



Test 1: Lectures 1 to 5
EEE4084F
2016-03-08



Instructions:

- Answer on a separate page.
- Make sure that your student number is on all your answer pages.
- There are 3 questions, each divided into sub-questions. Answer all questions.
- Total time: 35 minutes.
- Total marks: 35.

Question 1: Data Partitioning

[13 Total]

You are tasked to implement a multi-threaded 9×9 median filter on a system with the following specifications:

Component	Parameter	Value
CPU	Cores	4
	Cache	128 kiB per core
	Cache page size	1 kiB
	Clock	3.5 GHz
RAM	Size	2 GB
	Bandwidth	170 Gb/s
	Setup latency	11 ns

The data to be filtered are 1024×1024 8-bit grey-scale images. These are stored as arrays of rows, each of which is an array of pixels. Input and output data are separate (i.e. the algorithm is not in-place).

- #1 Assume that the main thread, as well as system background services, are idle during execution. How many worker (computation) threads would you use? Explain your reasoning. **[5]**
- #2 With the aid of a diagram, explain how you would partition the data for optimal execution time? Explain your reasoning. **[8]**

Question 2: Landscape of Parallel Computing

[14 Total]

This question relates to paper 1 titled “The Landscape of Parallel Computing Research: A View from Berkeley” by Asanovic et al.



- #1 The discussion commences that, historically there has been tension between real-time embedded computer systems and high performance computer (HPC) (or server type) systems, in which these systems characterised opposite ends of the computing applications spectrum. They argue, however, that these tensions are lessening in recent years, as desirable features of these types of platforms are starting to have increasingly more, rather than less, in common. Provide a brief explanation for this trend focusing, in particular, on insight into how old and new wisdoms have changed. [10]
- #2 Briefly explain what Asanovic et al. mean by the concept of a DWARF. Why did they decide it was necessary to add additional DWARFS instead of using the seven originally identified? [4]

Question 3: Parallel Computing and Benchmarking

[8 Total]

These questions are based on the lectures.

- #1 Name two reasons why you may want to convert a fully functional sequential solution into a parallel version. [2]
- #2 Briefly describe what is meant by a ‘golden measure’ and how you would calculate observed speedup for two versions of a program. [4]
- #3 Describe the main characteristics that distinguish a Von Neumann architecture from a Harvard architecture. [2]

