Answers

1 Problem solving

Recall activities

1

Top-down	Bottom-up	Modularisation
1 Problem broken down into main components **2** Each main component is broken down into sub-problems **3** Each sub-problem broken down into smaller solvable problems	**1** Smaller problems are solved first **2** Each solution, when merged with other solutions, solves a bigger problem **3** Mainly used for object-oriented programming	**1** Different parts can be solved by different teams/individuals **2** Can save time as modules can be worked on at the same time by different teams/individuals **3** Programmers can be allocated to modules based on their specialisms

2 Decomposition – Breaking down a complex problem into manageable component parts
Abstraction – Extracting key details from a problem and ignoring irrelevant information
Algorithm – Set of instructions that describe a solution to a problem

3 1. Easily understood by most people.
2. The steps can be converted into code when programming, easier than converting a paragraph of writing, which saves time and effort

4 1. Some problems require complex algorithms that take time to create, which can cause delays.
2. Some parts of a problem are not easy to convert into an algorithm, so may not give a true representation of the problem or solution

5 Add, divide, multiply, subtract

6

Symbol	Description	Example
=	Equal to or equivalent	*y* = 7
<>	Does not equal	*x* <> 6
>	Greater than	*y* = 4
>=	Greater than OR equal to	*x* >= 4
<	Less than	*y* < 4
<=	Less than OR equal to	*x* <= 4

7 **Across**
3. Flowchart
8. Pseudocode
10. Sequence
11. Syntax

Down
1. Function
2. Sort

4. Trace table
5. Selection
6. Condition
7. Iteration
9. Search

Short-answer exam-style practice questions

1 A problem-solving technique used to make real world problems understandable (1)

2 By separating the problem into different modules, each can be solved separately. (1) This means that each part is checked without the results of the overall problem being affected, so errors can be found more easily. (1)

3 To simulate what would happen when a program is executed. (1) The values of the variables in the code are displayed in a table to help identify any potential errors. (1)

4 Pseudocode (1) – an informal language using a mixture of programming words and general wording to describe the flow of an algorithm. (1)
OR
Flowcharts (1) – use standard symbols with connecting lines to show the flow of an algorithm. (1)

5 Variables are values that can change (1) in a problem, while constants do not change. (1)

6 A question with only two possible answers is written in a diamond shape. (1) This diamond is connected from above to the start of the flowchart (or to the point where the information being requested comes from). (1) From the bottom of the diamond, there are two answer lines. One represents true and the other represents false. (1) These both connect to the next stage of the algorithm, depending on what happens with the true or false answers. (1)

Long-answer exam-style practice questions

1 The algorithm assigns a grade (Pass, Merit or Distinction) automatically (1) based on the mark entered on using a keyboard. (1) This grade is then displayed on the screen. (1)

2

Mark entered	Message displayed on screen
72	Well done you gained a Distinction
28	Sorry, you need to retake the test
47	Well done you gained a Merit

3 Sample answer provided in workbook.

4 Sample answer provided in workbook.

5 One mark for each of the following up to a maximum of six marks:

- Correct symbols used (1)
- Goals for TeamX entered correctly (1)
- Goals for TeamY entered correctly (1)
- Correct comparison of Goals for TeamX and TeamY (1)
- Correct allocation of points for the winner based on comparison answer (1)
- Correct allocation of points for the loser based on comparison answer (1)

6

Marks	Answer
9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Benefits of modularisation** ▶ Easier to see underlying causes/issues ▶ Can develop plan for solving each issue ▶ Each aspect/module can be developed independently ▶ Each aspect/module can be tested independently ▶ Team members can be assigned to specialisms based in aspects/modules **Drawbacks of modularisation** ▶ Increased complexity when integrating the modules together ▶ Some modules can be dependent on others ▶ Developers may not understand the whole system requirements when only looking at own module(s)

Level	Marks	Descriptor
	0	▶ No content worthy of credit
Level 1	1–3	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points ▶ Forming a superficial or unsupported conclusion
Level 2	4–6	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points ▶ Forming a partially supported conclusion
Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

