

Administrative Details = Lab #4 due Thursday at 11pm = Quiz due today at 2:30pm = Read CSAPP Ch. 4.4-4.5 = Colloquium today at 2:35 in Wege = Water robots! = Some Winter Study classes to consider = <u>WSP 32: Making a Better Next Semester</u> = <u>CSCI 16</u>: Intro to CS Research Process = Post exam reflection and action plan

Last Time: The Y86 Datapath

- Memory and clocking
- How is information stored
- Construction a single-cycle datapath for Y86

Today: The Y86 Datapath

- Construction a single-cycle datapath for Y86
- Pipelining Concepts

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Today: The Y86 Datapath

- Construction a single-cycle datapath for Y86
- Pipelining Concepts



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Our goals for a better processor design:

- Faster clock rate
- Use machine more efficiently
- No longer execute only one instruction at a time

In order to claim we've made an "improvement", we need a way to measure success

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CyclesPerJob: Number of cycles between finishing jobs.





Laundry-o-matic washes, dries & folds
Wash: 30 min
Dry: 40 min
Fold: 20 min
It switches them internally with no delay
How long to complete 1 load? _____











Laundry-o-Matic

- Cycle Time: Clothing is switched every 90 minutes
- Latency: A single load takes a total of _____ minutes
- Throughput: A load completes each _____ minutes
- CyclesPerLoad: Every _____ cycles, a load completes

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Laundry-o-Matic

- Cycle Time: Clothing is switched every 90 minutes
- Latency: A single load takes a total of 90 minutes
- Throughput: A load completes each 90 minutes
- CyclesPerLoad: Every _____ cycles, a load completes

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30

Laundry-o-Matic

- Cycle Time: Clothing is switched every 90 minutes
- Latency: A single load takes a total of 90 minutes
- Throughput: A load completes each 90 minutes
- CyclesPerLoad: Every 1 cycles, a load completes

















Pipelined Laundry

- Cycle Time: Clothing is switched every 46 minutes
- Latency: A single load takes a total of _____ minutes
- Throughput: A load completes each _____ minutes
- CyclesPerLoad: Every ____ cycles, a load completes

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Pipelined Laundry

- Cycle Time: Clothing is switched every 46 minutes
- Latency: A single load takes a total of 138 minutes
- Throughput: A load completes each 46 minutes
- CyclesPerLoad: Every _____ cycles, a load completes

Pipelined Laundry

- Cycle Time: Clothing is switched every 46 minutes
- Latency: A single load takes a total of 138 minutes
- Throughput: A load completes each _____ minutes
- CyclesPerLoad: Every _____ cycles, a load completes

42

Pipelined Laundry

- Cycle Time: Clothing is switched every 46 minutes
- Latency: A single load takes a total of 138 minutes
- Throughput: A load completes each 46 minutes
- CyclesPerLoad: Every 1 cycles, a load completes

Single-Cycle vs Pipelined

has the higher cycle time
has the higher clock rate
has the higher single-load latency
has the higher throughput
has the higher CPL (Cycles per Load)
More stages makes a clock rate

45



Single-Cycle vs Pipelined Single has the higher cycle time has the higher clock rate

- _____ has the higher single-load latency
- _____ has the higher throughput
- has the higher CPL (Cycles per Load)
- More stages makes a _____ clock rate

46

48

Single-Cycle vs Pipelined

- Single has the higher cycle timePipelined has the higher clock rate
- Pipelined has the higher single-load latency
- has the higher throughput
- _____ has the higher CPL (Cycles per Load)
- More stages makes a _____ clock rate

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Single-Cycle vs Pipelined

- Single has the higher cycle time
- Pipelined has the higher clock rate
- Pipelined has the higher single-load latency
- Pipelined has the higher throughput
- has the higher CPL (Cycles per Load)
- More stages makes a _____ clock rate

Single-Cycle vs Pipelined

- Single has the higher cycle time
- Pipelined has the higher clock rate
- Pipelined has the higher single-load latency
- Pipelined has the higher throughput
- Neither has the higher CPL (Cycles per Load)
- More stages makes a _____ clock rate

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Single-Cycle vs Pipelined

- Single has the higher cycle time
- Pipelined has the higher clock rate
- Pipelined has the higher single-load latency
- Pipelined has the higher throughput
- Neither has the higher CPL (Cycles per Load)
- More stages makes a Higher clock rate