Pearson
BTEC Level 3 National in Computing
Unit 2: Fundamentals of Computer Systems (31769H)

Technology Update

First teaching September 2018

Issue 1

Introduction

This document provides additional information as to the digital technologies that students are expected to learn about within Unit 2: The fundamentals of Computer Systems

Due to the evolving nature of technology, an annual update will be available via the Pearson website.

This document does **not** replace the specification but should be used alongside the specification content to provide additional guidance and scope.

Sections of the specification that do not require additional expansion are not included in this document.

A: Hardware and Software

A1 Computer hardware in a computer system

Types of computer systems:
- multi-functional devices
- personal computers
- mobile devices
- servers.

Scope	Description/expansion
- servers - personal computers (Desktops and laptops) - single board computers - mobile devices (smartphones, modular smartphones, specialist phones, tablets, laptops, wearable computers) - digital cameras - games consoles - home entertainment systems (Televisions, projectors, DVD players/recorders, Blu-ray players, Personal Video Recorders (PVR), Set-top boxes (STB), Media Stations, Sound Systems) - navigation aids	Servers – a physical (or virtual) computer instance that controls a network and provides access to file/resource sharing facilities. Single board computers - small, inexpensive complete computers (e.g. bbc microbit, Raspberry Pi) designed for development projects and use in education. Modular smartphones – a smartphone that contains different components and features that can be changed by the user to change the functionality of the device (e.g. LG G5, Project Ara). Wearable computers – small highly portable technology systems designed to be worn by the user (e.g. Smartwatches, fitness trackers) often designed to work in conjunction with other devices (e.g. smartphone) as well as separately. Televisions include Smart TVs and 3D TVs STB/PVR –Both types of functionality are often provided by a single box e.g. Virgin Media Tivo, Sky+) Media stations – provide access to video/audio from a remote source.

The purpose, features and uses of internal components used in:
- multi-functional devices
- personal computers
- mobile devices
- servers.

Scope	Description/expansion
- Central processing unit (CPU) - Graphical processing unit (GPU) - Memory (RAM, ROM, Cache) - Motherboard/Mainboard - Secondary storage (HDD, SDD) - Cooling (fans, heatsink) - GPS receivers - Image capture (lens, image sensor)	CPU/GPU – Features of CPU and GPU include – Number of cores/threads, clock speed, size of cache. Clock speed – measured in Gigahertz(GHz) and is a measure of the number of cycles per second. Memory/Storage – Measured using bytes/Megabytes(MB)/Gigabytes etc. Image sensor - a sensor in a digital camera (or smartphone) that converts light in to an image.

The hardware used in computer systems:	
• input devices	
• output devices	
• storage devices.	

Scope	Description/expansion

• input devices
    o Keyboard
    o Touch Screen
    o Pointing devices (Mouse, stylus, touchpad)
    o Graphics tablets
    o Microphone
    o Scanner (2D and 3D)
    o Cameras
    o Sensors
    o Accessibility devices
 	
• output devices
    o Screens
    o Projectors
    o Printers (2D and 3D)
    o Actuators
    o Motors
    o Accessibility devices
 	
• storage devices.
    o USB flash drives
    o Memory cards
    o Hard drives (internal and external)
    o Optical drives/discs
    o Magnetic tape drives
	Graphics tablet – a device that allows users to 'draw' in a similar way to using paper and pen. Many also have additional features specifically designed to improve user experience when completing graphics tasks.
	
	Cameras – include digital still, digital video and webcams, dedicated.
	
	Sensors – including temperature (thermistor), pressure, light sensors, accelerometers, GPS receivers.
	
	Accessibility devices – also referred to as assistive technology are devices that provide support for users with additional needs, (e.g. alternative keyboards, sip-and-puff systems, wands and sticks, braille embossers).

Data storage and recovery systems:	
• redundant array of independent disks (RAID)	
• network attached storage (NAS)	

Scope	Description/expansion
• redundant array of independent disks (RAID) • network attached storage (NAS) • storage area network (SAN)	Redundant array of independent disks (RAID) – a system of using lots of storage drives to provide fail safes by spreading data across multiple drives. network attached storage (NAS) – file level storage connected to a network. storage area network (SAN) - high-speed network of storage devices that connects storage devices with servers. Provides block level storage

A2 Computer software in a computer system	
Operating systems: o types of operating system.	

