Remark: On problems that are easier to setup, you should be asking more difficult questions.

A this point work toward a progress report:

I suggest: make the progress report look like a draft of the paper with certain sections or proartions omitted.

Section 1: Introduction
- Basic problem
- Basic motivation
- Main results are [to be continued]

Section 2: Problem set up
- Basic setup [come from proposal]
- More advanced setup, more difficult problems [Addition material to come.]

OVER TIME

Concluding Section
- Results [yet to come]
- Future directions

References: Start collecting them now

Section: Obstacles, issues, etc.

DATA — In article, describe, Probably just a .zip, .gz, .tar that you email me

Final paper when stuff is filled in and edited

A sample "organic" progress will appear on my website

# Scheduling:

Remark: Some applications are a combo of the basic applications described in this course.

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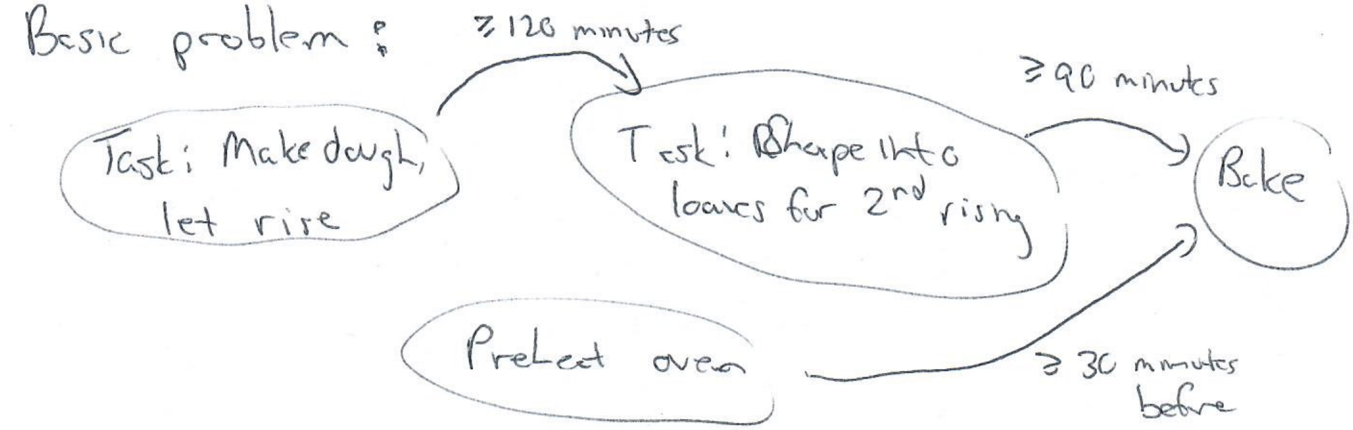
Basic problem:




More generally: We have $n$ tasks, that are scheduled at various times $x_1, \ldots, x_n \geq 0$

Constraints: for some pairs $i, j$,

$$x_i + \text{WaitTime}(i,j) \leq x_j$$

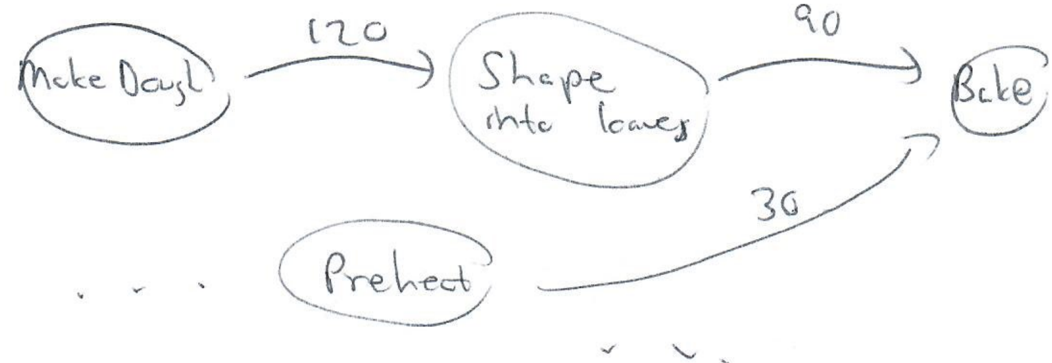
minimize

$$\max(x_1, \ldots, x_n), \qquad x_1, \ldots, x_n \geq 0$$

---

Use duality and total unimodularity to get a quick algorithm

E.g. (better to draw a directed graph with $n$ vertizes — one for each task — and directed edges for the wait time constraints:




If this is all then


proves you need at least 210 minutes

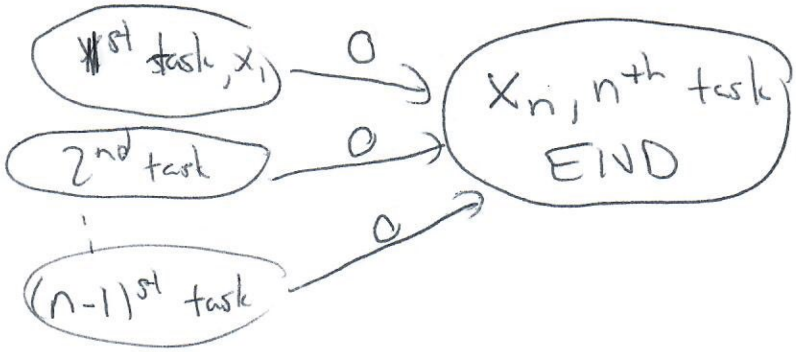
---

Duality ⇝ this type of path argument

Rem: for many LPs in "real world" the dual LP is useful.

So ...

(1) First insist that the $n^{\text{th}}$ task $\leftrightarrow$ $x_n$ looks like




if so the objective: minimize $x_n$

rather than minimize $T$ s.t. $x_1 \le T$, $x_2 \le T$, ...)

Special Case:

$$\min \; x_n \quad \text{s.t.}$$

dual

$y_{ij}$ $\quad \boxed{x_i + w(i,j) \le x_j}$ $\quad (i,j) \in E$ = set of directed edges

$$x_1, \ldots, x_n \ge 0$$

$E$ is a given set of pairs of $(i,j)$, each $i,j = 1, \ldots, n$

$w(i,j)$ is given for each $(i,j) \in E$.

Get

$$\sum_{i,j} y_{ij} \left( x_i - x_j \le -w(i,j) \right)$$

→ upper bound on $x_n$ ..

bound $i$

$$a_1 x_1 + \ldots + a_n x_n \le -w(i,j) y_{ij}$$

but $a_1 + \ldots + a_n = 0$