

Introduction to Computer Science

Student Guide

Modification History

Version	Date	Revision Description
V1.0	February 2017	Replaces Introduction to Computing

© NCC Education Limited 2017

All Rights Reserved

The copyright in this document is vested in NCC Education Limited. The document must not be reproduced by any means, in whole or in part, or used for manufacturing purposes, except with the prior written permission of NCC Education Limited and then only on condition that this notice is included in any such reproduction.

Published by: NCC Education Limited, The Towers, Towers Business Park, Wilmslow Road, Didsbury, Manchester M20 2EZ, UK.

Tel: +44 (0) 161 438 6200 Fax: +44 (0) 161 438 6240 Email: info@nccedu.com
<http://www.nccedu.com>

CONTENTS

1	Unit Overview and Objectives	7
2	Learning Outcomes and Assessment Criteria	7
3	Syllabus	9
4	Teaching and Learning	13
4.1	Lectures.....	13
4.2	Tutorials.....	13
4.3	Seminars/Laboratory Sessions	13
4.4	Private Study	14
5	Assessment	14
Topic 1: Introduction to Computer Systems and Hardware		15
1.1	Learning Objectives	15
1.2	Timings.....	15
1.3	Laboratory Sessions	16
1.4	Private Study	19
1.5	Tutorial Notes	20
1.5.1	Review of Private Study Exercises	20
Topic 2: Introduction to Application Software and System		21
Software		21
2.1	Learning Objectives	21
2.2	Timings.....	21
2.3	Laboratory Sessions	22
2.4	Private Study	23
2.5	Tutorial Notes	24
2.5.1	Review of Private Study Exercises	24
Topic 3: Internal Components of Computer Hardware		25
3.1	Learning Objectives	25
3.2	Timings.....	25
3.3	Laboratory Sessions	26
3.4	Private Study	27
3.5	Tutorial Notes	29

3.5.1 Review of Private Study Exercises	29
Topic 4: Computer Processors	31
4.1 Learning Objectives	31
4.2 Timings	31
4.3 Laboratory Sessions	32
4.4 Private Study	33
4.5 Tutorial Notes	34
4.5.1 Review of Private Study Exercises	34
Topic 5: Storage Devices and Input and Output Devices	35
5.1 Learning Objectives	35
5.2 Timings	35
5.3 Laboratory Sessions	36
5.4 Private Study	37
5.5 Tutorial Notes	38
5.5.1 Review of Private Study Exercises	38
Topic 6: Data Representation.....	39
6.1 Learning Objectives	39
6.2 Timings	39
6.3 Laboratory Sessions	40
6.4 Private Study	41
6.5 Tutorial Notes	42
6.5.1 Review of Private Study Exercises	42
Topic 7: Number Representation	43
7.1 Learning Objectives	43
7.2 Timings	43
7.3 Laboratory Sessions	44
7.4 Private Study	45
7.5 Tutorial Notes	46
7.5.1 Review of Private Study Exercises	46
Topic 8: Image and Sound Representation.....	47
8.1 Learning Objectives	47

8.2	Timings.....	47
8.3	Laboratory Sessions.....	48
8.4	Private Study.....	49
8.5	Tutorial Notes.....	50
8.5.1	Review of Private Study Exercises.....	50
Topic 9:	Digital Logic.....	51
9.1	Learning Objectives.....	51
9.2	Timings.....	51
9.3	Laboratory Sessions.....	52
9.4	Private Study.....	53
9.5	Tutorial Notes.....	54
9.5.1	Review of Private Study Exercises.....	54
Topic 10:	Computer Networks.....	56
10.1	Learning Objectives.....	56
10.2	Timings.....	56
10.3	Laboratory Sessions.....	57
10.4	Private Study.....	58
10.5	Tutorial Notes.....	59
10.6	Review of Private Study Exercises.....	59
Topic 11:	Network Topologies and the Internet.....	60
11.1	Learning Objectives.....	60
11.2	Timings.....	60
11.3	Laboratory Sessions.....	61
11.4	Private Study.....	62
11.5	Tutorial Notes.....	63
11.5.1	Review of Private Study Exercises.....	63
Topic 12:	Cultural, Ethical and Legal Issues Relating to.....	64
Computing.....		64
12.1	Learning Objectives.....	64
12.2	Timings.....	64
12.3	Laboratory Sessions.....	65

12.4 Private Study	66
12.5 Tutorial Notes	68
12.5.1 Review of Private Study Exercises	68

1 Unit Overview and Objectives

This unit aims to provide a sound knowledge and understanding of fundamental computer science topics. It covers the fundamental concepts relating to a wide range of computer hardware and software, the characteristics of hardware components, how data, images and sound are represented in a computer system, the fundamental concepts of computer networks, and cultural, ethical and legal issues related to computing.

