SCHEDULING

manufacturing management

SCHEDULING

- single machine problem
- flow shop problem
- job shop problem

CONCEPT OF SINGLE MACHINE SCHEDULING

- Processing time (t_j)
- Ready time (r_j)
- Due date (d_j)
- Completion time (C_j)
- Flow time (F_j)
- Lateness (L_j)
- Tardiness (T_j)

MEASURES OF PERFORMANCE

- Mean flow time: $\bar{F} = \frac{1}{n}\sum_{j=1}^{n} F_j$
- Mean tardiness $\bar{T} = \frac{1}{n}\sum_{j=1}^{n} T_j$

- Maximum flow time $F_{\max} = \underset{1 \le j \le n}{Max}\{F_j\}$
- Maximum tardiness $T_{\max} = \underset{1 \le j \le n}{Max}\{T_j\}$
- Number of tardy jobs $N_T = \sum_{j=1}^{n} f(T_j)$

where $f(T_j) = 1$, if $T_j > 0$, and $f(T_j) = 0$, otherwise

SHORTEST PROCESSING TIME

Example

Job (j)	1	2	3	4	5
Processing time (t) (hrs)	15	4	5	14	8

Find the optimal sequence, which will minimize the mean flow time and also obtain the minimum mean flow time.

Solution

Job (j)	2	3	5	4	1
Processing time (t) (hrs)	4	5	8	14	15
Completion time (C_j) (F_j)	4	9	17	31	46

Since, the ready time $r_j = 0$ for all j, the flow time (F_j) is equal to C_j for all j.

$$\bar{F} = \frac{1}{n}\sum_{j=1}^{n} F_j = \frac{1}{5}(4+9+17+31+46) = \frac{1}{5}(107) = 21.4 \text{ hours}$$

WSPT RULE

$$\bar{F}w = \frac{\sum_{j=1}^{n} w_j \cdot F_j}{\sum_{j=1}^{n} w_j}$$

EARLIEST DUE DATE RULE

$$L_j = C_j - d_j$$

MINIMIZING THE NUMBER OF TARDY JOBS

FLOW SHOP SCHEDULING

- A set of multiple-operation jobs is available for processing at time zero (Each job requires m operations and each operation requires a different machine)
- Set-up times for the operations are sequence independent, and are included in processing times
- Job descriptors are known in advance
- m different machines are continuously available
- Each individual operation of jobs is processed till its completion without break

JOHNSON'S PROBLEM

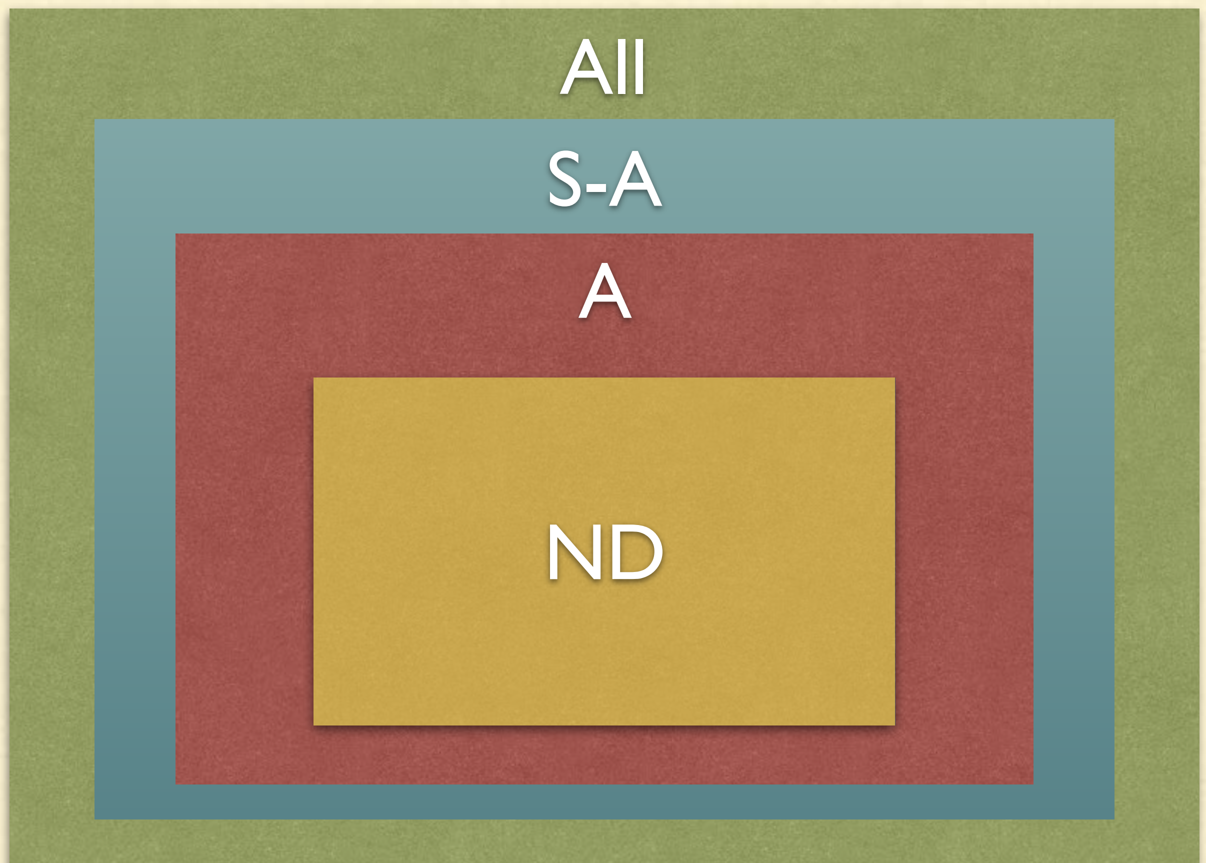
Job	Machine 1	Machine 2
1	t_{11}	t_{12}
2	t_{21}	t_{22}
3	t_{31}	t_{32}
n	t_{n1}	t_{n2}

JOB SHOP PROBLEM

TYPES OF SCHEDULES

- Local left shift
- limited left shift
- semi active schedules
- Non-delay schedules

VENN DIAGRAM SHOWING DIFFERENT SCHEDULES



All - all the schedules
S- sem active schedules
A-active schedules
ND-non delay schedules

TWO JOBS AND M MACHINES SCHEDULING

- ***Step 1:*** Construct a two dimensional graph in which *x*-axis represents the job 1, its sequence of operations and their processing times, and *y*-axis represents the job 2, its sequence of operations and their processing times (use same scale for both *x*-axis and *y*-axis).
- ***Step 2:*** Shade each region where a machine would be occupied by the two jobs simultaneously.
- ***Step 3:*** The processing of both jobs can be shown by a continuous line consisting of horizontal, vertical and 45 degree diagonal lines. The line is drawn from the origin and continued to the upper right corner by avoiding the regions. A diagonal line means that both jobs can be performed simultaneously.