Friday, April 9   Lecture Day #31

Finish Tabu Search.

Faster Scoring:
Our tweaks are usually very small.
This usually only changes a small
part of the score.
→ Compute the score faster by just
computing the difference.

Ex: Knapsack
current solution x with weight w
and value v
$s = $ tweak(x), item k in, item ℓ out
new weight $= w - w_\ell + w_k$
new value $= v - v_\ell + v_k$
don't have to re-add all of the

items again

Ex: TSP
Current tour

$$T = v_1 \rightarrow v_2 \rightarrow \cdots \rightarrow v_k \rightarrow \cdots \rightarrow v_\ell \rightarrow \cdots \rightarrow v_n \rightarrow v_1$$
$$\text{cost}(T) = L$$

new tour from reversing $v_k \rightarrow \cdots \rightarrow v_\ell$

$$S = v_1 \rightarrow \cdots \rightarrow v_{k-1} \rightarrow v_\ell \rightarrow v_{\ell-1} \rightarrow \cdots \rightarrow v_k \rightarrow v_{\ell+1} \rightarrow \cdots \rightarrow v_n$$

new length: $L - W_{k-1,k} - W_{\ell,\ell+1} + W_{k-1,\ell}$

$$+ W_{k,\ell+1}$$

Advanced Topics:
* Sometimes using just the "move" as
the taboo is too crude. If this
is the case, make (move, score of
solution) the taboo. This would forbid
a move if doing it would give
you the same score that you got
last time you did it.

* Aspiration Criteria: You can decide ahead of time to ignore the taboo list in some cases. Example: if the new solution is the best you've ever seen.

* If neighborhoods are too large (TSP), this will be too slow.
  Two options:
  (1) Change the tweak function to give smaller nbhds, that possibly violate your constraints (penalize score).

  (2) instead of generating the whole neighborhood, generate 100 random tweaks, and pick the best non-taboo out of those — if your proportion is too small, you might never see taboo things

  exploitation   exploration

* extra intensification/diversification
  Sometimes TS needs to pause and go into modes that focus on

intens. or divers.

- Keep track of how often components of solutions are used in best/worst/any candidates.
Ex: How often a particular item is used among the 100 best solutions.

If more intensification is needed: restart the search w/ the best solution so far, and require some of the most common good items to stay in there.

If more diversification is needed, restart with a random solution and forbid some of the most common good items.

When? No improvement after a while, at regular intervals, etc.