2 Learning Outcomes and Assessment Criteria

Learning Outcomes; The Student will:	Assessment Criteria; The Student can:
1. Understand fundamental concepts relating to hardware and software	1.1 Describe the functions of a computer system 1.2 Describe a range of computer systems or justify the use of a type of computer system for a particular purpose 1.3 Define the term 'hardware' 1.4 Describe the purpose or characteristics of computer hardware 1.5 Define the term 'software' 1.6 Identify categories of software 1.7 Describe types of application software or justify the use of application software for a particular purpose 1.8 Describe types of system software or justify the use of system software for a particular purpose 1.9 Describe types of utility software or justify the use of utility software for a particular purpose

<p>2. Understand the characteristics of hardware components</p>	<p>2.1 Describe internal components of computer hardware 2.2 Describe the components of a central processing unit (CPU) 2.3 Describe the functions of a CPU 2.4 Explain the function of the fetch-decode-execute cycle 2.5 Describe how hardware components communicate with each other 2.6 Identify units of measurements of computer storage 2.7 Describe a range of computer storage media or justify the use of a type of storage media for a particular purpose 2.8 Describe a range of input devices or justify the use of a type of input device for a particular purpose 2.9 Describe a range of output devices or justify the use of an output device for a particular purpose</p>
<p>3. Understand how data is represented in a computer system</p>	<p>3.1 Describe how data is represented by binary 3.2 Describe how data is represented by ASCII 3.3 Describe how data is represented by Unicode 3.4 Explain how encryption can be used to represent data 3.5 Explain how compression can facilitate the storage and transmission of data 3.6 Explain the purpose of number systems 3.7 Explain the binary number system 3.8 Demonstrate addition or subtraction of binary numbers 3.9 Demonstrate an understanding of two's complement 3.10 Explain the hexadecimal number system 3.11 Demonstrate conversion between decimal, binary or hexadecimal numbers 3.12 Describe how images are represented in a computer system 3.13 Describe how sound is represented in a computer system 3.14 Explain how compression can facilitate storage and transmission of images or sound 3.15 Define the term 'digital logic' 3.16 Explain the purpose and operation of logic gates</p>

<p>4. Understand the fundamental concepts of computer networks</p>	<p>4.1 Explain the purpose of a computer network 4.2 Describe types of computer network or explain the criteria for selecting a particular type of network 4.3 Describe the hardware used in a computer network 4.4 Describe the software used in a computer network 4.5 Describe the transmission media used in a computer network 4.6 Describe types of network transmission protocols 4.7 Describe types of computer network topology or justify the use of a topology for a particular purpose 4.8 Describe Internet and World Wide Web technologies 4.9 Discuss computer network issues</p>
<p>5. Understand cultural, ethical and legal issues relating to computing</p>	<p>5.1 Explain what a cultural issue is 5.2 Describe a range of cultural issues 5.3 Explain how cultural issues can be addressed 5.4 Explain what an ethical issue is 5.5 Describe a range of ethical issues 5.6 Explain how ethical issues can be addressed 5.7 Identify laws and guidelines that relate to computing 5.8 Describe situations where laws and guidelines have been used to deal with people using computers to commit crimes or cause offence</p>

3 Syllabus

Syllabus			
Topic No	Title	Breakdown of learning hours	Content
1	Introduction to Computer Systems and Hardware	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Definition of computer system • Functions of a computer system • Data and information • An overview of a typical computer system • Types of computer systems • Big data • The Internet of Things • Definition of hardware • The role of computer hardware • Types of computer hardware • Accessibility <p>Learning Outcome: 1</p>

2	Introduction to Application Software and System Software	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Definition of software • Categories of software • Software compatibility • Types and uses of application software • How to obtain software • Software licences • Criteria to consider when selecting application software • System software <ul style="list-style-type: none"> - operating system software - utility software - driver software • Criteria to consider when selecting system software <p>Learning Outcome: 1</p>
3	Internal Components of Computer Hardware	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Internal components: Motherboard, chips, central processing unit (CPU), clock, memory, chipset, expansion slots and cards, power supply, fan, buses, connectors • How components communicate with each other • How components communicate with external devices <p>Learning Outcomes: 2</p>
4	Computer Processors	1 hour of lectures 1 hour of laboratory 1 hour of tutorials 2 hours of private study	<ul style="list-style-type: none"> • The role of a computer processor • Types of processor • Components of a CPU • The functions of a CPU • How components of a CPU communicate with each other • The fetch-execute-decode cycle <p>Learning Outcome: 2</p>

5	Storage Devices and Input and Output Devices	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Computer storage • Units of measurement of computer storage • Computer storage media • Storage locations • Criteria to consider when selecting computer storage • Input devices • Criteria to consider when selecting input devices • Output devices: • Criteria to consider when selecting output devices <p>Learning Outcome: 2</p>
6	Data Representation	1 hour of lectures 1 hour of laboratory 1 hour of tutorials 2 hours of private study	<ul style="list-style-type: none"> • Binary representation of data • ASCII representation of data • Unicode representation of data • Hexadecimal representation of data • Definitions of encryption and decryption • Examples of encryption • Definition of compression • Compression of data <p>Learning Outcome: 3</p>
7	Number Representation	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Number systems • Decimal number system • Binary number system • Why consider number systems? • Addition of binary numbers • Subtraction of binary numbers • Two's complement • Hexadecimal number system • Converting decimal, binary and hexadecimal numbers <p>Learning Outcome: 3</p>

