

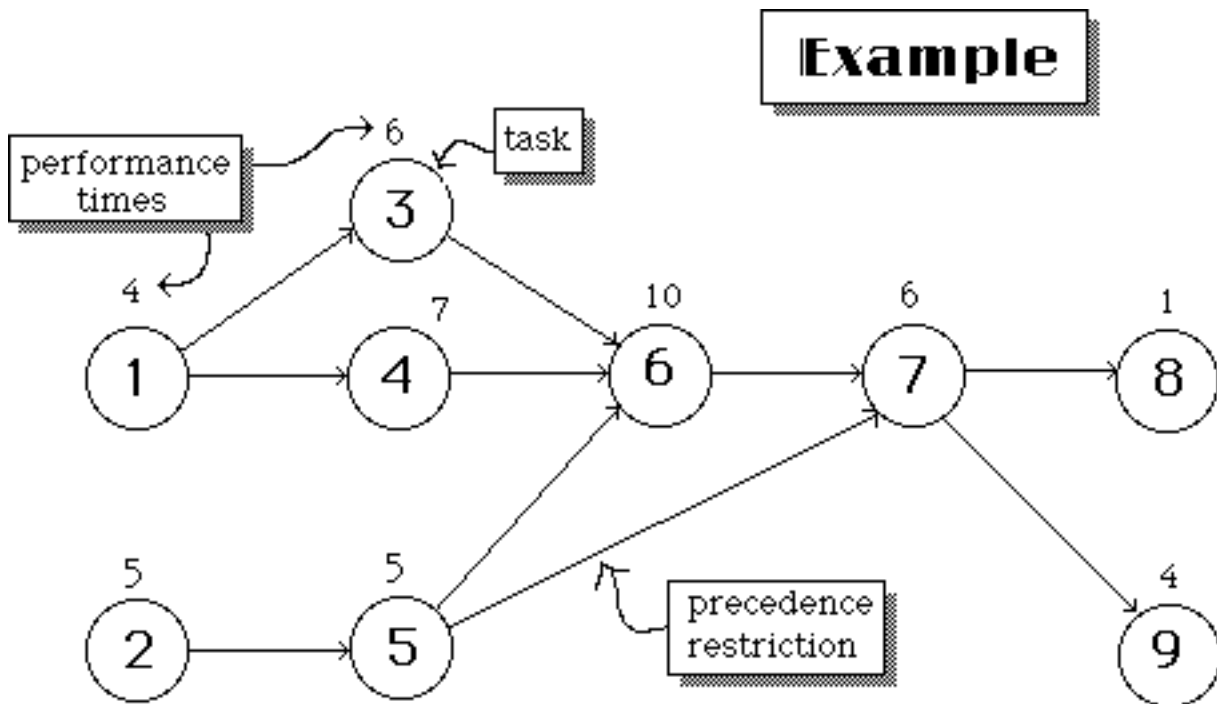
ASSEMBLY LINE BALANCING

- ☞ The line balancing problem
- ☞ Mathematical programming models
- ☞ Heuristic algorithms



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- An assembly line consists of a series of **work stations** along which a product moves.
- The product remains at each work station an amount of time called **cycle time**. While it is at a work station, one or more **tasks** are performed, each with a known **performance time**.
- **Precedence restrictions** may be imposed. That is, "task i precedes task j " ($i \rightarrow j$) means that task i must be performed at the same or earlier station than j .



Task # <i>i</i>	Performance time P_i	Predecessor tasks
1	4	-
2	5	-
3	6	1
4	7	1
5	5	2
6	10	3,4,5
7	6	5,6
8	1	7
9	4	7

