

Theorem 7

Solving Problem LP

Construct a graph G such that

- For each inequality $x_j - x_i \leq a_{ij}$ in S , there is an edge that goes from x_i to x_j in G , weighted with a_{ij} .
- Add an extra node x_s and connect it with all the other nodes, setting the weight on the newly-created edges to 0.

Run the Bellman-Ford algorithm on such graph with source x_s . If the algorithm terminates, the shortest-paths distances found are a possible solution of S . Otherwise, if it detects a negative cycle, the system is inconsistent.

Algorithm OPT1

Given a synchronous circuit G , determine a retiming r such that $\Phi(G_r)$ is as small as possible.

1. Compute W and D using Algorithm WD.
2. Sort the elements in the range of D .
3. Binary search among the elements $D(u, v)$ for the minimum achievable clock period. To test whether each potential clock period is feasible, apply the Bellman-Ford algorithm to determine whether the conditions in Theorem 7 can be satisfied.
4. For the minimum achievable clock period, use the values for the $r(v)$ found by the Bellman-Ford algorithm as the optimal retiming.