8	Image and Sound Representation	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Image representation • Image file formats • Compression of images • Sound representation • Sound file formats • Compression of sound <p>Learning Outcome: 3</p>
9	Digital Logic	1 hour of lectures 1 hour of laboratory 1 hour of tutorials 2 hours of private study	<ul style="list-style-type: none"> • Digital logic • Truth Tables • Logic gates <ul style="list-style-type: none"> - AND - OR - NOT - NAND - NOR <p>Learning Outcome: 3</p>
10	Computer Networks	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Definition of a computer network • Types of network • Criteria for selecting a network • Network hardware • Network transmission media • Network transmission protocols • Network software <p>Learning Outcome: 4</p>
11	Network Topologies and the Internet	2 hours of lectures 1 hour of laboratory 2 hours of tutorials 4 hours of private study	<ul style="list-style-type: none"> • Define a network topology • Types of topology • Criteria for selecting a topology • Definition of the Internet • Definition of the World Wide Web (WWW) • World Wide Web technologies • Computer network issues <p>Learning Outcome: 4</p>

12	Cultural, Ethical and Legal Issues Relating to Computing	3 hours of lectures 1 hour of laboratory 3 hours of tutorials 6 hours of private study	<ul style="list-style-type: none"> • Definition of cultural issues • Examples of cultural issues • Addressing cultural issues • Definition of ethical issues • Examples of ethical issues • Addressing ethical issues • UK laws and guidelines <ul style="list-style-type: none"> - Data Protection Act (1998) - Computer Misuse Act (1990) - Copyright, Designs and Patents Act (1988) • Global laws and computers • Examples of situations where the law has been applied <p>Learning Outcome: 5</p>
----	--	---	--

4 Teaching and Learning

Suggested Learning Hours					
Lectures:	Tutorial:	Seminar:	Laboratory:	Private Study:	Total:
22	22	-	12	44	100

The teacher-led time for this module is comprised of lectures and tutorials. The breakdown of the hours is also given at the start of each topic.

4.1 Lectures

Lectures are designed to start each topic and PowerPoint slides are presented for use during these sessions. Students should also be encouraged to be active during this time and to discuss and/or practice the concepts covered. Lecturers should encourage active participation wherever possible.

4.2 Tutorials

These are designed to deal with the questions arising from the lectures and private study sessions and will focus on the completion of a range of exercises to reinforce learning achieved through the lecture and private study sessions.

4.3 Seminars/Laboratory Sessions

In these sessions, students are required to work through various exercises. The details of these are provided in the Student Guide for this unit. Each student must have a copy of the ITCS Student Guide and must be instructed to bring it to the lessons for the unit.

4.4 Private Study

The Student Guide also contains details of the Private Study exercises. Students are expected to revise the content of lectures and complete these exercises to improve their understanding. Teachers will need to set time frames for the completion of exercises and go over the suggested answers with students. No answers are given in the student guide. Completion deadlines should ideally be prior to the scheduled tutorial for each topic, as there is time allowed during this session for the review of answers.

There are some references to websites throughout these materials and further online sources of information can be found on the NCC Education Campus (<http://campus.nccedu.com>). Teachers may also choose to substitute their own examples wherever they feel it is appropriate.

5 Assessment

This module will be assessed by means of an examination, based on the assessment criteria given above. Students will be expected to demonstrate that they have met the unit's learning outcomes.

Topic 1: Introduction to Computer Systems and Hardware

1.1 Learning Objectives

This topic provides an overview of computer systems and computer hardware.

On completion of the topic, students will be able to:

- Describe the functions of a computer system
- Describe a range of computer systems or justify the use of a type of computer system for a particular purpose
- Define the term *hardware*
- Describe the purpose or characteristics of computer hardware

1.2 Timings

Lectures: 2 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 4 hours

Tutorials: 2 hours

1.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise 1: Using Computer Systems

- Describe the type/s of computer systems you use regularly, e.g. stand-alone, network, general purpose, embedded.
- State where you use these systems.
- Explain what sort of tasks you use them for.
- Describe any data that is input and processed by the computer systems.
- Describe the information that is output by the computer systems.

Exercise 2: Users and computer systems

Complete the table below by inserting the types of computers that each user working at an organisation might access during their work. An example has been provided for you.

