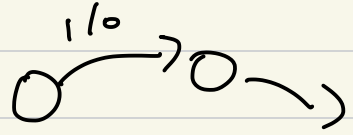


CS315-01 Pipelining

Project 06



Project 07 - Pipelining

Single Cycle Processor

Multi Cycle Processor

Pipelining

Doing Laundry

Laundry steps

1) Wash

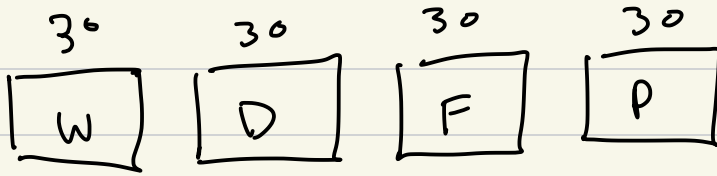
2) Dry

3) Fold

4) Put away

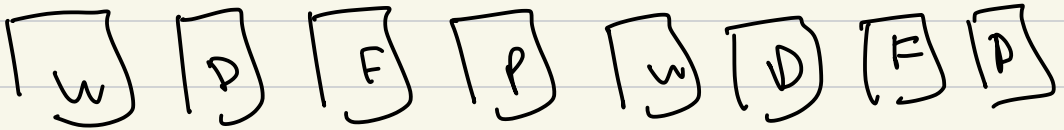
each step

take 30 mins



1 load
= 2 hrs

120 mins

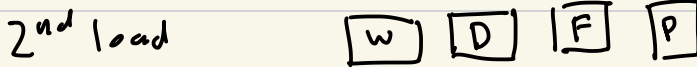
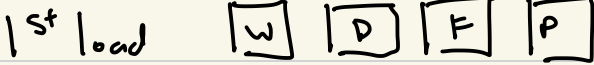


= 4 hrs

Laundry Pipeline

30 30 30 30

2hr 2.5hr 3.0hr 3.5hrs



2 load = 2.5 hrs (150 mins)

4 loads = 3.5 hrs (210 mins)

Serial

4 hrs

8 hrs

100 loads ?

$$\text{Serial : } 100 \times 2\text{hr} = \boxed{200 \text{ hrs}}$$

$$\text{PL : first cut } 100 \times \underline{0.5} = 50 \text{ hrs} \\ \text{approx.}$$

Second cut

$$4_{\text{step}} \times (0.5) + (100-1) \times (0.5)$$

$$2\text{hrs} + 99 \times 0.5$$

$$2\text{hr} + 49.5 \text{ hr} = \boxed{51.5 \text{ hrs}}$$

4x speedup

1000 loads

$$(4 \times 0.5) + (1000-1) \times 0.5$$

$$2 + 999 \times 0.5$$

$$2 + 499.5 = \boxed{501.5 \text{ hrs}}$$

In principle :

A n -stage pipeline
can speed up execution
by

$$\frac{1}{n}$$

$$4 \text{ stages} = \frac{1}{4}$$

addi a0, zero, 1

IF D2

addi a1, zero, 2

IF D2

Pipeline Hazards

Data Hazards

Control Hazards (branches / Jumps)

↓
li t0, 1
li t1, 2
add t2, t0, t1

} writes

RAW
read after write

time →

