

KS32403/KS31904 Computer Architecture
(32 marks)

Instructions:

1. This is an open-book test, you must refer to the lecture notes and text book only. You are not allowed to share the answers with others.
2. To confirm honesty, please turn on your video camera during the test for record.
3. Answer all questions. Write your answer on blank papers, capture and 'private message' it to me within 5 minutes after the test ends.
4. You must upload the same answer script (pdf format) in SMARTV3 within 24 hours after the test ends.
5. This test will cover 10 to 15% of your total mark.

Question 1 (12 marks)

Assume an Intel Core i3 and an Intel Core i7, clocked at a rate of 4GHz and 3.5 GHz respectively.

- a. Calculate the clock cycle for each processor?
(2 marks)
- b. How long each processor will take to execute an instruction that consisting of 8 clock cycles?
(2 marks)
- c. Which processor is faster? Do you think that the clock rate alone is enough to measure the computer performance? Explain.
(5 marks)
- d. Can both processors be combined to form a multicore system? Explain.
(3 marks)

Question 2 (10 marks)

A non-pipelined processor has a clock rate of 5GHz and a pipelined processor has a clock rate of 2.5 GHz and both execute a program with 1.5 million instructions. The non-pipelined issues instruction at a rate of two per clock cycle. The pipeline has six stages, and instructions are issued at a rate of one per clock cycle. Assuming no penalties,

- a. What is the execution time of the pipelined processor for this program compared to a non-pipelined processor?
(5 marks)
- b. The pipelined processor has been upgraded to 4GHz. What is the execution time of the pipelined processor for this program compared to a non-pipelined processor?
(3 marks)
- c. What is throughput (in MIPS) of this upgraded pipelined processor?
(2 marks)

Question 3 (10 marks)

A non-pipelined and a pipelined processor have been used to execute a program with 2 million instructions as given in Table 1.

- a. Calculate the average CPI and MIPS for both processors. (4 marks)
- b. Which processor has better throughput? (1 mark)
- c. Is the pipelined processor faster than the non-pipelined? Explain with proof. (5 marks)

Table 1

Instruction type	Instruction mix	CPI	
		400 MHz non-pipelined	500 MHz pipelined
Arithmetic & Logic	50	1	2
Load/Store	20	2	3
Branch	10	4	6
Memory reference	20	8	10