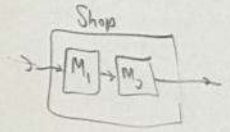
Job Shop Scheduling

Example 4.

$F2 \mid \ldots \mid C_{max}$

Flow Shop

Maximum Completion Time = Time when all jobs have been processed

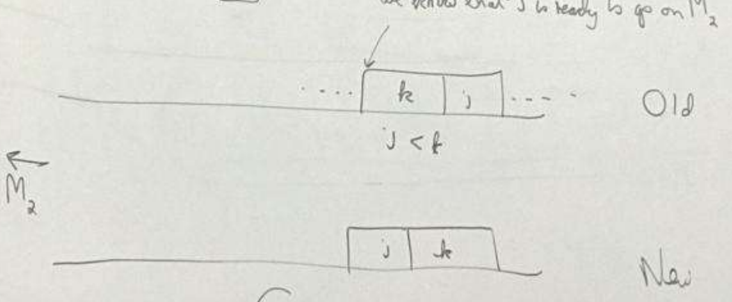


Permutation Schedule

Jobs go onto M_2 in the same order as on M_1.

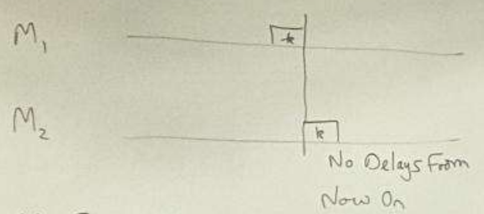
We can assume a permutation schedule

$\ldots 4\ 3\ 2\ 1 \rightarrow \boxed{M_1}$



C_{max} unchanged

Permutation Scheduli



(I) C_{max} is always the sum of $n+1$ processing times.

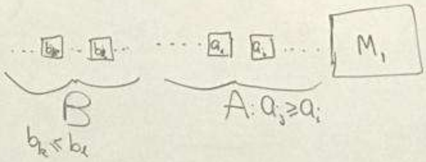
(II) Therefore, Subtraction p from every processing time reduces <u>all</u> permutation schedules by the same amount.

Assume now that processing times are $a_1, a_2, \ldots, a_n$ on M_1

$b_1, b_2, \ldots, b_n$ on M_2

Johnson's Rule

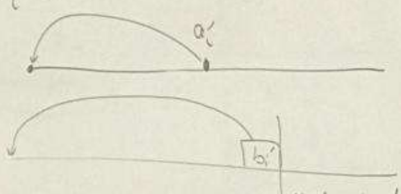
$A = \{ i : a_i \le b_i \}$, $B = [n] \setminus A$



Let $\rho = \min\{a_1, a_2, \ldots, a_n, b_1, b_2, \ldots, b_n\}$

$a_i' = a_i - \rho$ & $b_i' = b_i - \rho$, $i = 1, 2, \ldots, n$.

