



University
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School of
Computing Science

CSC1104 – Computer Organisation & Architecture

Laboratory/Tutorial 1: Components and Performance of Computers

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Objectives

- Evaluate the program and CPU performance.
- Identify the major components and ports of Raspberry Pi 4 and their function.

Questions:

1. A program written in Java runs 15 seconds on a processor. A new Java compiler is released that requires only 0.6 as many instructions as the old compiler. Unfortunately, it increases the CPI by 1.1. How fast can this program run with the new compiler?

2. Please derive the detailed size of these terms one by one.

8 GHz = _____ MHz = _____ KHz = _____ Hz

16 GHz = _____ MHz = _____ KHz = _____ Hz

40 MHz = _____ GHz = _____ KHz = _____ Hz

600 MHz = _____ GHz = _____ KHz = _____ Hz

300 KHz = _____ GHz = _____ MHz = _____ Hz

5000 KHz = _____ GHz = _____ MHz = _____ Hz

4 GiByte = _____ MiByte = _____ KiByte = _____ Bytes

20 GiByte = _____ MiByte = _____ KiByte = _____ Bytes

100 MiByte = _____ GiByte = _____ KiByte = _____ Bytes

90 KiByte = _____ GiByte = _____ KiByte = _____ Bytes

1 second = _____ ms = _____ μ s = _____ ns = _____ ps

200 ms = _____ s = _____ μ s = _____ ns = _____ ps

150 μ s = _____ s = _____ ms = _____ ns = _____ ps

600 ns = _____ s = _____ ms = _____ μ s = _____ ps

800 ps = _____ s = _____ ms = _____ μ s = _____ ns

3. Using a typical benchmark program running on 2 computers, the following machine characteristics result:

Computer	Clock Rate (MHz)	Performance (MIPS)	CPU Execution Time (secs)
A	5	1	12x
B	25	18	x

The final column shows that the Computer A required 12 times longer than the Computer B measured in CPU execution time.

- What is the **relative size of the instruction count** of the machine code for this benchmark program running on the two machines?
- What are the CPI values for the two machines?

4. Consider two different computers, with two different instruction sets, both of which have a clock rate of 200 MHz. The following measurements are recorded on the two machines running a given set of benchmark programs:

Instruction Type	Instruction Count (millions)	Cycles per Instruction
Computer A		
Arithmetic and logic	8	1
Load and store	4	3
Branch	2	4
Others	4	3
Computer B		
Arithmetic and logic	10	1
Load and store	8	2
Branch	2	4
Others	4	3

Determine and compare the average CPI, MIPS rate, and execution time for each computer.

5. Please perform a literature study on the hardware structure of a Raspberry Pi 4 Model B+ platform and the sensor HAT board. Please identify its major components, ports, types of sensors and their functions.



