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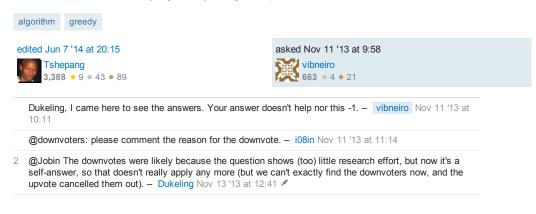
Greedy algorithms and optimal substructure

On Wikipedia page it is said that greedy algorithms are ideal only for problems which have optimal
substructure.

Questions:

1. What is optimal/non-optimal substructure?

2. What is local and global optimum?

3. How to prove that Greedy algorithm yields global optimum?

algorithm   greedy

edited Jun 7 '14 at 20:15	asked Nov 11 '13 at 9:58
Tshepang	vibneiro
3,388 ● 9 ● 43 ● 89	**663** ● 4 ● 21

Dukeling, I came here to see the answers. Your answer doesn't help nor this -1. — vibneiro Nov 11 '13 at
10:11

@downvoters: please comment the reason for the downvote. — i08in Nov 11 '13 at 11:14

2   @Jobin The downvotes were likely because the question shows (too) little research effort, but now it's a
self-answer, so that doesn't really apply any more (but we can't exactly find the downvoters now, and the
upvote cancelled them out). — Dukeling Nov 13 '13 at 12:41 ✎

1 Answer

I have found the answers and glad to share:

1. What is optimal/non-optimal substructure? A problem is said to have **optimal substructure**
   if an optimal solution can be constructed efficiently from optimal solutions of its subproblems.
   This property is used to determine the usefulness of dynamic programming and greedy
   algorithms for a problem

2. What is local and global optimum? **Local optimum** of an optimization problem is a solution
   that is optimal (either maximal or minimal) within a neighboring set of candidate solutions.
   Global optimum - is the optimal solution among all possible solutions, not just those in a
   particular neighborhood of values.

3. How to prove that Greedy algorithm yields global optimum? Usually, **global optimum** can be
   proven by induction. Typically, a greedy algorithm is used to solve a problem with optimal
   substructure if it can be proved by induction that this is optimal at each step. Otherwise,
   providing the problem exhibits overlapping subproblems as well, dynamic programming is
   used.

To prove that an optimization problem can be solved using a greedy algorithm, we need to prove
that the problem has the following:

Optimal substructure property: an optimal global solution contains the optimal solutions of all
its subproblems.

Greedy choice property: a global optimal solution can be obtained by greedily selecting a locally
optimal choise.

Matroids can be used as well in some case used to mechanically prove that a particular problem
can be solved with a greedy approach.

And finally, good examples of greedy algorithm are:
http://www.cs.nott.ac.uk/~nza/G52ADS/dijkstra1.pdf

edited Nov 11 '13 at 10:54	answered Nov 11 '13 at 10:34