Scope	Description/expansion
real-time operating system single-user single task single-user multi-tasking multi-user	Real-time operating system – an OS designed to process information at high speed with no buffer delays. Typically these are event driven and react to stimulus but can be time sharing. Used in time critical systems such as driver assist technologies in cars, industrial robots etc. Single-user single task – used for systems that will be used by only one user and complete only one task at a time used for simple/less powerful devices. Single-user multi-tasking – used so that a single user can access the device at a time but can run multiple programs at once. Most modern desk top operating systems (e.g. Windows 10, Linux/GNU) are single user multi-tasking. Multi-user – Allows more than one user to access programs and data at the same time. Typically used on servers, mainframes and supercomputers

| Utility software:
o the purpose, features and uses of utility software
o factors affecting the choice, use and performance of utility software. | |

Scope	Description/expansion
• Anti-Virus/Anti-malware • Backup software • Compression tools • Disk analysers • Disk defragmenters • Disk Partitioners • Encryption software • File managers • Firewall • Network utilities • Package managers	Disk analysers – a diagnostic tool that checks the condition of a computer's hard drive and reports on available space. Disk defragmenters – reorganises data on a hard disk drive (HDD) so related data is grouped together in order to improve search and load times. Disk Partitioners – used to split a single storage medium into multiple volumes. Allows a user to separate data and use multiple file systems on a single disk. Encryption – a method of protecting data by scrambling the contents using algorithm (which makes use of a key) so that data cannot be read unless the correct key is provided. Encryption can be used during data transmission or to protect stored data.

	Network utilities –allows a user to monitor and log activity on a network and alter network settings.
	Package managers – used to keep track of installed software and related components. Used to update or install/uninstall additional software.

Application software:
o the purpose, features and uses of application software
o factors affecting the choice, use and performance of application software.

Scope	Description/expansion
• Communications software • Computer aided design (CAD) • Database Management Systems (DBMS) • Digital Graphics and animation • Enterprise Resource Packages (ERP) • Entertainment software • Office software Learners should understand how application software is implemented on different platforms and devices and how this affects the features and performance of software.	Communication software – includes email, instant messaging, social media and video conferencing. Computer aided design (CAD) – software used to produce highly detailed technical drawings such as building plans or when designing a car's engine Database Management Systems – used to create and manage complex, relational databases. Enterprise Resource Packages (ERP) – an integrated software package used in industry to share data between all areas of a business including manging orders, stock, payroll and company finances Entertainment software – a group of software programs that include, media players and games.

A3 Data processing	
The use, features and implications of computer systems for data processing.	
Scope	Description/expansion
Data and information generated, collected and used for: • Commerce (including stock control, loyalty systems, purchasing and sales predictions) • Online services and targeted marketing (e.g. Cookies, Transactional data, Location, Device ID, Payment systems and information) • Manufacturing • Weather monitoring and prediction • Data warehousing	Cookies – plain text files that are stored on users' computers and used to store information about the user's activity or preferences. Transactional data – any data that is created, submitted etc. during a digital transaction. Data warehousing – a system for processing and analysing large quantities of data
The role of hardware in collecting data.	
Scope	Description/expansion
Input devices for automatic collection • Barcode scanners • Cameras • Microphone • OMR/OCR readers • RFID • Scanner (2D and 3D) • Sensors	OMR/OCR – Optical Mark Recognition (readers) and Optical Character Recognition the processing marks on a page to process large quantities of written responses. E.g. OMR for processing answers to multiple choice questions and OCR for Processing applications such as Passport forms. RFID – Radio Frequency Identification, the use of small tags to store information that can be powered and read by being close to a reader.
The role of software in collecting data.	
Scope	Description/expansion
• Questionnaires and surveys • Spreadsheets (analysis and output) • DBMS and SQL • Barcodes/QR codes • Voice recognition	QR Codes – Quick Response codes a way to link to data and online services using a camera and QR reader.
Backup and data recovery procedures.	
Scope	Description/expansion
• Types of back up (Full, incremental, differential) • Storage media • Onsite vs Offsite • In house vs 3rd party services	Full back up – All data is backed up every time the back up is run Incremental – Only data that has changed since the last back up will be backed up

