M2 meeting

Open Systems Management

Supply Chain configuration

- The supply chain is modeled into a network
  - Each node represents a process

    Ex: screen manufacturing, transportation, etc…
  - Each node has several options

    Ex: for transportation we have plane and truck

- We choose the options at each stage to minimize the total supply chain cost

- Solved with a dynamic algorithm

A few equations…

- Optimization problem:

Safety stock cost

$$\mathbf{P} \quad \min \sum_{i=1}^{N} \Big[\alpha c_i \left[D_i \left(s_i^{\text{in}} + t_i - s_i^{\text{out}} \right) - \left(s_i^{\text{in}} + t_i - s_i^{\text{out}} \right) \mu_i \right] + \alpha \left(c_i - \frac{x_i}{2} \right) t_i \mu_i + \beta x_i \mu_i \Big]$$

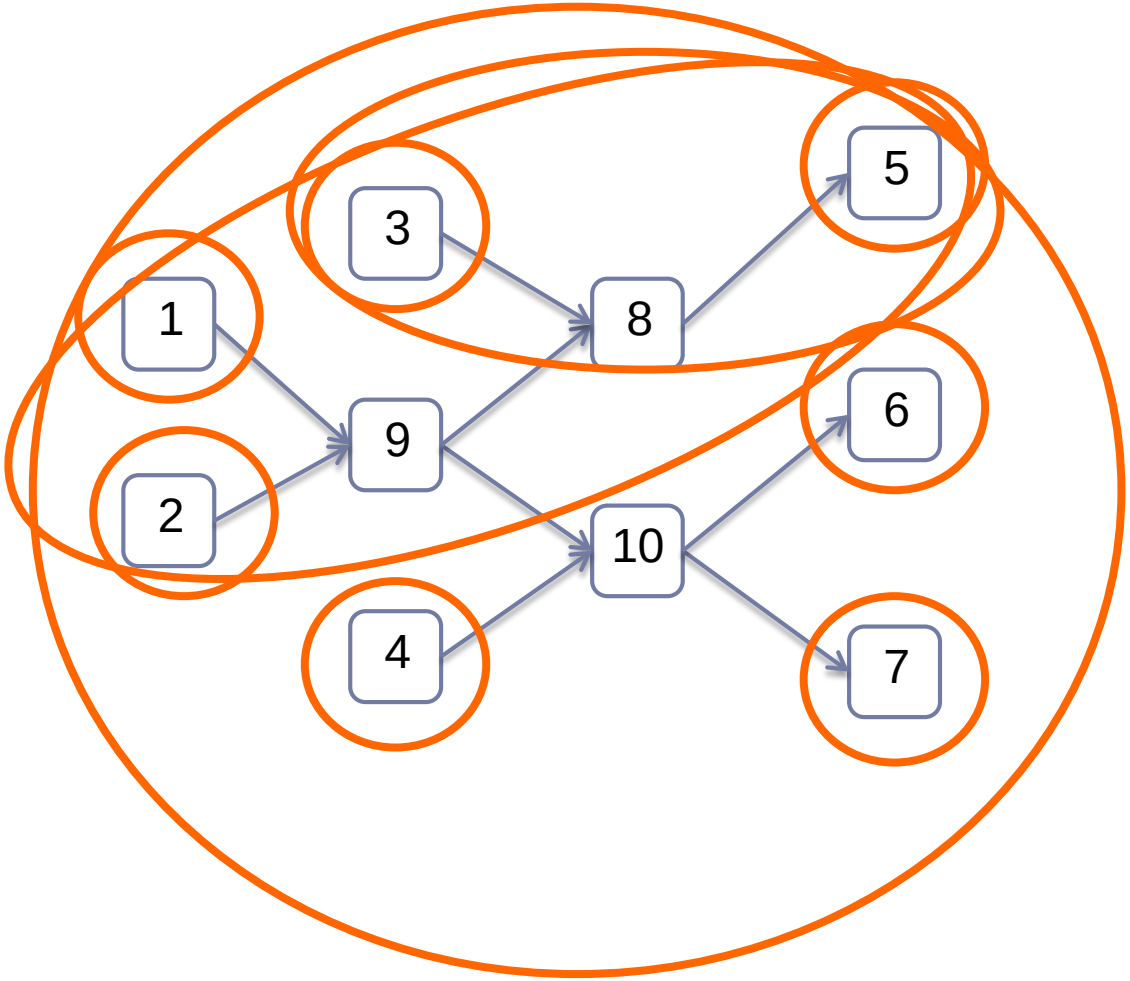
Pipeline stock cost

COGS

- Functional equations for the algorithm:

