

Answers to 1 Fundamentals of computer systems

Check your understanding page 2

- a) Examples (2 to be given): buttons; light-sensitive, CCD, CMOS chip; microphone
- b) Examples (2 to be given): screen; speaker; flash
- c) Example (1 to be given): card reader

Check your understanding page 4

- 1 An embedded system is a computer system that is part of (built into) another device.
- 2 Examples (2 to be given): medical diagnosis; engineering fault finding; making choice of insurance policy; consumer advice; other decision guidance
- 3 Knowledge base, inference engine and interface

Check your understanding page 5

- 1 Examples (2 to be given): CAT scans; medical records; expert systems; drug lookup; X-ray imaging; machinery control systems; general administration; looking up drug interactions; remote surgery; DNA sequencing
- 2 Data integrity means that the state of the data reflects reality and it is fit for purpose.
- 3 Any 2 of: deliberate alteration; accidental alteration; software fault; hardware fault; copying fault; input errors; malware; external disasters
- 4 The purpose of software testing is to reveal errors and to ensure that software conforms to specifications.
- 5 Any 2 of: software is complex; testing takes a long time; testing is expensive; not every pathway through a program can be tested

Check your understanding page 7

- 1 Any 3 of: allow interoperability; promote a minimum degree of quality; facilitate learning new software; reduce costs
- 2 Any 2 of: universally accepted; makes learning easier; similar look and feel between products
- 3 Examples (2 to be given): wireless 801.11; TCP/IP; ASCII; Unicode
- 4 Any 2 of: owned by an organisation; often widely used; ensure compatibility between a vendor's products; trade secret
- 5 Any 2 of: not owned by an organisation; publicly available; produced collaboratively; not dominated by an interest group; not for profit and available free or at a small cost; sufficiently detailed to allow interoperability

Check your understanding page 9 (top)

- 1 Ethical means what is right; legal means what is allowed by law.
- 2 Examples (3 to be given): people can view the data an organisation holds on them; people can request that

incorrect information be corrected; people can require that data is not used for direct marketing; organisations cannot use data in any way that may potentially cause damage or distress; organisations must adequately protect data from unauthorised access; organisations must only collect data for a specified and lawful purpose; organisations must not transmit personal data outside the European Economic Area

- 3 Cyber crime is any crime involving the use of a computer.

Check your understanding page 9 (bottom)

- 1 Examples (2 to be given): excessive landfill; toxic waste released into land, water or air; waste of resources
- 2 Examples (2 to be given): server virtualisation; more use of solid state storage; automatic standby; laying out equipment so that it can be cooled efficiently; setting the air conditioning at an optimum level, not too low; using modern screens not CRTs

Answers to 2 Computing hardware

Check your understanding page 12 (top)

- 1 The CPU carries out processing on the computer; it fetches and executes instructions.
- 2 The CPU clock speed is 2.5 MHz (2.5 million instructions can be processed per second); it has 4 cores (4 independent processors working together).
- 3 Advantage: A dual-core processor can process data simultaneously, so faster. Disadvantage: A more complicated operating system is needed; it is harder to write software for multiple processors.

Check your understanding page 12 (bottom)

- 1 ROM is needed for the initial settings and boot sequence; RAM is needed to store data and programs in use.
- 2 Operating system; programs; data in use by programs
- 3 Data is swapped between RAM and the hard disk; hard disk access is slower than RAM access, which slows access to data; performance is slower because transferring data is slow.
- 4 More RAM means fewer data transfers to virtual memory and improved performance.

Check your understanding page 14

- 1 a) $P = 1$
b) $Q = 1$
c) $R = 0$
d) $S = 1$
e) $T = 0$
f) $V = 1$

2

A	B	C	X	W
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	0	1
1	0	1	1	1
1	1	0	0	1
1	1	1	0	1

Check your understanding page 18

- Input examples (2 to be given): touch screen; microphone; accelerometer; light sensor; buttons; camera
Output examples (2 to be given): touch screen; speaker; motor (to make the phone vibrate)
- Examples (3 to be given): Braille keyboard – raised dots to identify symbols; speaker and voice synthesis to read documents; microphone with voice recognition to issue commands

Check your understanding page 20

- Secondary storage is needed to store data and programs when the power is switched off because RAM is volatile and loses contents when there is no power.
- USB flash memory drive
 - CD ROM
 - Hard disk drive
 - Flash memory card.

