



# Fundamentals of Computer Architecture

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## What Is This Book About?

- This book teaches **computer architecture and organization**.
  - *Computer architecture* describes the properties of the computer as viewed from the perspective of the programmer;
  - *Computer organization* describes the internal properties of the computer as viewed from the perspective of the hardware engineer.



## Who Is The Book Aimed At?

- The book is aimed at all first-year undergraduates taking a computer architecture and organization module. Such a course is normally compulsory on
  - computing degrees
  - software engineering degrees
  - and HN computing courses.
- Additionally, many electronic engineering undergraduate courses have similar modules in their first year.
- It will also be useful to those studying a taught conversion Masters in computing, as well as further reading for 'A' level computing students.



## Note For Lecturers

- The book can be used in a number of ways, to suit the wide range of computer architecture syllabi.
  - It can be used as sole material for a 24 lecture course;
  - It can be used in conjunction with other materials in order to best fulfil your own unique syllabus, in order to give flexibility for either a 12 or a 24 lecture course. Each syllabus for a computer architecture course is slightly different, so it is expected that you will select the particular chapters that your syllabus concentrates on, using further material to expand your appropriate areas of interest.



## How Is The Book Organized?

- **The building blocks** - which contains chapters on designing a simple processor, fundamental concepts, registers, buses, memory, the ALU, and how our processor runs stored programs;
- **Using the processor** - which contains chapters on writing structured programs, stacks and writing subroutines, addressing modes, memory-mapped I/O, interrupts and systems software;
- **Under the bonnet** - which contains chapters on micro-instructions, building an instruction set, and the control unit;
- **The real world** - which closes with chapters on advanced features found in microprocessors in the wild.



## What Does Each Chapter Contain?

- An overview;
- The main body of the chapter (using practical examples, either programs for a simulated processor called JASP or circuit designs for a circuit simulation tool called Digital Works);
- A summary;
- Where appropriate, a set of self test questions - answers are in appendix G;
- Where appropriate, a set of further exercises to aid the learning process.



## Software

- The software packages distributed with this text are the JASP toolkit and Digital Works
  - **The JASP Toolkit**
    - Based around the design of a simple processor named JASP - *Just Another Simulated Processor*.
    - The main tool is JASPer (*Just Another Simulated Processor emulator*) – a simulated processor used throughout this text.
  - **Digital Works**
    - A circuit design and simulation package.



## What Is On The Accompanying CD?

- On the accompanying CD you will find:
  - The JASP toolkit;
  - The Digital Works package (30 day license);
  - All example programs;
  - All example circuit diagrams.



## Is There A Website?

- <http://www.palgrave.com/science/computing/burrell/>
- On the site you'll find such useful materials as:
  - The latest copy of the JASP toolkit;
  - A link to the Digital Works website;
  - Further exercises;
  - Lecturers' materials including answers to exercises and PDF slides for each chapter;
  - Errata for this text.



## About The Author

- Mark is a Principal Lecturer within the School of Informatics at Northumbria University located in the North-East of England. Currently he is on secondment to Online Services within the University.
- He has taught computing fundamentals for many years and his package JASPer has been used as a teaching aid in this area since 1995.