

# Air Pollution Control Equipment

A company wants to install a new an air pollution control equipment in one of its facilities.



We want to schedule this project.

# Air Pollution Control Equipment

The project is made of the following tasks.

Task	Description	Duration	Precedence
A	Build internal components	2	none
B	Modify roof & floor	3	none
C	Construct collection stack	2	A
D	Pour concrete & install frame	4	B
E	Build high temperature burner	4	C
F	Install control system	3	C
G	Install air pollution device	5	D, E
H	Inspection & testing	2	F, G

A task T1 precedes a task T2 if T1 must be completed before T2 starts.

# PERT Method

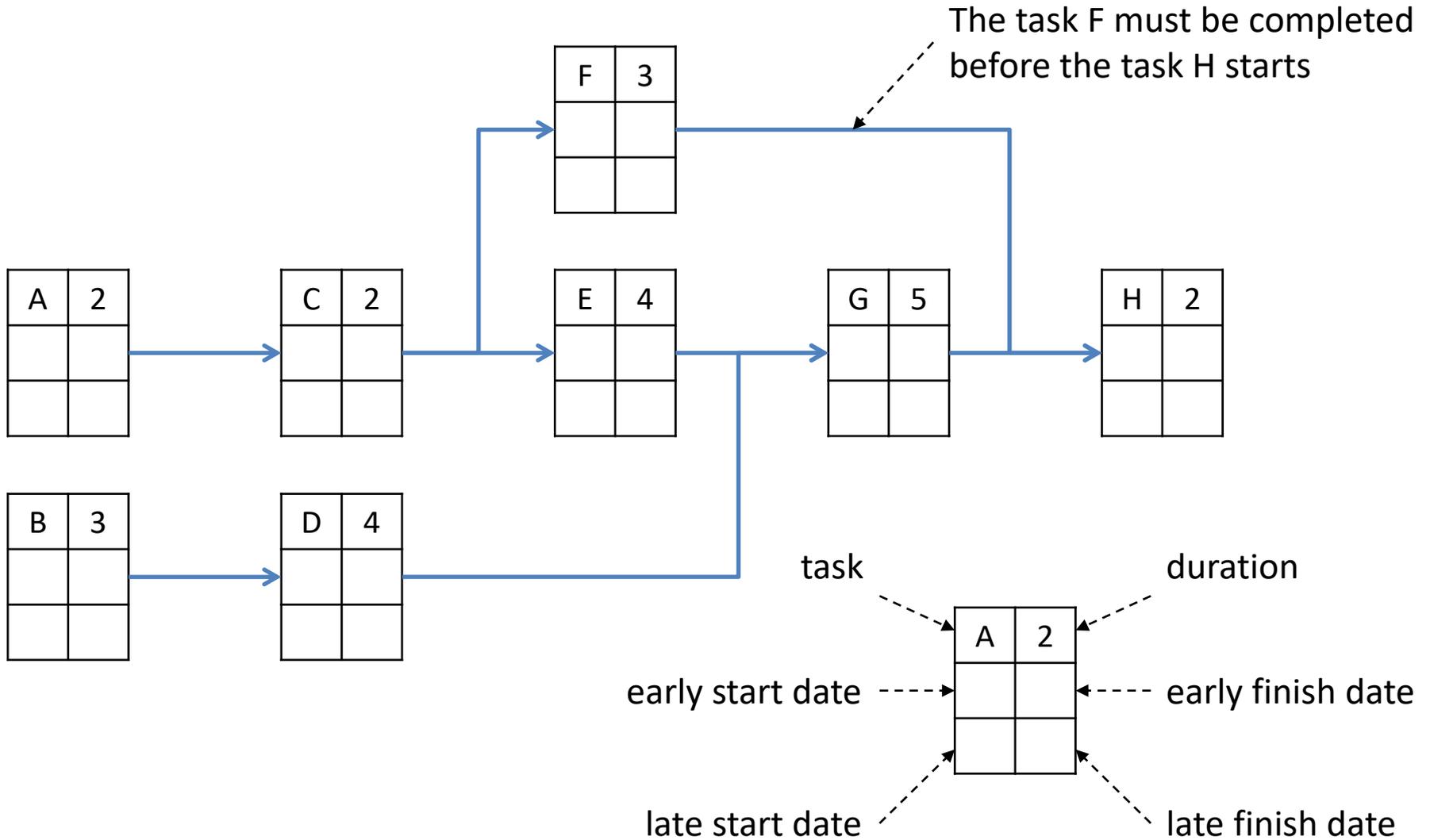
The program (or project) evaluation and review technique (**PERT**) is a statistical tool used in project management, which was designed to analyze and represent the tasks involved in completing a given project.

First developed by the United States Navy in the 1950s, it is commonly used in conjunction with the critical path method (**CPM**).

In a PERT diagram (graph):

- Nodes represent events, i.e. either beginning or completion of activities of the project under study. There is thus two nodes per activity/task in the project.
- Edges represent:
  - Either activities, when they join a node representing the beginning of an activity to the node representing the completion of this activity. In this case, the length of the edge is the estimated duration of the activity.
  - Or precedence constraints, when they join a node representing the completion of an activity to the node representing the beginning of another activity. The length of these edges is normally 0.

# PERT Diagram



# Early and Late dates

We want to calculate for each activity:

- The early date, i.e. the first date at which this activity can start.
- The late date, i.e. the last date at which this activity can start without harming the project.

Calculate early dates:

early-date(beginning of the project) = 0

while there is a non treated node

    Find a node N whose all predecessors are treated

    Set the early date of N as the maximum over its predecessors of the early date of the predecessor, plus the length of the edge joining them.

Calculate late dates, proceed in the same way, but backward from the node representing the completion of the project (considering that the late date for this node is its early date).

# Application

The **PERT method** is a tool for **project management**. In this chapter, we assumed that durations of tasks were deterministic. In real-life applications, it is hardly the case. Therefore, uncertainties are taken into account by introducing **probability distributions** on durations. The PERT method is *de facto* a **statistical tool**.

Note that during project executions, things never execute as scheduled. This can be due to ambiguity resulting from subjective estimates that are prone to human errors or can be the result of variability arising from unexpected events or risks. Therefore, the PERT diagram should be dynamically re-organized and re-assessed.