Abstract. It is known that every positive integer n can be represented as a finite sum of the form $n = \sum a_i 2^i$, where $a_i \in \{0, 1, -1\}$ for all i, and no two consecutive a_i's are non-zero. Such sums are called *nonadjacent representations*. Nonadjacent representations are useful in efficiently implementing elliptic curve arithmetic for cryptographic applications.
In this paper, we investigate if other digit sets of the form $\{0, 1, x\}$, where x is an integer, provide each positive integer with a nonadjacent representation. If a digit set has this property we call it a *nonadjacent digit set* (NADS). We present an algorithm to determine if $\{0, 1, x\}$ is a NADS; and if it is, we present an algorithm to efficiently determine the nonadjacent representation of any positive integer. We also present some necessary and sufficient conditions for $\{0, 1, x\}$ to be a NADS. These conditions are used to exhibit infinite families of integers x such that $\{0, 1, x\}$ is a NADS, as well as infinite families of x such that $\{0, 1, x\}$ is not a NADS.