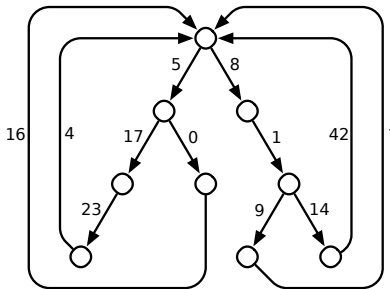


1. A *looped tree* is a weighted, directed graph built from a binary tree by adding an edge from every leaf back to the root. Every edge has non-negative weight.



A looped tree.

- (a) How much time would Dijkstra’s algorithm require to compute the shortest path between two vertices  $u$  and  $v$  in a looped tree with  $n$  nodes?
  - (b) Describe and analyze a faster algorithm.
2. After graduating you accept a job with Aerophobes-Я-Us, the leading traveling agency for people who hate to fly. Your job is to build a system to help customers plan airplane trips from one city to another. All of your customers are afraid of flying (and by extension, airports), so any trip you plan needs to be as short as possible. You know all the departure and arrival times of all the flights on the planet.

Suppose one of your customers wants to fly from city  $X$  to city  $Y$ . Describe an algorithm to find a sequence of flights that minimizes the *total time in transit*—the length of time from the initial departure to the final arrival, including time at intermediate airports waiting for connecting flights. [Hint: Build an appropriate graph from the input data and apply Dijkstra’s algorithm.]