For any finite set of integers $A$, define its sumset $A + A$ to be $\{ x + y : x, y \in A \}$. In a recent paper, Martin & O’Bryant studied sum-dominant sets, where $|A + A| > |A - A|$. They prove a positive percentage of all sets are sum-dominant, and investigate the distribution of $|A + A|$ given the uniform distribution on subsets $A \subseteq \{0, 1, \ldots, n-1\}$. They also conjecture the existence of a limiting distribution for $|A + A|$ and show that the expectation of $|A + A|$ is $2n - 11 + O((3/4)n/2)$.

Using a graph-theoretic framework, we derive an explicit formula for the variance of $|A + A|$ in terms of Fibonacci numbers. We also prove exponential upper and lower bounds (independent of $n$) for the distribution of $|A + A|$. These bounds are based on bounds on probabilities like $P(k + a_1, \ldots, k + a_m \not\in A + A)$, which we show are approximately exponential in $k$ for fixed $a_1, \ldots, a_m$. Finally, we show that $P(k, k + 1, \ldots, k + m \not\in A + A)$, the probability of $A + A$ missing a block of consecutive elements, is approximately $(1/2)^{(k+m)/2}$ for large $m, k$. This approximation implies that essentially the only way for $A + A$ to miss a consecutive block of $m + 1$ elements starting at $k$ is to miss all elements up to $k + m$. (Received September 19, 2011)