# Bin Covering of Subsets

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**Abstract.** We extend the bin covering problem of numbers [1, 2] to the bin covering problem of subsets and discuss its application in wireless sensor networks. Given a lower bound $k$ on the amount that each bin must be filled, the bin covering problem of numbers aims to distribute a given set of numbers into as many bins as possible. The bin covering problem of numbers is NP-hard, and research has concentrated on polynomial-time approximation algorithms. For bin covering of subsets, we are given a family $T$ of subsets of a ground set $U$, and the problem is to partition $T$ into as many bins as possible so that each bin contains at least $k$ elements of $U$. First we propose a greedy heuristic for the bin covering problem of numbers that delivers a $1 + \frac{2}{H_{|S|}}$ approximation in which $H_n$ is the $n$-th harmonic number. The greedy heuristic is extended to deal with the bin covering problem of subsets. The extended heuristic achieves a $1 + \frac{2H_k}{H_{|T|}}$ approximation. To apply the algorithm to Wireless Sensor Networks (WSN), we consider $U$ as a set of targets to be monitored , and each sensor is denoted by a subset of $U$ consisting of the targets in its sensing range. The Maximum lifetime Target Coverage (MTC) problem [3, 4] in Wireless Sensor Networks (WSN) is to divide the set of sensors into as many groups as possible so that each group can cover all the targets. Since the groups of sensors take turns monitoring all the targets, more groups means longer lifetime of the WSN. That is, the problem can be reduced to the bin covering problem of subsets with $k = |U|$.

## References

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