The Used Car Problem

You've just purchased a used car for $12,000 and want to determine the best keep/trade-in strategy over the half dozen years.

Age in Car (years)	Annual Maintenance Cost	Trade-In Price At End of Year	Replacement Cost
0	$2,000	$7,000	$12,000
1	$4,000	$6,000	$12,000
2	$5,000	$2,000	$12,000
3	$9,000	$1,000	$12,000
4	$12,000	$0	$12,000

Goal: Minimize Net Costs:
Maintenance Cost + Purchasing Cost - Trade-In Money Received

Formulate as a Network Problem

Node i = Beginning of year i.

For $i < j$, an arc (ij) corresponds to purchasing a car at the beginning of year i and keeping it until the beginning of year j.

Let c_{ij} = cost of using arc ij.

Now c_{ij} = cost of purchasing car at start of year i + Maintenance cost incurred in years $i, i+1, i+2, ..., j-1$− Trade-in at begining of year j.

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Some Examples (measured in thousands of dollars)

$c_{12} = 12 + 2 - 7 = 7$

$c_{13} = 12 + (2 + 4) - 6 = 12$

$c_{14} = 12 + (2 + 4 + 5) - 2 = 21$

$c_{15} = 12 + (2 + 4 + 5 + 9) - 1 = 31$

$c_{16} = 12 + (2 + 4 + 5 + 9 + 12) - 0 = 44$

Note that $c_{13} = c_{24} = c_{35} = c_{46}$ and, in general $c_{ij} = c_{i+k,j_k}$