Answers to 3 Software

Check your understanding page 22

- An operating system hides the complexities of the hardware and allows the user to operate the computer without having to write programs.
- An application performs a useful real-world job; an operating system controls the hardware.

Check your understanding page 26

- Examples (3 to be given): copying files; selecting software; controlling sound volume; connecting to WiFi; deleting files; moving files; checking battery state; updating software; installing new software
- Any 2 of: problems with accents, speed of talking, dialects
- The user interface is the boundary between the computer and users.
- Examples: greater control; able to group commands; quicker to operate than a GUI

- Examples: difficult to type on small on-screen keyboard; no need to learn commands; suitable for non-specialist; can make use of touch screen technology; extra touch facilities available, such as pinch or tap

Check your understanding page 29

- Any 2 of: extra information; about a file; stored along with the file
- Any 3 of: who owns it; who can view it; who can run it; whether it has been backed up; date/time
- Any 2 of: the way in which files are organised by an operating system; arrangement of files and directories, such as hierarchical; naming conventions

Check your understanding page 30

- The facilities available to a user; the operations that a user can perform.
- Any 2 of: sets attributes; to files and directories; such as read, write and execute

Check your understanding page 32

- Any 3 of: spyware protection; firewalls; disk organisation; formatting; file transfer; defragmentation; system maintenance; system information and diagnosis; system cleanup tools; automatic updating
- Any 3 of: upgrades are available; security loopholes are fixed; bugs are fixed; new features are produced
- Disk formatting prepares a storage medium for file storage.

Check your understanding page 33

- Advantages – any 2 of: designed for precise requirements; may provide training; may provide maintenance or upgrades. Disadvantages – any 2 of: expensive; need to wait; company may go out of business
- Source code, is publicly available, can be modified by user.

Answers to 4 Representing data

Check your understanding page 34

- 22
- 73
- 205

Check your understanding page 35 (top)

- 3072 GB
- 2560 KB

Check your understanding page 35 (bottom)

- 100010
- 1110011
- 1100011

Check your understanding page 36

1

		1	0	1	1	0	0
+		1	1	1	0	0	1
Answer	1	1	0	0	1	0	1
Carry	1	1	1				

2

		1	0	1	1	1	1
+			1	0	0	1	1
Answer	1	0	0	0	0	1	0
Carry	1	1	1	1	1	1	

3

	1	0	0	1	1	0	1
+		1	0	1	0	1	1
Answer	1	1	1	1	0	0	0
Carry			1	1	1	1	

Check your understanding page 38 (top)

- $3 * 16 + 10 = 48 + 10 = 58$
- $10 * 16 + 13 = 160 + 13 = 173$
- $5 * 16 + 14 = 80 + 14 = 94$
- $5 * 16 + 11 = 5B$
- $10 * 16 + 9 = A9$
- $3 * 16 + 3 = 33$

Check your understanding page 38 (bottom)

- $10110110 = 1011$ and $0110 = 11$ and $6 = B6$
- $11001001 = 1100$ and $1001 = 12$ and $9 = C9$
- $10011011 = 1001$ and $1011 = 9$ and $11 = 9B$
- $A5 = 10$ and $5 = 10100101$
- $7D = 7$ and $13 = 01111101$
- $F3 = 15$ and $3 = 11110011$

Check your understanding page 39

- Cat, Elephant, Gorilla, bear, dog
- ASCII uses 7 or 8 bits to represent characters; has a limited set of characters available. Unicode uses 16 or more bits; has many more characters available; including characters from all alphabets.

Check your understanding page 41

- 16
- 3056×2292 pixels
 - 24
 - 480 dpi

- The size of the file is affected by: image size (no of pixels height and width); colour depth; resolution.

Check your understanding page 42

- The higher the sample rate, the higher the quality of the sampled sound.
- High sample rate and high bit rate = more data = larger file size.

Check your understanding page 43

- It can't tell the difference; if it expects to find an instruction, it will treat the data as an instruction.
- Instructions are stored as opcode and operand; both are stored as bit patterns; each opcode has a unique bit pattern in the computer instruction set.

