

CS286-002: Lecture Note (Lecture #11, October 12, 2026)

1. Distribute:

- Attendance card
- Exercise Handout (10/7/2026)

2. Announcements:

- The midterm exam: October 14
 - Cheat sheet
 - A calculator
 - Exam will start at 3:00 p.m. – it is suggested to come to the campus 15-20 minute earlier
- Quiz #6 has been graded
 - The graded Quiz #6 should be returned at the end
 - The suggested solutions for Quiz #6 have been posted to the course home
- Midterm exam covers the first programming project

3. Wrapping up “Datapath Architectures”

- “How much is a pipeline processor faster than its scalar counterpart?”
- A suggested exercise question:

QUESTION #6

(a) Derive a formula for how much faster a super-pipeline processor is, compared to its scalar counterpart (for executing infinitely large number of instructions) when the super-pipeline processors does not experience any super-scalar or pipeline hazard. Assume that the scalar processor has K internal stages, running at the same clock cycle rate of R Hz and that the super-pipeline processor has S parallel data-paths. Show your work.

(b) Find how much a super-pipeline processor is faster than its scalar counterpart (for the above).

4. One left-over question from Quiz #5:

#10: What are the five different types of the numbers IEEE-754 floating-point numbers that can not be accurately represented by a processor?

Note: This question does not ask descriptions of the five different types of the numbers. Instead, it asks the name of the five different types of the numbers.

5. Suggested Exercises

- Quiz #7 questions:

#11: Show the formula to calculate the execution time (for scalar processors) using, IC (instruction count), R (clock cycle rate), and one more parameter.

#12: Processors with a lower clock rate execute the same binary programs faster than the processors with a higher clock rate. How is this possible?

#13: For the following performance metrics for processors, show which way each metric is better:

Execution time: short → long

CPU Clock rate: low → high

Clock cycle time: short → long

CPI: small → large

MIPS rate: small → large

- Suggested Exercise Questions:

QUESTION #1

Suppose that you wrote the following statements in C/C++:

```
int my_int_01;
unsigned int my_int_02;
void main(void)
{
    my_int_02 = 63489;
    my_int_01 = my_int_02;
    printf("my integer: %d\n", my_int_01);
}
```

QUESTION #7

We have a processor, called Processor A. The processor clock cycle rate and CPI of processor A are:

- Processor A: Clock cycle rate = 900 MHz ($1\text{M} = 10^6$)
- CPI = 1.8

Now a new processor is being developed, called Processor B. The processor clock cycle rate and CPI of processor B are:

- Processor B: Clock cycle rate = 1.2 GHz ($1\text{G} = 10^9$)

How can Processor A perform as well as Processor B? Show all your work for full credit.