Total work content

48

If the cycle time is c and the number of work stations is k , then

$$kc \geq \sum_{i=1}^n P_i = \text{work content}$$

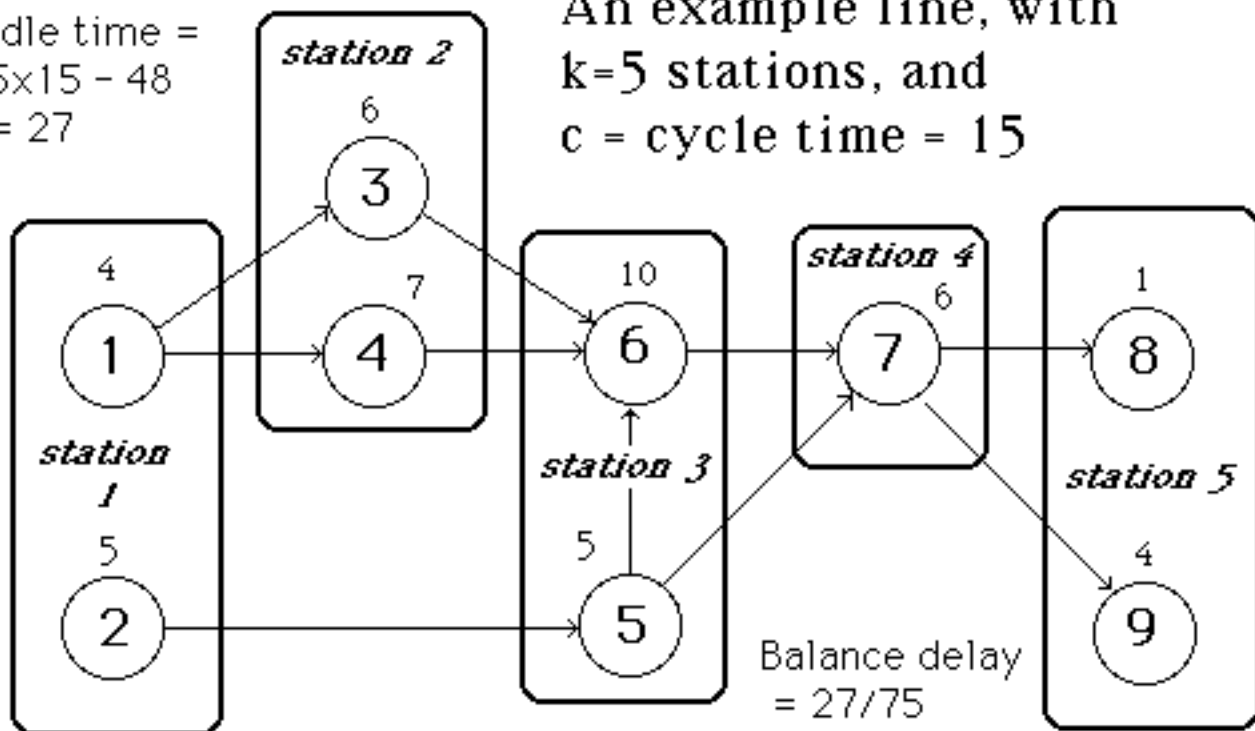
Idle time: $I = kc - \sum_{i=1}^n P_i$

Balance delay:

$$d = \frac{kc - \sum_{i=1}^n P_i}{kc} = \frac{I}{kc}$$

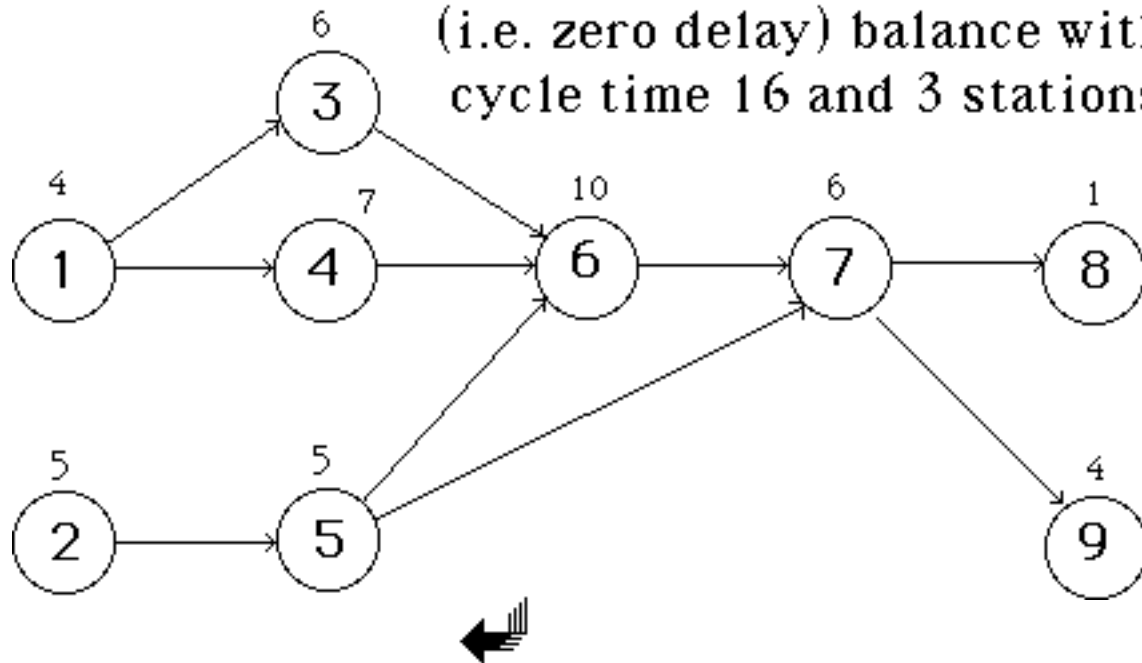
$$\begin{aligned} \text{Idle time} &= \\ 5 \times 15 - 48 \\ &= 27 \end{aligned}$$

An example line, with
 $k=5$ stations, and
 $c = \text{cycle time} = 15$



$$\begin{aligned} \text{Balance delay} &= 27/75 \\ &= 36\% \end{aligned}$$

Since the work content is $48 = 3 \times 16$,
is it possible to find a "perfect"
(i.e. zero delay) balance with
cycle time 16 and 3 stations?



Heuristic Algorithms for Assembly Line Balancing

- ☞ The Kilbridge & Wester Algorithm
- ☞ The Ranked Positional Weight Method (RPWM)
- ☞ The Reversed RPWM
- ☞ COMSOAL
- ☞ Genetic Algorithm

