CM1205

Architecture and Operating Systems

Assessment

- Coursework Assessment (20%)
  - Hand-out   Wk 6
  - Hand-in   Wk 8

- Exam (80%)

Recommended Texts

1. **Linda Null, "The Essentials of Computer Organization and Architecture," Jones & Bartlett Learning, 2012**
2. Rob Williams, "Computer Systems Architecture," Addison-Wesley, 2006
3. Andrew S. Tanenbaum, "Modern Operating Systems," Pearson Education, 2008
4. **Abraham Silberschatz "Operating System Concepts," Wiley, 2010**
5. **IRVINE, "Assembly Language for INTEL based computers." Prentice Hall**

Learning Strategies

- Attend the lectures
  - Attendance monitoring

- Help Class
  - Exercise sheets will be provided
  - Answers will be discussed
  - Help you revise the lecture

Learning Strategies (Cont'd)

- Positive Learning
    - Use online resources and recommended text books effectively
    - Attend help class and bring your questions/suggestions to the help class

- Attend labs

Learning Central

▫ https://learningcentral.cf.ac.uk/

- What will you find on LearningCentral
  ▫ Lecture notes
  ▫ Course-related Announcements
  ▫ Results
  ▫ Other material

- THE NEXT SLIDE IS PROBABLY NEARER THE TRUTH, AS TO HOW YOU WILL FEEL IN THE BEGINNING, BUT PLEASE HANG IN THERE AND HOPEFULLY ALL WILL BECOME CLEAR.

"I didn't understand all that stuff he said between 'Good Morning, Class' and 'That concludes my lecture for today'."

Overview of Topics

- History of Computers
- Hardware Architecture and Machine Level Programming
- Data representation
- Operating Systems

History of Computer Development

- Pre-Babbage
  - 1600 - 1830
- Babbage's day
  - 1830 - 1840
- Industrial Century
  - 1840 - 1940
- The war decade
  - 1940 - 1950
- Post-War era
  - 1950 onward

Stimuli to the development of computation

- TRADE and COMMERCE
  i.e. Business Transactions
- TRAVEL and TRANSPORTATION
- GOVERNMENT
  e.g. Censuses, Taxation
- MILITARY (War & Defence)
- INDUSTRY- Engineering and Manufacturing
- ECONOMICS vs PEOPLE

At various times in various combinations

Pre-Babbage 1600-1830
Babbage's Day 1830- 1840

- 1617 Napiers Bands (John Napier)
- 1621 Slide Rule (William Oughtred)
- 1642 Pascaline (Blaise Pascal)
  (The first Calculator)
- 1694 Pascaline+ (Gottgried Liebnitz)
- 1822 Difference Engine (Charles Babbage)
  ◦ Designed
- 1833 Analytic Engine (Charles Babbage)
  ◦ Designed
- Difference Engine   Analytic Engine
  ▫ Built 1855   Built 1944

The Industrial Century 1840 - 1940

- Industrial Revolution Precision Engineering
- Use of Electrical Power (from c.1870 onward)
- Punched Card Input Hollerith 1890
  (American Census)

- Electronic valves in analogue computers (1930's)
- Binary Electrical Circuits for calculation
  Buch & Stibite 1930
- Eccles – Jordan trigger flip-flop 1919
  (binary storage element)
- Keyboard Input (Burroughs 1892)
  (Felt 1887)

- Boolean Algebra (George Boole, 1854)

The War Decade 1940-1950
Electronic Relays & Electronic valves

- ASCC   Electro-Mechanical equivalent to Babbages AE 1937-44 AITKEN, Harvard/IBM
- Z-Series   Electro-mechanical, binary 1938-41 ZUSE, Germany
- COLOSSUS Electronic but special purpose 1943 Turing, Bletchley Park (UK)
- ENIAC   Electronic "wired' program. 1943-46 Eckert & Mauchley, Moore School (USA)
- EDVAC   Electronic, stored program, design. 1945-51 Von Neumann, (USA)
- EDSAC   Electronic stored program, working 1947-49 Wilkes, Cambridge (UK) equivalent to EDVAC
- MARK 1   Electronic stored program working 1948-50 Kilburn & Williams, Manchester (UK)

Computer Generations

- 1   1946-56   Valves, machine Level Languages
- 2   1957-64   Individual Transistors, High Level languages
- 3   1965-70   Integrated Circuit Boards, Time sharing Operating Systems
- 4   1971-   LSI 1st Microprocessor (INTEL 4004), Structured programming
- 5   1990?-   VLSI + non Von Neumann Architectures

1950 – 1990 +

- Programming Languages
- Operating System Software
- Computer Systems
- HCI
- User Interface Style
- Networks
- Power/Scope
  Cost/Size
  throughout period

Very rapid

UP

DOWN
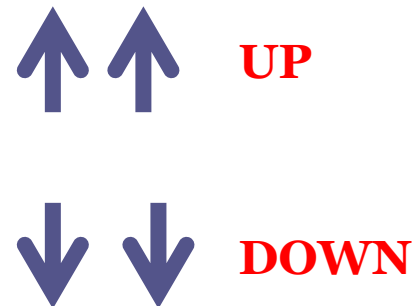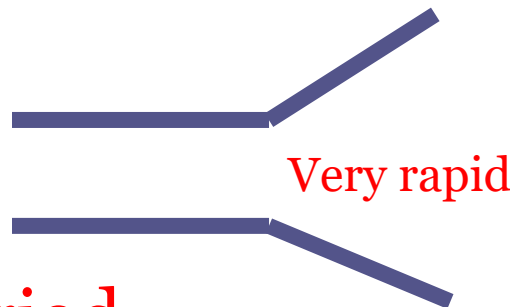
Programming Languages