TYPE OF USER	TYPE OF COMPUTERS
Someone working at a small business (less than ten employees)	Server, desktop, laptop, notebook, smartphone
Someone working at a large business (over one hundred employees)	
A scientist working at a university undertaking scientific research	
A receptionist at a surgery	
A person working at home	
An employee at a pharmaceutical company undertaking drug research	
An airline booking representative	

An administration assistant at a cinema	
A manager at an electricity company	
A researcher at a defence institution	
A journalist	
An administrator at a hospital	
A teacher at a school or college	
A manager at a national supermarket chain	
A stockbroker	
A weather forecaster of a national weather forecasting organisation	

Exercise 3: The functions of computer systems

It is important to understand the functions of a computer system. Consider the following three computer systems and their users. For each user, identify data that they might input to the system, information that they may need output and information that will need to be stored. Complete the table below with your answers:

a) Doctor at a surgery	<u>DATA INPUT</u>
	<u>INFORMATION OUTPUT</u>
	<u>INFORMATION STORED</u>
b) Administrator at a college	<u>DATA INPUT</u>
	<u>INFORMATION OUTPUT</u>
	<u>INFORMATION STORED</u>

c) Coffee shop manager	<u>DATA INPUT</u>
	<u>INFORMATION OUTPUT</u>
	<u>INFORMATION STORED</u>

Exercise 4: Big data

The amount of data that is being used and stored globally is growing at a rapid rate. Research and describe at least four benefits and at least four limitations of big data.

1.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: The Internet of Things

Read the following article: *An engineer uses IoT to tackle illness*, Patrick Thibodeau, Computerworld, Aug 8, 2016

<http://www.computerworld.com/article/3105585/internet-of-things/an-engineer-uses-iot-to-tackle-illness.html>

Research two other areas, other than health, that could benefit from the Internet of Things. During your research, make a note of the computer systems and hardware that are used.

Exercise 2: Wearable hardware

Describe at least four advantages and at least four disadvantages of wearing computer hardware.

Exercise 3: Accessible computer hardware

Research two people whose lives have been improved by the use of assistive technology. Make notes on the hardware that they use and how it helps them.

The following website will help you.

http://www.huffingtonpost.co.uk/kim-lawther/how-technology-is-transforming-disabled-peoples-lives_b_9479556.html

1.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

1.5.1 Review of Private Study Exercises

Exercise 1: The Internet of Things

Read the following article: *An engineer uses IoT to tackle illness*, Patrick Thibodeau, Computerworld, Aug 8, 2016

<http://www.computerworld.com/article/3105585/internet-of-things/an-engineer-uses-iot-to-tackle-illness.html>

Research two other areas, other than health, that could benefit from the Internet of Things. During your research, make a note of the computer systems and hardware that are used.

Exercise 2: Wearable hardware

Describe at least four advantages and at least four disadvantages of wearing computer hardware.

Exercise 3: Accessible computer hardware

Research two people whose lives have been improved by the use of assistive technology. Make notes on the hardware that they use and how it helps them.

The following website will help you.

http://www.huffingtonpost.co.uk/kim-lawther/how-technology-is-transforming-disabled-peoples-lives_b_9479556.html

Topic 2: Introduction to Application Software and System Software

2.1 Learning Objectives

This topic provides an overview of application software and system software.

On completion of the topic, students will be able to:

- Define the term 'software'
- Identify categories of software
- Describe types of application software
- Justify the use of application software for a particular purpose
- Describe types of system software
- Justify the use of system software for a particular purpose
- Describe types of utility software
- Justify the use of utility software for a particular purpose

2.2 Timings

Lectures: 2 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 4 hours

Tutorials: 2 hours

2.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Two

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

2.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: Using software

Identify the type/s of application and systems software that you use regularly. Explain what sort of tasks you use each type for

Exercise 2: Obtaining software

Describe the advantages and disadvantages of the following methods of obtaining software.

- Closed source/proprietary/commercial/off-the-shelf/packaged
- Open source software (OSS)/public domain
- Custom/bespoke/tailored
- Software as a Service (SaaS)/on-demand software
- Freeware
- Shareware
- In-app purchase

Exercise 3: Operating systems

Research the following operating systems, find three facts about each type and document your information.

- Windows
- OS X
- Linux
- Android
- iOS

Exercise 4: Touch screens

Describe the advantages and disadvantages of touch screen interfaces.

2.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

2.5.1 Review of Private Study Exercises

Exercise 1: Using software

Identify the type/s of application and systems software that you use regularly.

Explain what sort of tasks you use each type for

Exercise 2: Obtaining software

Describe the advantages and disadvantages of the following methods of obtaining software.

- Closed source/proprietary/commercial/off-the-shelf/packaged
- Open source software (OSS)/public domain
- Custom/bespoke/tailored
- Software as a Service (SaaS)/on-demand software
- Freeware
- Shareware
- In-app purchase

Exercise 3: Operating systems

Research the following operating systems, find three facts about each type and document your information.

- Windows
- OS X
- Linux
- Android
- iOS

Exercise 4: Touch screens

Describe the advantages and disadvantages of touch screen interfaces.