Answers to 5 Databases

Check your understanding page 45

- Validation is a check on data, as it is input, carried out by software or the computer.
- A range check validates that data falls between two extreme values.
- Verification is a check that data is correct, compared with the source or a duplicate data file.
- Any 2 of: an extra digit; added to a data item; produced by an algorithm or calculations
- Any 2 of: length (e.g. maximum); type (e.g. no numbers); presence (must be there)
 - Any 2 of: length (e.g. 6 characters); range (e.g. not before or after some particular date)
 - Length (e.g. max 1); type (character / string)
 - Number (must be numeric); range (no more or less than some legitimate figure)
 - Length (no longer than max. allowed); type (must be string / character)
 - Any 2 of: presence (must be entered); length (if checking a new one); type (includes e.g. letters / numbers / special characters / upper/lower case); lookup (matches the one in the system)
- Data that is (unnecessarily) entered more than once.
 - City names are repeated.
 - Alternative spellings might be used, so data is not found.
 - Store city names and addresses in separate tables.

Check your understanding page 50

- Any 3 of: database management system, software, that controls the setting up, and interrogation, of a database
- Store of data, organised, persistent
- A flat file database comprises one table.
- Any 3 of: data stored in tables, linked, on key fields, each row in a table is the same structure and size

Check your understanding page 54

- Any 4 of: forms, queries, tables, modules, reports, programming language, (any) means of protecting data
- An entity is a real-world object; a table is a data structure that holds data about an entity.
- QBE, a visual interface; query language, programmed
- Correct: Carillo/Birmingham, Vega/Worcester, Gordon/Southampton (1 mark for any 2 pairs)
 - Carillo/Birmingham
 - 1 mark for each correct pair: Vincent/78967, Gordon/56787
 - Correct: Carillo, Hernandez, Mcleod, Vincent, Cohen (1 mark for any 2)
- SELECT Surname, Salary WHERE Sex = 'f' AND City = 'Birmingham' (1 mark for each condition)
 - SELECT Surname, Forename, Street WHERE Years in employment >= 3 OR Salary > 50000

Answers to 6 Computer communications and networking

Check your understanding page 58

- The purpose of a NIC is to allow a computer to connect to a network and it does this by sending and receiving electrical signals.
- A hub sends data to all connected ports; a switch sends data to specific addresses.
- Hide SSID (service set identifier), restrict access to specific MAC addresses, encryption (WEP or WPA)
- A router directs data packets, to their destinations.
- A network bridge is a hardware device, that connects two networks.

Check your understanding page 59

- Any 3 of: database; web; file; print; email; games
- A client-server network has separate client machines as workstations that request services and a server to provide services. A peer to peer network doesn't have a server. Instead, services are carried out by the computers, or 'peers' on network. On a peer to peer network all computers have equal status, they act as workstations and also all have network functionality.

Check your understanding page 61

- Any 2 of: bi-directional signal traffic; collisions; re-sends often necessary
- Any 2 of: fewer collisions; faster transmission; robust – can survive some broken connections

Check your understanding page 63

- A network protocol defines rules, standards, for data transmission.
- Examples: TCP, concerned with connections; IP, concerned with packet construction; DNS, translates domain names to IP addresses; SSL, concerned with encryption; FTP, transmitting files; HTTP, transmission of web pages; IMAP, emails; POP3, emails; Telnet, text communications (1 mark for each of two protocols, 1 mark for additional information about each protocol)
- A data packet is a unit of data, sent on a network.
- Packet switching is a system for routing packets, across different routes, reassembling them at destination.
- An IP address is a number, representing a node on a network.
- 256
- Any 2 of: number that represents a device on a network; permanently stored in the device; 6 pairs of hexadecimal numbers

Check your understanding page 66

- Any 3 of: accidental deletion or damage by operator; deliberate deletion or damage; software fault; hardware fault; any natural catastrophe; terrorism or war
- How important is it to lose no data at all, how often data changes
- A backup is a copy of live data; an archive is a copy of data that is old or not used any more. Archived data is deleted from the day-to-day system.
- Automatic transfer of operation, to redundant or extra system
- User name; password (allow biometric methods)
- Any 3 of: long enough; mixture of text, numbers, special characters; not easily guessed word; changed often
- Any 3 of:
 - do not transmit
 - offensive or obscene material
 - material with the intent to cause annoyance, inconvenience or needless anxiety
 - material with the intent to defraud
 - defamatory material
 - material that infringes the copyright of another person
 - do not use the network for bulk mailings or marketing
 - do not access unauthorised material
 - do not waste staff time
 - do not corrupt / destroy data
 - do not violate other users' privacy
 - do not install unauthorised software.