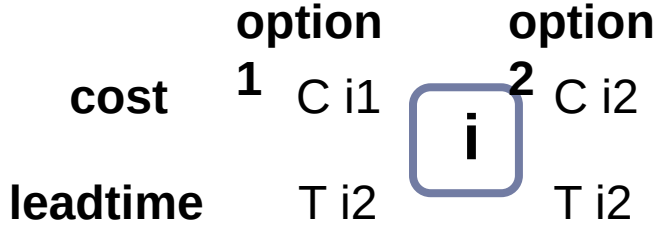
  FE(i) = min[cost of stage I + FE(subnetwork linked to i)]

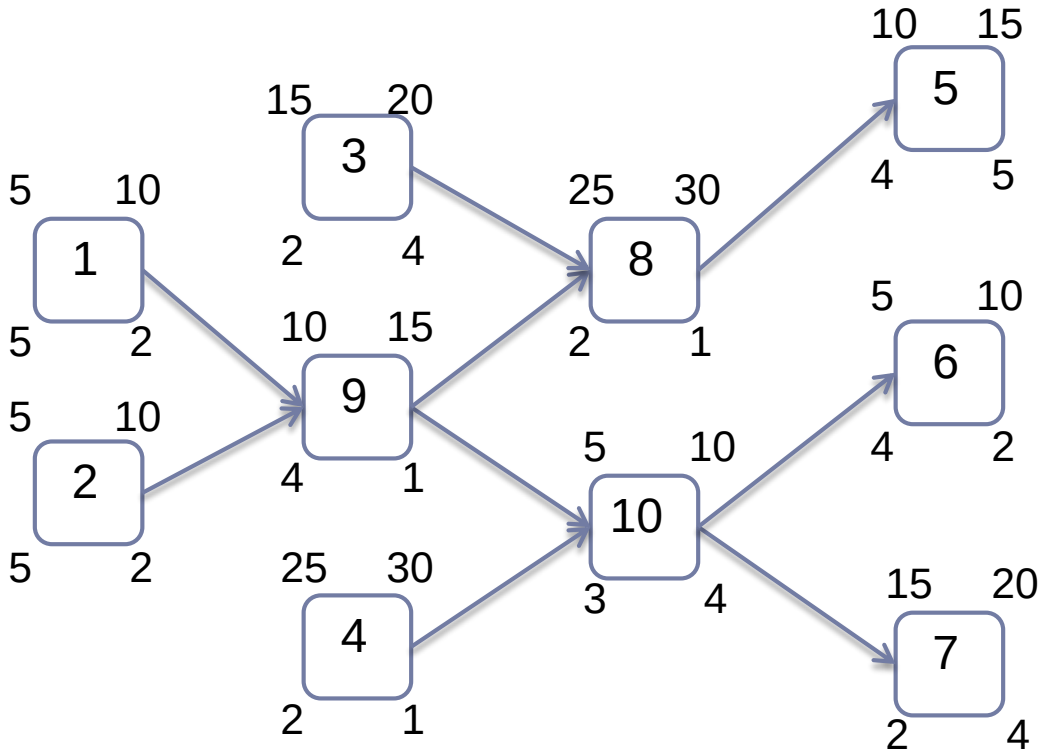
Running the algorithm



The inputs

- Cost and leadtime at each stage





The inputs

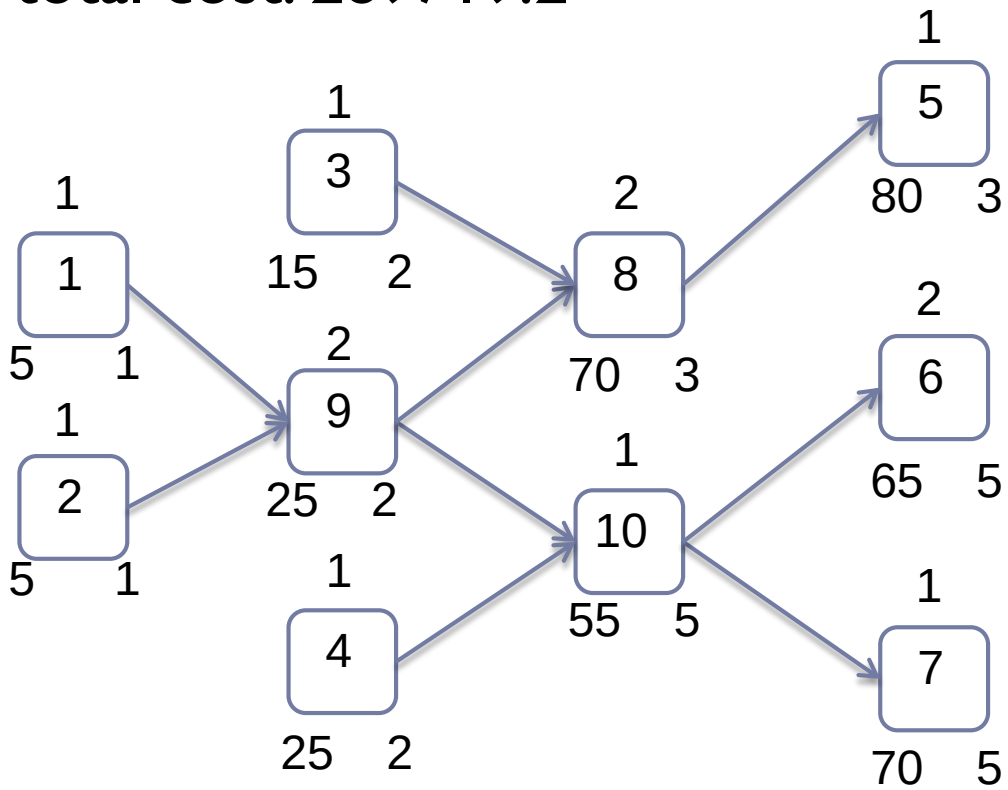
- External demand:
  - The mean of the demand
  - The maximum demand function (depends on the standard deviation of the demand)
- The external service time