- FORTRAN Scientific   1957
- COBOL   Business   1960
- LISP   AI etc…   1960
- BASIC   (interactive teaching)   1961
- PL/1   Fortran/Cobol   1965
- PASCAL   Structured   1970
- C   Systems Programming   early   70's
- PROLOG   Logic Programming   mid   70's
- SQL   Datadases   late   70's
- ADA   Embedded systems   1980
- PYTHON   OO scripting language   1989
                                      released 1991
- JAVA   Object Oriented/internet   1994

Operating Systems Software

- Automate the basic operation of a computer system, sharing it between users and tasks:- filestore, i/o device, CPU etc.
- OS/360   1964   IBM 360 Mainframe
- CP/M   1975   8-Bit micro's e.g. INTEL 8080 & ZILOG Z80

Control Program for Microcomputers

- UNIX   1975   Minicomputers e.g. PDP-11 7 VAX

Mostly written in C

- MS-DOS   1981   IBM PC micocomputers & Compatibles

Disc based OS

- WINDOWS   1985   Microsoft Windows 1.0

Computer Systems

- MAINFRAME:
  - 1950's/60's   IBM 360 range, ICL 2900 range
- 'SUPER':
  - 1980's/90's   CRAY range, SUN E-range
- MINI:
  - 1960's/70's   PDP-11 (DEC) range, VAX range
- MICRO:
  - 1970's   INTEL 4004 (1971) 4-Bit

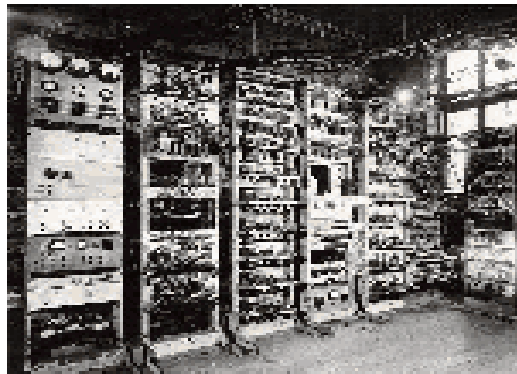   Late 70's early 80's INTEL 8080, Zylog Z80 8-Bit
  - 1981   INTEL 8086 16-Bit
  - 1983   INTEL PENTIUM 32-Bit
  - 2003   64-bit processors formally introduced into mainstream PC's. But have been around since the 1970's in CRAY.
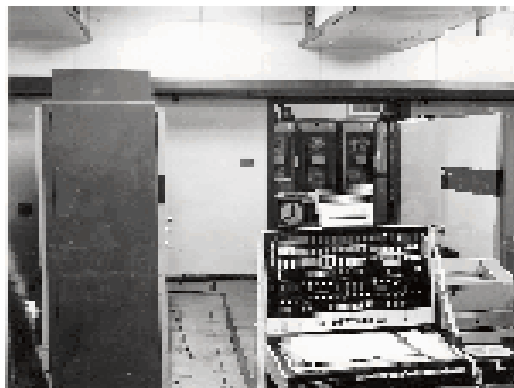
MARK I

MEG/MERCURY

TRANSISTOR COMPUTER

ATLAS

MU5

HCI Devices & Media

- Paper Tape, Punched Cards (Hard Copy off-line)
  - 1950's / 60's
- Paper Based TELETYPE   (Hard Copy on-line)
  - 1960's / 70's
- Keyboard + Screen (mono) Terminals (Soft copy on-line)
  - 1970's -
- Colour Screen, high resolution mouse etc.etc (Soft copy on-line)
  - 1980's -

User Interface Styles

- COMMAND LINE:
  - 1960's / 70's   e.g. UNIX CP/M
- MENU_BASED
  - 1970's / 80's   e.g. UCSD PASCAL
- WINDOWS_BASED
  - 1980's -   e.g. MS Windows OS/2
- HYPERMEDIA etc
  - 1990's -   e.g. Browsers
    Significant contributions made by XEROX and APPLE to user interface research and development from the 1970's

Networking-1

- The earliest global network – mid 19th Century.
- This was Samuel Morses Electric Telegraph system
     (1844)- "The Victorian Internet"
- By 1874 – internationally established
     (Europe, N.America, India, London was the hub)
- 650,000 Miles of Telegraph wire.
- 30,000 Miles of Sub-Marine cable.
- 20,000 Towns connected.
- Transmitting information much faster than a human being could carry it reliably and over long distances.

Networking-2

- Internet (1982) formally DARPERNET (1973)
- Based on Transmission Control/Internet Protocol (TCP/IP)
- A global collection of interconnected computer networks.
- 30 million computers connected by 1997
- World Wide Web-www (1990)
- A simple and powerful Point-and-click means of accessing millions of Multimedia pages of information connected by interpage links and distributed across the internet.
- Latest development is the idea of information GRIDS and the CLOUD

Architecture, Data Representation and Machine Level Programming.

- Introduction
- Basic Principles
- Fundamental
  - Von Neumann (Architecture)
  - Binary Coding Systems
  - Addressing Modes.