Topic 3: Internal Components of Computer Hardware

3.1 Learning Objectives

This topic provides an overview of the internal components of computer hardware.

On completion of the topic, students will be able to:

- Describe internal components of computer hardware
- Describe how hardware components communicate with each other
- Understand how components communicate with external devices

3.2 Timings

Lectures: 2 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 4 hours

Tutorials: 2 hours

3.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Three

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term.

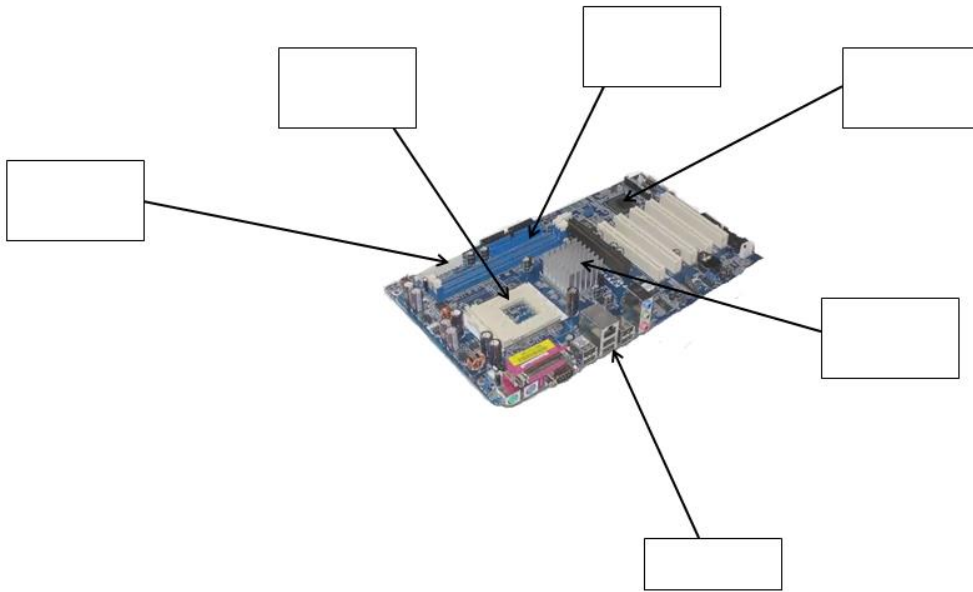
Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

3.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: The motherboard

Label the following components of a motherboard.



Exercise 2: Random Access Memory

Research the following types of random access memory chips and document the differences between each type:

- Static random access memory (SRAM)
- Dynamic Random access memory (DRAM)
- Synchronous Dynamic Random Access Memory (SDRAM)
- Non-Volatile RAM (NVRAM)
- O-DIMM RAM

Exercise 3: Connector cables

Research four types of connector cables and document your findings in a table as shown below:

Connector cable name	Features	Device that it links to

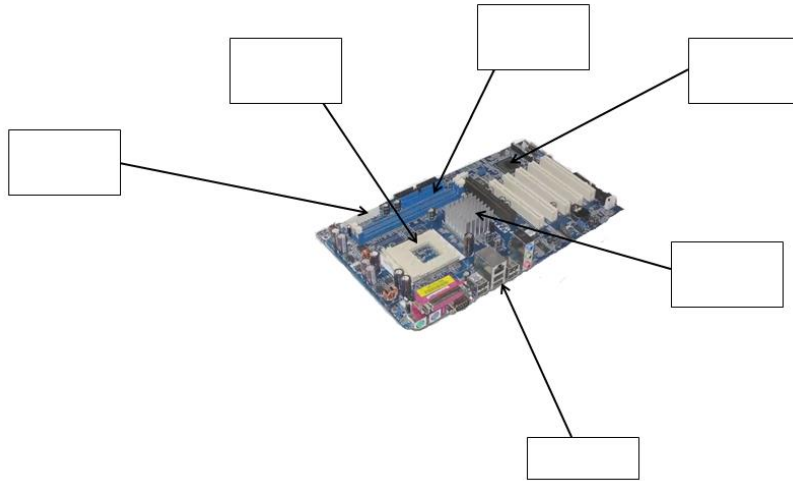
3.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

3.5.1 Review of Private Study Exercises

Exercise 1: The motherboard

Label the following components of a motherboard.



Exercise 2: Random Access Memory

Research the following types of random access memory chips and document the differences between each type:

Static random access memory (SRAM)

Dynamic Random access memory (DRAM)

Synchronous Dynamic Random Access Memory (SDRAM)

Non-Volatile RAM (NVRAM)

SO-DIMM RAM

Exercise 3: Connector cables

Research four types of connector cables and document your findings in a table as shown below:

Connector cable name	Features	Device that it links to

Topic 4: Computer Processors

4.1 Learning Objectives

This topic provides an overview of computer processors.