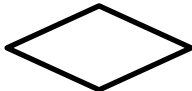|	
• Policy and procedure	Differential – Any changed since the last FULL back up will be backed up
	Storage Media – Optical Media, Magnetic tape, Flash Dives, Hard Drive (including internal, external and Raid Arrays)

E How data is transmitted by computer systems

E1 Transmitting data	
Types of communication channel:	

Scope	Description/expansion
• simplex • half-duplex • full-duplex • point-to-point • multi-drop.	Simplex – Data is transmitted in one direction only Half-duplex – Data is transmitted in both directions but only ever in one direction at a time. Full-duplex – Data is transmitted in both directions simultaneously. Point-to-point – Communication between two endpoint 'nodes' (e.g. a telephone connection where only the two phones can hear each other, or a network switch) Multi-drop – Multiple devices/or components connected to the same communication network/bus and listening for data that is specifically for them.

Methods of connecting devices and transmitting data across and between computer systems.	

Scope	Description/expansion
• Wired Connection and transmission methods (Ethernet, USB, Fibre Optic, HDMI, DVI) • Wireless connection and transmission methods (Bluetooth, Wi-Fi, NFC, Ifra-Red, Mobile/Cellular networks) Learners should also understand how these are used in combination for larger systems and networks when communicating over, or accessing services on, the Internet	USB – Universal Serial Bus to include USB 2 and 3 and the use of USB B and C connection ports (including Thunderbolt). Mobile/Cellular networks – use of a mobile phone service provider to provide data connectivity. Includes 3G and 4G networks as well as voice calls, SMS and MMS services

Protocols used to govern and control data transmission.	

Scope	Description/expansion
• HTTP • HTTPS • POP3 • IMAP4 • SMTP • VoIP • FTP • TCP/IP	HTTP –used to control the transmission and receiving of web pages HTTPS – Secure version of HTTP that uses encryption to protect data during transmission POP/IMAP – used control of receiving/incoming emails – learners should be aware of the differences between the two protocols SMTP – used to control the sending /outgoing emails

	FTP – used for transferring files directly to a device or server TCP/IP – a set of protocols used to allow devices to connect and communicate over a network
Types of compression: o lossy o lossless.	

Scope	Description/expansion
Lossy: • MP3 • MP4 • JPEG Lossless: • FLAC • GIF • PNG • ZIP	Lossy compression – The removal of data from a file to shrink the overall file size Lossless – Use of algorithms, such as run length encoding (RLE), to shrink a file size in a way that ensures all data can be retrieved.

The applications and Implications of data compression	
Scope	Description/expansion
Attributes of a file affected by compression: • bit depth • dimensions • file type • meta data • resolution • sample rate Learners should understand how and why compression is used and how the process of compression affects the file and how it used, including impacts on performance of a system and users.	Bit depth – The number of bits used to express the colour of a single pixel within an image. Dimensions – The length and height measurements of an image or video file File type – How a file is encoded so that a computer system can identify how it should be processed Meta data – additional data within a file that provides additional information for the system/user (e.g. camera settings, GPS location) Resolution – The number of pixels, in a given area, in an image or video file Sample rate – the number of times a sound is sampled in a second when converting when converting from analogy to digital.

F The use of logic and data flow in computer systems

F1 Boolean logic	
The use, application and interpretation of Boolean logic to identify data flow and solve problems. The use, application and interpretation of Boolean logic to identify logical structures, represent data flow and solve problems.	
Scope	Description/expansion

• Mathematical operators:
    ○ +
    ○ −
    ○ / (DIV)
    ○ *
• Relational operators (=, <, >, <>, <=, >=).
• Boolean operators (NOT, AND, OR).
• Truth tables (NOT, AND, OR)
	Truth table – a table that identifies all the possible input and output values for a given logical construct.

F2 Flow charts and system diagrams	
The use, application and interpretation of flow charts and diagrams to represent data flow in and between computer systems. The use, application and interpretation of flow charts and diagrams to solve problems.	
Scope	Description/expansion
Flowchart symbols to be used: Terminator Process Decision Input/output Arrow	Terminator – Used to show the start or end of a flowchart. Process – a computer process such as a calculation or calling a function. Decision – a logical test within a process. Input/output – use to show input from outside the system (e.g. user typing at a keyboard) or to show output from the system (e.g. error message) Arrow – used to show data/program flow from one part of the diagram to another.