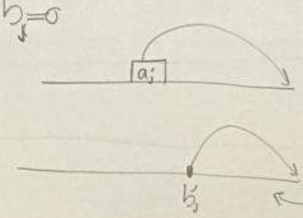
Case 1: $a_i' = 0$



OD

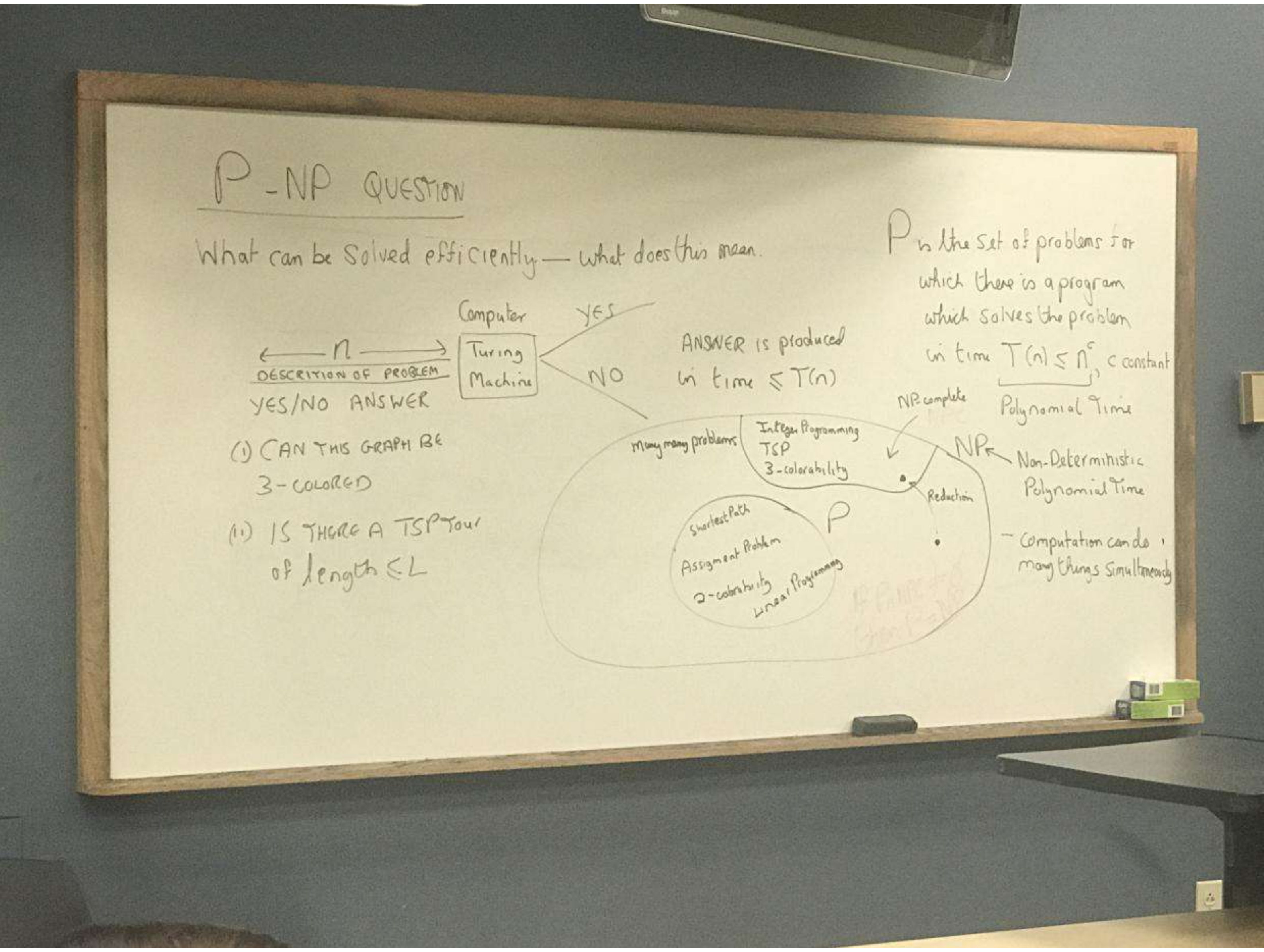
Nothing is delayed by this move.

Case 2: $b_j' = 0$



No change in delay

$\Rightarrow$ Johnson Rule.


P - NP QUESTION
What can be solved efficiently — what does this mean.
Computer
Turing Machine
n
DESCRIPTION OF PROBLEM
YES
NO
ANSWER is produced
in time ≤ T(n)
YES/NO ANSWER
(i) CAN THIS GRAPH BE 3-COLORED
(ii) IS THERE A TSP Tour of length ≤ L
P is the set of problems for which there is a program which solves the problem in time T(n) ≤ n^c, c constant
Polynomial Time
NP complete
NP
Non-Deterministic Polynomial Time
— Computation can do many things simultaneously
Many many problems
Integer Programming
TSP
3-colorability
Reduction
P
Shortest Path
Assignment Problem
2-colorability
Linear Programming