

CSE 101 Homework 5
Greedy Algorithms
Part 2
Due Tuesday, May 7

Cookie assignment Consider the following problem:

You are baby-sitting n children and have $m > n$ cookies to divide between them. You must give each child exactly one cookie (of course, you cannot give the same cookie to two different children). Each child has a greed factor g_i , $1 \leq i \leq n$ which is the minimum size of a cookie that the child will be content with; and each cookie has a size s_j , $1 \leq j \leq m$. Your goal is to maximize the number of content children, i.e., children i assigned a cookie j with $g_i \leq s_j$.

Give a correct greedy algorithm for this problem (10 points), prove that it finds the optimal solution (20 points), and give an efficient implementation (10 points).

Implementation Often, even when greedy algorithms do not find optimal solutions, they are used as heuristics. An *independent set* in an undirected graph G is a set of nodes I so that no edge has both endpoints in I . In other words, if $\{u, v\} \in E$, then either $u \notin I$ or $v \notin I$. The maximum independent set problem is, given G , find an independent set of the largest possible size.

Implement a greedy algorithm for maximum independent set based on including nodes of smallest degree. Test it on random graphs where each possible edge is in the graph with probability $1/2$. What is the average size of the independent set it finds for graphs of different sizes? (Try n as many powers of 2 as you can.) How do you conjecture the size will grow as a function of n ?