CS 315-02 Pipelining

Project06

Project07

Single Cycle Processor
Multi Cycle Processor

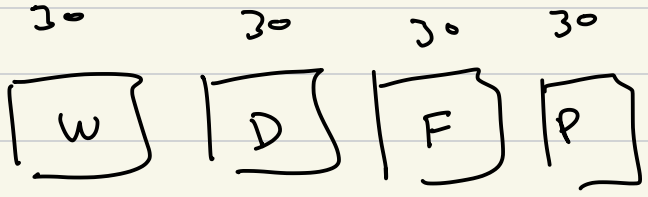
Pipelining

Doing Laundry

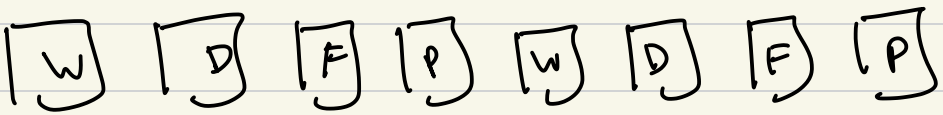
Laundry steps

1) Wash
2) Dry
3) Fold
4) Put away

each step takes 30 mis



1 load = 2 hrs (120 mins)



= 4 hrs

2hr 2.5 1.2

30 30 30 30 30 30 30

1st load W D F P

2nd load W D F P

3rd load W D F P

4th load W D F P

		Serial
2	loads = 2.5 hrs (150 mins)	4 hrs
4	loads = 3.5 hrs (210 mins)	8 hrs

100 loads?

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

PL (first cut): $100 \times 0.5 = 50\text{ hrs}$

second cut:

$(4 \times 0.5) + (100-1) \times (0.5)$

↑ steps

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

$2\text{ hrs} + 49.5\text{ hrs}$

$= \boxed{51.5\text{ hrs}}$

1000 loads:

1st load

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

$2\text{hrs} + 999 \times 0.5$

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

In principle

A n-stage pipeline can speed up execution by

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

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

Pipeline Hazards

Data Hazards

Control Hazards (branches / Jumps)

```
li t0, 1
li t1, 2
add t2, t0, t1
```

RAW read after write

time →