Heide
Avi Wigderson

Abstract

We consider computation trees (CTs) with operations $S \subseteq \{+, -, *, \text{DIV}, \text{DIV}_c\}$, where DIV denotes integer division and DIV_c integer division by constants. We characterize the families of languages $L \subseteq \mathbb{N}$ that can be recognized over $\{+, -, \text{DIV}_c\}$ and $\{+, -, *, \text{DIV}\}$, resp. and show that they are identical. Furthermore, we prove lower bounds for CT's with operations $\{+, -, \text{DIV}_c\}$ for languages $L \subseteq \mathbb{N}$ which only contain short arithmetic progressions. We cannot apply the classical component counting arguments as for operation $S \subseteq \{+, -, *, ./\}$ because Geometry of Numbers about arithmetic progressions on integer points in high-dimensional convex sets for our lower bounds.