On completion of the topic, students will be able to:

- Describe the components of a central processing unit (CPU)
- Describe the functions of a CPU
- Explain the function of the fetch-decode-execute cycle

4.2 Timings

Lectures: 1 hour

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 2 hours

Tutorials: 1 hour

4.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Four

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term.

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

4.4 Private Study

The time allocation for private study in this topic is expected to be 2 hours.

Exercise 1: CPU families

Research CPUs from four different manufacturers and record the following features for each one of them:

Type of processor

Clock speed

Cores

Cache size

Cost

Exercise 2: Own device CPU

Research and record information on the features from Exercise 1 for a CPU that is used in a device that you use regularly.

4.5 Tutorial Notes

The time allowance for tutorials in this topic is 1 hour.

4.5.1 Review of Private Study Exercises

Exercise 1: CPU families

Research CPUs from four different manufacturers and record the following features for each one of them:

Type of processor

Clock speed

Cores

Cache size

Cost

Exercise 2: Own device CPU

Research and record information on the features from Exercise 1 for a CPU that is used in a device that you use regularly.

Topic 5: Storage Devices and Input and Output Devices

5.1 Learning Objectives

This topic provides an overview of storage devices and input and output devices.

On completion of the topic, students will be able to:

- Identify units of measurements of computer storage
- Describe a range of computer storage media
- Justify the use of a type of storage media for a particular purpose
- Describe a range of input devices
- Justify the use of a type of input device for a particular purpose
- Describe a range of output devices
- Justify the use of an output device for a particular purpose

5.2 Timings

Lectures: 2 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 4 hours

Tutorials: 2 hours

5.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Five

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

5.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: Advantages and disadvantages of four types of storage device

Research and document the advantages and disadvantages of four types of storage device.

Exercise 2: Robotic arms

Robotic arms are used in a number of application areas. Undertake research to find five facts about this type of input device.

Exercise 3: Input devices

Undertake research and find three facts about each of the following types of input device:

Membrane keyboard

Wireless keyboard

Biometric reader

Exercise 4: Output Devices

Document the specification of an output device that you use regularly.

5.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

5.5.1 Review of Private Study Exercises

Exercise 1: Advantages and disadvantages of four types of storage device

Research and document the advantages and disadvantages of four types of storage device.

Exercise 2: Robotic arms

Robotic arms are used in a number of application areas. Undertake research to find five facts about this type of input device.

Exercise 3: Input Devices

Undertake research and find three facts about each of the following types of input device:

Membrane keyboard
Wireless keyboard
Biometric reader

Exercise 4: Output Devices

Document the specification of an output device that you use regularly.

Topic 6: Data Representation

6.1 Learning Objectives

This topic provides an overview of data representation.

On completion of the topic, students will be able to:

- Describe how data is represented by binary
- Describe how data is represented by ASCII
- Describe how data is represented by hexadecimal
- Explain how data is represented by Unicode
- Explain what is meant by encryption
- Identify examples of encryption
- Explain the purpose of data compression

6.2 Timings

Lectures: 1 hour

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 2 hours

Tutorials: 1 hour

6.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Six

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

6.4 Private Study

The time allocation for private study in this topic is expected to be 2 hours.

Exercise 1: Encryption

Describe the advantages and disadvantages of encryption.

Exercise 2: Caesar Cipher

Research the Caesar Cipher and write a brief encrypted note to be read and decrypted by your class mates in the tutorial.

6.5 Tutorial Notes

The time allowance for tutorials in this topic is 1 hour.

6.5.1 Review of Private Study Exercises

Exercise 1: Encryption

Describe the advantages and disadvantages of encryption.

Exercise 2: Caesar Cipher

Research the Caesar Cipher and write a brief encrypted note to be read and decrypted by your class mates in the tutorial.

Topic 7: Number Representation

7.1 Learning Objectives

This topic provides an overview of number representation.

On completion of the topic, students will be able to:

- Explain the purpose of number systems
- Explain the binary number system
- Demonstrate addition or subtraction of binary numbers
- Demonstrate an understanding of two's complement
- Explain the hexadecimal number system
- Demonstrate conversion between decimal, binary or hexadecimal numbers

7.2 Timings

Lectures: 2 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 4 hours

Tutorials: 2 hours

7.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Seven

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

7.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: Student guide to Binary

Create a student guide to binary. You must include information on addition and subtraction of binary and demonstrate clearly how addition and subtraction can be undertaken in binary. Your guide should be easy to understand.

Exercise 2: Student guide to Hexadecimal

Create a student guide to hexadecimal. You should show how hexadecimal can be used to represent colours. Your guide should be easy to understand.

Exercise 3: Student guide on Number Conversions

Create a student guide on conversions between decimal, binary and hexadecimal number systems. Your guide should be easy to understand.

7.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

7.5.1 Review of Private Study Exercises

Exercise 1: Student guide to Binary

Create a student guide to binary. You must include information on addition and subtraction of binary and demonstrate clearly how addition and subtraction can be undertaken in binary. Your guide should be easy to understand.

