Scheduling Notation

We will give the typical notation used in the course

Jobs

- **Number:** n
- **Typical Index:** j
- **Features:**
  - **processing time:** p_j **or** p_{ij}
  - **release date:** r_j
  - **deadline or due date:** d_j
  - **weight** w_j

soft deadline

hard deadline

Machines

- Number: m
- Typical Index: i
- Possible Environments:
  - **1** : one machine
  - **P,Pm**: parallel (identical machines)
  - **Q,Qm**: related machines (different speeds)
  - **R,Rm**: unrelated machines (processing time depends on job and machine)
  - Shop Environments
    - **J**: job shop – each job has linear constraints among its task
    - **F**: flow shop – each job has the same linear constraints among its task
    - **O**: open shop – no constraints among tasks

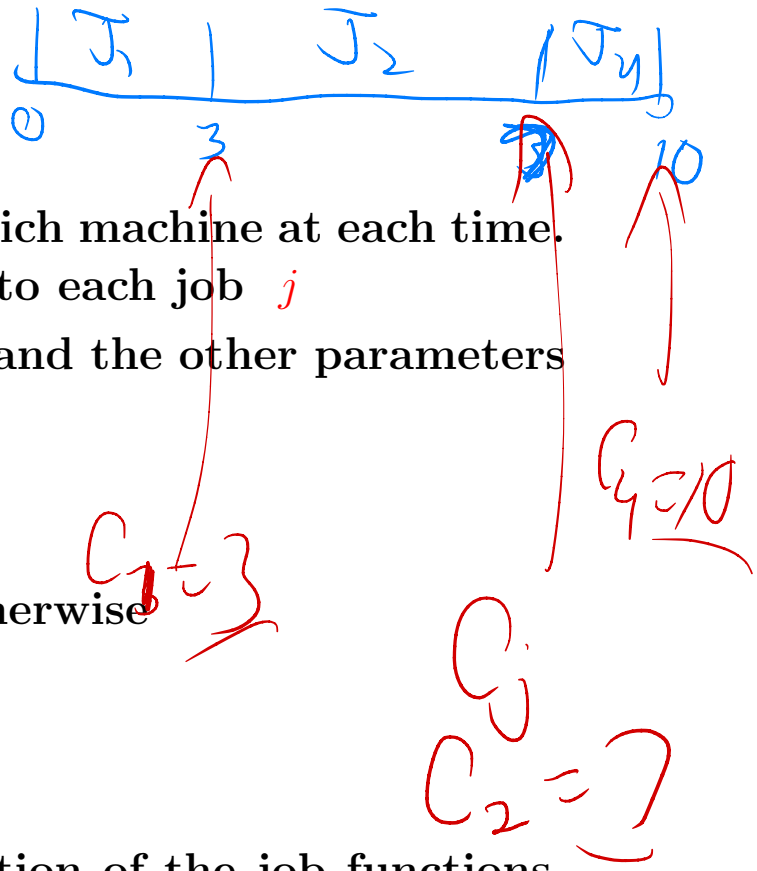
Constraints

We give some examples here:

- r_j: **release date**
- **pmtn**: **preemption**
- **prec**: **precedence constraints**
- s_{jk}: **sequence dependent set up times**
- **bkdwn**: **machines may breakdown**
- **block**: **limited buffer size**

non-preemption is the default

Objectives



– A schedule designates which job runs on which machine at each time. It therefore assigns a completion time C_j to each job j

– We evaluate a job by some function of C_j and the other parameters of job, e.g.

* Lateness: $L_j = C_j - d_j$
* Tardiness: $T_j = \max\{L_j, 0\}$
* Unit Cost: $U_j = 1$ if $C_j > d_j$ and 0 otherwise
* Flow (Response) Time: $F_j = C_j - r_j$
* Idle Time: $I_j = C_j - r_j - p_j$
* Stretch: $S_j = (C_j - r_j)/p_j$

– We then evaluate a schedule by some function of the job functions, usually a minimization of a

* sum
* weighted sum
* discounted weighted sum
* maximum (We use $X_{\max}$ as shorthand for $\max_j X_j$).

3 field notation

$C_{max} = \max_j \{C_j\}$

- machines — constraints — objective
- Default is no preemption Examples:
  - $P||C_{\max}$ – parallel identical machines, minimize the schedule length (makespan)
  - $1|\text{prec, pmtn}|\sum w_j C_j$ - one machine, precedence constraints and preemption, minimize the sum of weighted completion times
  - $P\infty|\text{prec}|C_{\max}$ - project scheduling
  - $Jm|\text{nowait}|C_{\max}$ - nowait job shop scheduling, minimize makespan
  - $1|\text{pmtn}|\sum w_j T_j$ - one machine, preemption, minimum weighted tardiness

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