Swansea University
Prifysgol Abertawe

Concepts of Computer Science I

Introduction

Dr. Mike Edwards

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The Module

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Lecturers:

Dr. Mike Edwards, CoFo 217, michael.edwards@swansea.ac.uk
Dr. Jingjing Deng, CoFo 223, j.deng@swansea.ac.uk

Lectures: 10 teaching weeks of 3, 1-hour lectures (labs in Weeks 6, 7, 8)

Auditorium, Great Hall on **Monday, 1 hour, 13:00-14:00**
GH043, Great Hall on **Friday, 2 hour, 12:00-14:00**

Assessment:

- 3 Assignments (10% each)
  Data Representation (Released: 8th Oct., Deadline: 25th Oct.)
  Assembly Programming (Released: 29th Oct., Deadline: 15th Nov.)
  Logic Gates (Released 19th Nov., Deadline: 4th Dec.)
- Exam (70%)

My Expectations

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- You will likely have covered some of the content of this module before, there will be differences and challenges for all – do not assume you know everything already!
- When things are new and challenging, deciding that its “too hard for me” or “why do I need to know this anyway” is the wrong attitude!
- When you don’t understand something, please ask.
- Have fun!

Reading List

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CS-150 Concepts of Computer Science 1

Module ID: CS-150

Recommended reading (1)

Book

Computer science illuminated / Nell Dale, The University of Texas at Austin, John Lewis, Virginia Tech. (Sixth edition.)
Dale, Nell (Nell B.); Lewis, John
(2016)

Other reading (2)

Book

Computer systems (4th ed.)
Warford, J. Stanley
Jones and Bartlett Publishers c2010
GiGetIt
New Item

Book

Computer science : an overview / J. Glenn Brookshear, David T. Smith, and Dennis Brylow. (International ed. of 11th revised ed.)
Brookshear, J.Glenn.
Pearson Education Limited, 2011.

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Blackboard

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On the Blackboard site you will find:

- Module Information
- Announcements
- Module Content
  - PowerPoint Slides as used in Lectures
  - Video Tutorials
- Assessment and Feedback
- Reading List

Topics Within the Module

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- Brief history of computers and software
- Number systems
- Data representation
- Computing components
- Assembly language programming
- Programming languages and translation
- Logic, gates and circuits

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Brief History of Computers and Software

- Nature of computer systems
- Levels of abstraction
- History of hardware
- History of software
- Computing vs Computer Science vs ICT
- Types of computer user

Number Systems

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- Categories of numbers
  Natural, negative, integer and rational numbers
- Positional notation
- Differing number bases
  Base 10, 2, 8 and 16
- Conversion between bases
  – Simple algorithms
- Important bases for Computer Science

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Data Representation

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- Analogue vs. digital information
- Binary formats for negative and floating-point values
  - Sign-magnitude, 2s complement and floating-point
- Characteristics of the ASCII and Unicode character sets
- Data compression and compression ratios
- Perform various types of text compression
  - Key-word encoding, Run-length encoding, Huffman encoding
- The nature of sound and its representation
- How RGB values define a colour
- Distinguish between raster and vector graphics

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Computing Components

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- Components and their function in von Neumann machine
  - ALU, Control unit, CPU, Memory
- Fetch-decode-execute cycle of von Neumann machine
- Organization and access of memory
- Auxiliary storage devices
  - Seek time, Latency, Access time
- Parallel computer configurations and speeding up processing
  - Pipelining
  - SISD, MIMD, SIMD, MISD
  - RISC architectures

Low Level Programming

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- What operations can a computer can perform
  - Machine language
- The Pep/8 virtual machine
- Immediate and direct addressing modes
- Writing simple machine-language programs
- Machine language and assembly language
- Creating and running an assembly-language program
- Writing simple programs using the Pep/8 virtual machine
- Concept of assembler instructions

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Pseudocode and Language Translation

- Distinguish between following an algorithm and developing one
- Describe the pseudocode constructs used in expressing an algorithm
- Use pseudocode to express an algorithm
- Design and implement a test plan for a simple assembly-language program
- Translating pseudocode into assembly language
- Translating assembly language into machine code
- Translating high-level languages into executable form
- Compilers, Interpreters and Compiler-Compilers
- Recursion vs Iteration
  - A question of efficiency
- Evolution of programming languages

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Gates and Circuits

- Identify the basic gates and describe the behavior of each
  - NOT, AND, OR, XOR, NAND and NOR
- Describe how gates are implemented using transistors
- Combine basic gates into circuits
  - Combinational circuits
  - Sequential circuits
- Describe the behavior of a gate or circuit using Boolean expressions, truth tables, and logic diagrams
  - Circuit equivalence
- Compare and contrast a half adder and a full adder
- Describe how a multiplexer works
- Explain how an S-R latch operates
- Describe the characteristics of the four generations of integrated circuits