- And of course the shape of the network and the number of options (=2 here)

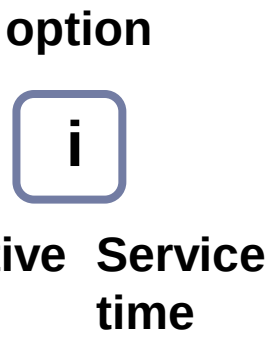
Results

- The algorithm calculates:
  - The optimal total cost of the supply chain
  - The optimal options at each stage
  - The optimal service time at each stage

Simulation with a high holding cost

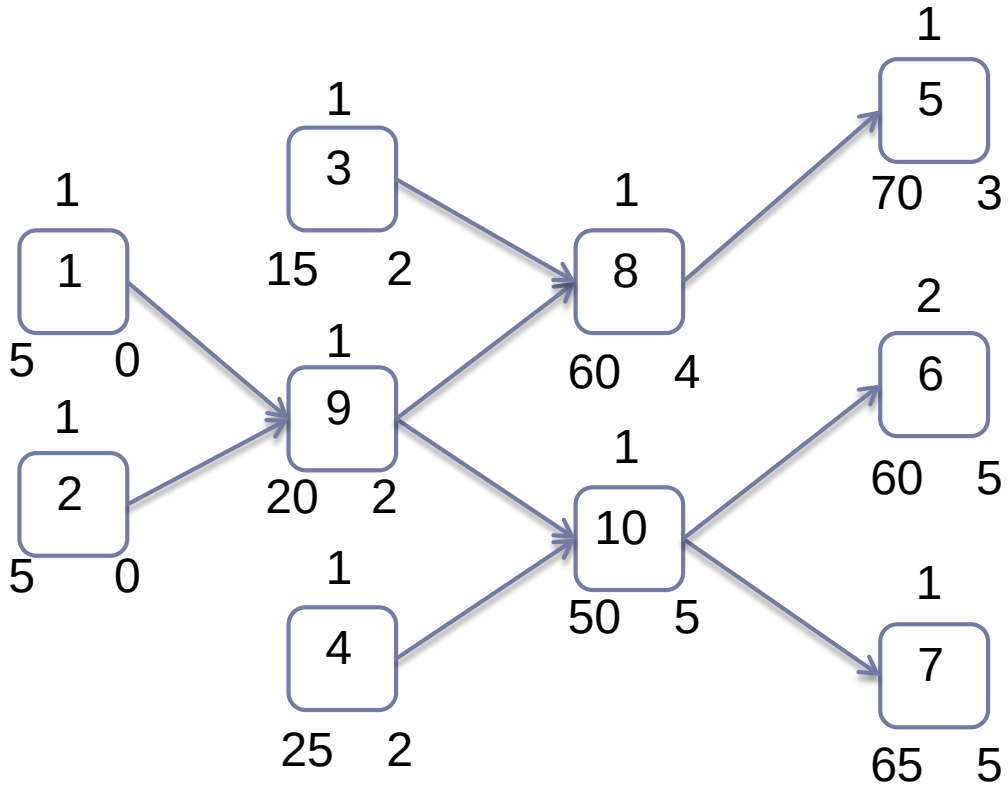
- The high-cost/short-leadtime are taken at the downstream stages (not at the upstream stages)
- SC total cost: 289719.2