Check your understanding page 67

- Any 2 of: standard way to identify a resource on the internet; human-friendly format; levels read from right to left
- Options a and c
- They need a router to connect to the ISP; to allow various devices to connect.

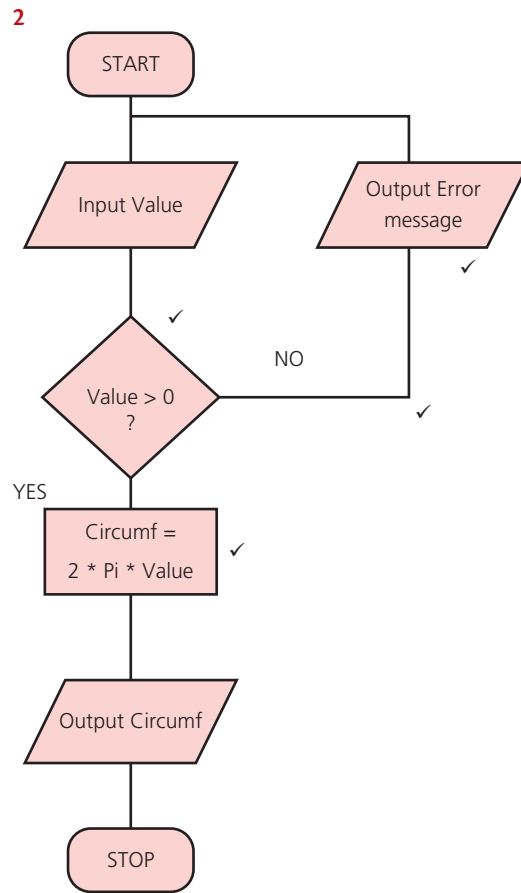
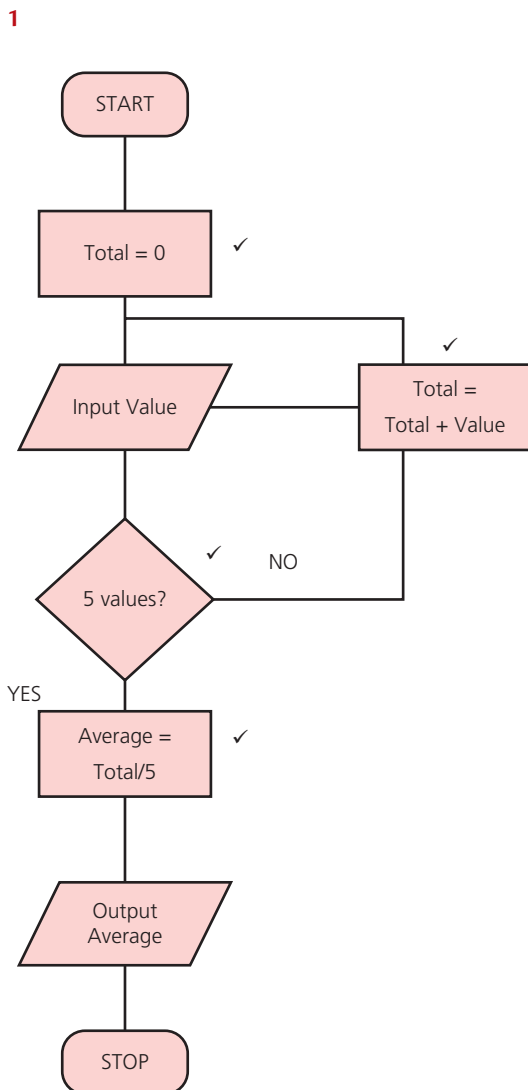
- 4 The internet is an infrastructure of connected networks; the world wide web is a collection of web pages.
- 5 A DSL connection is a digital subscriber line, a means of using the spare capacity of ordinary analogue telephone connection to connect to the internet.
- 6 A modem converts between digital and analogue signals.

