

Computer Architecture: unassessed tutorial exercises

Exercise 1.1

We wish to compare the performance of two different systems: S1 and S2. System S1 costs £10K and System S2 costs £15K. The following measurements have been made on these systems:

Program	Time on S1	Time on S2
1	10 seconds	5 seconds
2	3 seconds	4 seconds

- (a) One user cares only about the performance of program 1. Given that cost effectiveness is measured in executions per second per pound, which machine is more cost effective for running program 1? By how much?
- (b) Another user is concerned with throughput of the systems as measured with an equal workload of programs 1 and 2. Which system has better performance for this workload, given that performance is inversely proportional to execution time? By how much? Which system is more cost effective for this workload? By how much?
- (c) Yet another user has the following requirements: Program 1 must be executed 200 times each hour. Any remaining time can be used for running program 2. If the system has enough performance to execute program 1 the required number of times per hour, performance is measured by the number of executions per hour for program 2. Which system has higher performance for this workload? Which is more cost effective?

Exercise 1.2

The following additional measurements have been made for the systems described in Exercise 1.1:

Program	Instructions executed on S1	Instructions executed on S2
1	20×10^6	16×10^6

- (a) Find the instruction execution rate (instructions per second) for each machine when running program 1.
- (b) If the clock rate of system S1 is 20 MHz and the clock rate of system S2 is 30 MHz, find the clock cycles per instruction (CPI) for program 1 on both systems.
- (c) Assuming that the CPI for program 2 on each machine is the same as the CPI for program 1, find the instruction count for program 2 running on each machine.