Exercise 2: Student guide to Hexadecimal

Create a student guide to hexadecimal. You should show how hexadecimal can be used to represent colours. Your guide should be easy to understand.

Exercise 3: Student guide on Number Conversions

Create a student guide on conversions between decimal, binary and hexadecimal number systems. Your guide should be easy to understand.

Topic 8: Image and Sound Representation

8.1 Learning Objectives

This topic provides an overview of how image and sound are represented in a computer system.

On completion of the topic, students will be able to:

- Describe how images are represented in a computer system
- Describe how sound is represented in a computer system
- Explain how compression can facilitate storage and transmission of images or sound

8.2 Timings

Lectures: 2 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 4 hours

Tutorials: 2 hours

8.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Eight

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

8.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: Image File Formats

Find three features of each of the following and explain the differences between them.

JPEG
PNG
GIF

Exercise 2: Bitmap Graphic Editors

Research a bitmap graphic editor. Use it and document at least ten features.

Exercise 3: Vector Graphic Editors

Research a vector graphic editor. Use it and document at least ten features.

Exercise 4: Bitmap vs Vector Graphic Editors

Having used both a bitmap and a vector graphic editor, state which one you preferred to use and explain the reasons for your choice.

8.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

8.5.1 Review of Private Study Exercises

Exercise 1: Image File Formats

Find three features on each of the following and explain the differences between them.

JPEG
PNG
GIF

Exercise 2: Bitmap Graphic Editors

Research a bitmap graphic editor. Use it and document at least ten features.

Exercise 3: Vector Graphic Editors

Research a bitmap graphic editor. Use it and document at least ten features.

Exercise 4: Bitmap vs Vector Graphic Editors

Having used both a bitmap and a vector graphic editor, state which one you preferred to use and explain the reasons for your choice.

Topic 9: Digital Logic

9.1 Learning Objectives

This topic provides an overview of digital logic.

On completion of the topic, students will be able to:

- Define the term 'digital logic'
- Explain the purpose and operation of logic gates

9.2 Timings

Lectures: 1 hour

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 2 hours

Tutorials: 1 hour

9.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Nine

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

9.4 Private Study

The time allocation for private study in this topic is expected to be 2 hours.

Exercise 1: Match truth tables to logic gates

Draw a logic gate for each of the following truth tables

a)

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

b)

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

c)

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

d)

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

e)

A	C
0	1
1	0

9.5 Tutorial Notes

The time allowance for tutorials in this topic is 1 hour.

9.5.1 Review of Private Study Exercises

Exercise 1: Match truth tables to logic gates

Draw a logic gate for each of the following truth tables

a)

A		B
0		0
0		1
1		0
1		1

b)

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

c)

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

d)

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

e)

A	C
0	1
1	0

Topic 10: Computer Networks

10.1 Learning Objectives

This topic provides an overview of computer networks.

On completion of the topic, students will be able to:

- Explain the purpose of a computer network
- Describe types of computer network or explain the criteria for selecting a particular type of network
- Describe the hardware used in a computer network
- Describe the software used in a computer network
- Describe the transmission media used in a computer network
- Describe types of network transmission protocols

10.2 Timings

Lectures:	2 hours
Seminars:	0 hours
Laboratory Sessions:	1 hour
Private Study:	4 hours
Tutorials:	2 hours

10.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Ten

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

10.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: Specification for a new local area network

You have been asked by a manager of a small department in a large marketing company to set up a local area network of six computers and devices.

Provide a specification of the hardware and software that you will need to use.

Exercise 2: Wireless Networks

Research the advantages and disadvantages of using wireless networks and document your information.

Exercise 3: Network security software

Recommend three types of security software that should be used by the department referred to in Exercise 1. For each type of software, provide four reasons why you recommend it is used.

10.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

10.6 Review of Private Study Exercises

Exercise 1: Specification for a new local area network

You have been asked by a manager of a small department in a large marketing company to set up a local area network of six computers and devices.

Provide a specification of the hardware and software that you will need to use.

Exercise 2: Wireless Networks

Research the advantages and disadvantages of using wireless networks and document your information.

Exercise 3: Network security software

Recommend three types of security software that should be used by the department referred to in Exercise 1. For each type of software, provide four reasons why you recommend it is used.

Topic 11: Network Topologies and the Internet

11.1 Learning Objectives

This topic provides an overview of network topologies and the Internet.

On completion of the topic, students will be able to:

- Describe types of computer network topology or justify the use of a topology for a particular purpose
- Describe Internet and World Wide Web technologies
- Discuss issues that affect computer networks

11.2 Timings

Lectures: 2 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 4 hours

Tutorials: 2 hours

11.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Eleven

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

11.4 Private Study

The time allocation for private study in this topic is expected to be 4 hours.

Exercise 1: Mobile websites and Apps

Describe at least six differences between a mobile website and an App.