Simulation with a low holding cost

- The high-cost/short-leadtime options are almost not selected. Only for the last option
- SC total cost: 33508.3



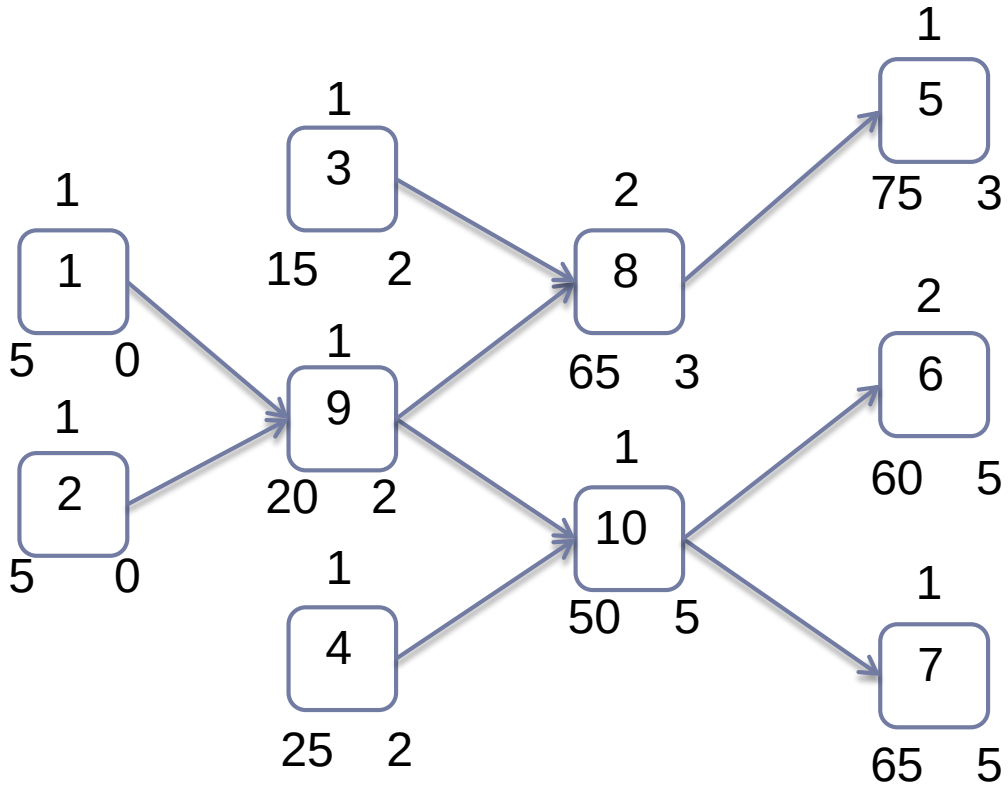
option

i

Cumulative cost **Service time**

Simulation with low demand deviation

- SC total cost: 61395.1



option

i

Cumulative cost **Service time**

Simulation with a high demand deviation

- There is more high-cost/low-leadtime options selected
- SC total cost: 66062.7