Check your understanding page 70

- 1 Lossy compression: data is removed, cannot re-create original file; lossless compression: data is encoded, can re-create original file.
- 2 Images can be very large files; to save storage space; downloads may be unacceptably slow.
- 3 File formats need to be readable by all browsers, readable by most standard software.
- 4 Hypertext Markup language, text file, used to describe web pages.
- 5 XML separates HTML display code, from data, reduces amount of HTML code needed.

Answers to 7 Programming

Check your understanding page 72 (top)



Check your understanding page 72 (bottom)

- 1
 - Input height
 - Input base
 - area = $0.5 * \text{height} * \text{base}$
 - Output area
- 2
 - Set total to zero
 - Set count to 0
 - Repeat
 - Input value
 - Add value to total
 - Add 1 to count
 - Until count = 10
 - average = total/count
 - Output average

Check your understanding page 74

- 1 High-level code uses words; machine code is in binary; high-level code is designed to be read by human programmers; high-level code is portable and can be translated for different machines; machine code is specific to a particular machine.
- 2 An interpreter translates and executes one line at a time whereas a compiler translates the whole source code; errors are identified one command at a time making it easier to debug the code whereas a compiler reports all the errors in

the code at once making them hard to locate and debug; execution can be resumed once an error is identified whereas with a compiler the code must be modified and recompiled before it can be run; code can be developed and tested in stages whereas with a compiler the code needs to be compiled, executed each time the code is modified.

- 3 Compiled code runs quickly once compiled; it does not need the translator to be present when running, reducing memory requirements; compiled code is difficult for others to modify, without access to the source code.

Check your understanding page 75

- 1 Any 4 of: Editor; automation tools, e.g. auto-complete code, colour code keywords, indent structures; translator; debugging tools, e.g. highlight errors, suggest possible solutions; run-time environment; auto-documentation
- 2 Any 4 of: indenting shows structures, makes it easy to see the structures within the code to identify processes; colour coding highlights key words, identifies the commands used making it easier to locate actions; auto-documentation tracks variables, sub-routines and comments, keeps a record of all the variables and sub-routines and how and where they are used, uses comments to explain the function for sections of the program to identify which section does what.

Check your understanding page 77

- 1 a) Selection
b) Iteration
c) Sequence

```
2
For i = 1 to 5
Output i * i
Next
```

```
3
i = 1
While i <= 5
Output i * i
i = i + 1
Endwhile
```

Check your understanding page 78 (top)

Variable name	Typical value	Data type	Typical size
ItemCode	F1234	String	5 bytes
QuantityInStock	23	Integer	2 or 4 bytes
RetailPrice	147.99	Real	4 or 8 bytes
OnOrder	TRUE	Boolean	1 bit (or 1 byte)

Check your understanding page 78 (bottom)

- 1 a) VAT
b) Wholesale Price, Retail Price
- 2 The value of a constant is set when declared, cannot be changed by the program; a variable changes value as the program is running.
- 3 A variable is a named storage space reserved in memory to hold or store the value associated with that variable name.
- 4 Real (or language equivalent name); value may contain decimal part.

Check your understanding page 79

- a) 3.5
- b) 3
- c) 0
- d) 5
- e) 6

Check your understanding page 80

- a) TRUE
- b) FALSE
- c) TRUE
- d) FALSE
- e) TRUE

Check your understanding page 81

- a) 5
- b) 56
- c) 28
- d) 9
- e) 6
- f) 3

Check your understanding page 83

- 1 A syntax error is an error in the rules or grammar of the language; examples (1 to be given): misspelt key word e.g. FR, WILE, REPAT; incorrect use of assignment e.g. 3 + 4 = x; undeclared variables
- 2 Error only apparent when the program is running, often caused by errors in the logic of the program; examples (1 to be given): division by zero; programs that will not complete; stack overflow; incorrect output
- 3 Assignment A + B = C should be C = A + B; syntax error
- 4 a) 180
b) 1100
c) 200
d) 600