Exercise 2: The Internet Society

Research the Internet Society and document five items of information about this organisation.

Exercise 3: Browser comparison

Compare four different web browsers and document your information in a table as follows:

Browser	Ease of Use/Support	Speed	Security

Exercise 4: Network Issues

Security is a major concern when using the Internet. Identify three security threats to Internet users and for each of these threats, describe a security measures that can be taken to try and avoid the threat.

11.5 Tutorial Notes

The time allowance for tutorials in this topic is 2 hours.

11.5.1 Review of Private Study Exercises

Exercise 1: Mobile websites and Apps

Describe at least six differences between a mobile website and an App.

Exercise 2: The Internet Society

Research the Internet Society and document five items of information about this organisation.

Exercise 3: Browser comparison

Compare four different web browsers and document your information in a table as follows:

Browser	Compatibility	Ease of Use/Support	Speed	Security

Exercise 4: Network Issues

Security is a major concern when using the Internet. Identify three security threats to Internet users and for each of these threats, describe a security measures that can be taken to try and avoid the threat.

Topic 12: Cultural, Ethical and Legal Issues Relating to Computing

12.1 Learning Objectives

This topic provides an overview of cultural, ethical and legal issues that relate to computing.

On completion of the topic, students will be able to:

- Explain what a cultural issue is
- Describe a range of cultural issues
- Explain how cultural issues can be addressed
- Explain what an ethical issue is
- Describe a range of ethical issues
- Explain how ethical issues can be addressed
- Identify laws and guidelines that relate to computing
- Describe situations where laws and guidelines have been used to deal with people using computers to commit crimes or cause offence

12.2 Timings

Lectures: 3 hours

Seminars: 0 hours

Laboratory Sessions: 1 hour

Private Study: 6 hours

Tutorials: 3 hours

12.3 Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise: Glossary of terms for Topic Twelve

Produce a glossary of words and terms that you have encountered in this topic.

You can include photographs and/or diagrams to help you to understand the meaning of a word or term

Remember to ask your tutor to clarify any words or abbreviations that are unclear to you.

12.4 Private Study

The time allocation for private study in this topic is expected to be 6 hours.

Exercise 1: Cultural issues and computing

In Lecture One (slides eight and thirteen) you were asked to consider the following questions:

- Are computers changing the way in which we communicate with one another?
- Are computers changing how we learn?
- Is automation a positive development?

State whether you agree or disagree with each of the above questions and list the reasons for each of your choices.

Exercise 2: Cultural awareness

Take a look at the following website: <http://www.everyculture.com/> and choose a country of your choice. Make a list of five aspects of that country's culture that is different to your culture and list five aspects that are the same.

Exercise 3: Automation – pros and cons

In Lecture Two you were asked to consider a scenario based around the introduction of automation to a factory. Explain the advantages and disadvantages of introducing automation and explain why you think it is ethically acceptable or unethical.

Exercise 4: Monitoring employees at work

Is it appropriate and ethically acceptable that employees are monitored at work, for example, while using e-mail, voicemail, accessing the Internet, their keystrokes?

Exercise 5: The Data Protection Act (1998)

Take a look at the following website: <https://ico.org.uk/> and write down information about three cases where the Data Protection Act was not adhered to.

Exercise 6: Global computing laws

Look at the following website: <http://www.cyberlawdb.com/gclid/> Find information about one computing law of the country that you live in or one law in another country and write a few notes about it so that you can share the information at the tutorial.

12.5 Tutorial Notes

The time allowance for tutorials in this topic is 3 hours.

12.5.1 Review of Private Study Exercises

Exercise 1: Cultural issues and computing

In Lecture One (slides eight and thirteen) you were asked to consider the following questions:

- Are computers changing the way in which we communicate with one another?
- Are computers changing how we learn?
- Is automation a positive development?

State whether you agree or disagree with each of the above questions and list the reasons for each of your choices.

Exercise 2: Cultural awareness

Take a look at the following website: <http://www.everyculture.com/> and choose a country of your choice. Make a list of five aspects of that country's culture that is different to your culture and list five aspects that are the same.

Exercise 3: Automation – pros and cons

In Lecture Two you were asked to consider a scenario based around the introduction of automation to a factory. Explain the advantages and disadvantages of introducing automation and explain why you think it is ethically acceptable or unethical.

Exercise 4: Monitoring employees at work

Is it appropriate and ethically acceptable that employees are monitored at work, for example, while using e-mail, voicemail, accessing the Internet, their keystrokes?

Exercise 5: The Data Protection Act (1998)

Take a look at the following website: <https://ico.org.uk/> and write down information about three cases where the Data Protection Act was not adhered to.

Exercise 6: Global computing laws

Look at the following website: <http://www.cyberlawdb.com/gclid/> Find information about one computing law of the country that you live in or one law in another country and write a few notes about it so that you can share the information at the tutorial.