# ASSEMBLY LINE BALANCING

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

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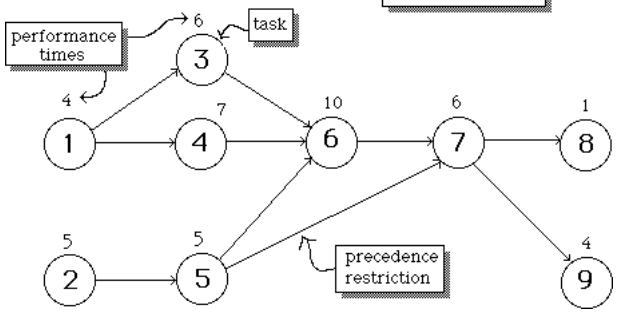
- An assembly line consists of a series of **work stations** along which a product moves.
- The product remains at each work station an amount of time called **cycle time**. While it is at a work station, one or more **tasks** are performed, each with a known **performance time**.
- **Precedence restrictions**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



## Example




| Task # 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

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

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

**Balance delay:**

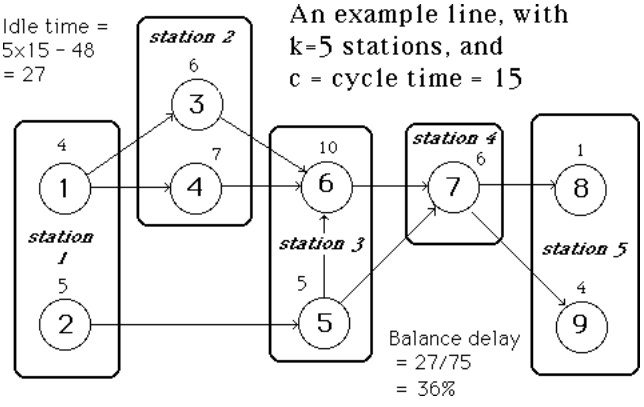
$$d = \frac{kc - \sum_{i=1}^{n} P_i}{kc} = \frac{I}{kc}$$





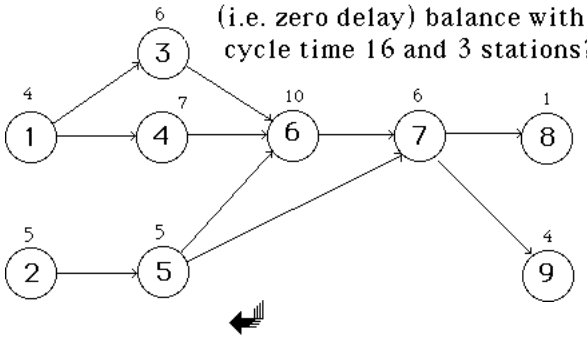
Idle time = 5x15 - 48 = 27

An example line, with k=5 stations, and c = cycle time = 15






Since the work content is 48=3×16, 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