7 One mark for each of the following up to a maximum of six marks:

- User enters dog age on keyboard (1)
- If age <=2 multiply age by 12 (1)
- If age >2 multiply age by 16 (1)
- Add 31 to either figure (1)
- Output final dog age on screen (1)
- Output calculated human age on screen (1)

2 Introduction to programming

Recall activities

1

Data type	Description	Example	Real world example
String	A collection of characters grouped as an object	"Alexa", "computer"	An object's name such as a 'shirt'
Character	A single alphanumeric character	"d", "@"	An individual's initial
Integer	Whole number	200, 21, 2	Number of shirts in stock
Real/Float	Numbers with fractional parts	3.99	Price for each shirt
Boolean	Either true or false value	"True", "Yes"	Answer to the question 'Is the shirt in stock?'

2 Constant – stored value that does not change when used in a program
Variable – stored value that changes when used in a program
Declare – process of naming a variable
Cast – to allocate a data type to a variable

3 A data structure is a way of **organising** and storing data on the computer, so it can be **accessed** and modified efficiently. There are **three** types of data structures:

- lists
- arrays
- dictionaries.

A **list** is an ordered data structure that uses a single **identifier** and an **index**. It has no predefined **scope** and does not require defined attributes.

An array is a data structure that uses a **single** identifier and **multiple** indices to store data. It can be one-dimensional or **multi-dimensional** using **multiple** indices. An array has a predefined scope and can **only** hold data of the **same** data type.

A dictionary is an ordered data structure that stores the data in a **pair** of a key and a **value**. The **value** can be returned by referring to its **key**. Items in the dictionary can be changed and **duplicates** are **not** allowed.

4 Local variables can only be used on a subroutine or specific function.
Global variables can be used anywhere in a program.

5 To carry out a calculation using variables or values in a program.

6 To define the relationship between/compare two values.

7 To connect two or more conditions leading to an output based on the conditions being met or not.

8

Operator	Purpose	Example of use
==	To show that two values are the same	C == D
<	To show that a value on the left is less than the value on the right	K < G
>	To show that a value on the left is greater than the value on the right	K > G
<>	To look for a value that is not equal to a defined value	C <> D
<=	To look for a value on the left that is equal to or less than the value on the right	C <= D
>=	To look for a value on the left that is equal to or more than the value on the right	C => D
NOT	To flip the value that has been returned	NOT (H > 5 and H < 7) 6 would be True so FALSE
AND	To check that two conditions have been met and then provide a TRUE value	H > 5 AND H < 7 If H = 8 then False as greater than 5 but more than 7
OR	To check two conditions and return TRUE if one or both conditions are TRUE	H > 5 OR H < 7 If H =8 then True as greater than 5 but more than 7

9 "r" – file is opened to be READ
"a" – opens a file for editing/appending, can also create a new file
"w" – opens a file to WRITE into, can also create a new file if needed
"x" – creates a specified named file, creates an error if the file already exists

10 Text mode in the as a file type

11 "b"

12 f = open ("mynotes.txt", rt)
OR
f = open ("mynotes.txt")

13 READ mynotes.txt Record

14 IF – to generate a selection in a program/algorithm based on it being True or not
THEN – to direct the program on a route if the condition(s) are TRUE
ELSE – to direct the program on a route if the previous condition is FALSE
ELSEIF – to direct the program to a route if the condition(s) specified is FALSE
CASE – to allow for multiple choices in a less confusing manner than lots of ELSEIF

15 Carries out an iteration in the code as long as a condition is met/true

16 Used to iterate through a list or dictionary

17 Linear search – starts at the beginning of the data and examines each piece of data in turn until the required data is found.
Binary search – data is sorted, then the data is divided in half with data being found above or below this value. This is repeated again and again until result found.

18

	Bubble sort	Insertion sort	Merge sort	Selection sort	Quick sort
Benefit 1	Items are swapped in place and do not need extra storage	Good when sorting a small list	Good with large data sets/lists	Good when sorting a small list	Good when using very large data sets/lists
Benefit 2	Minimum space requirements	Simple to use	Operation can be overlapped with input/output (I/O)	Items are sorted in place and do not need extra storage	Items are sorted in place and do not need extra storage
Limitation 1	Takes a long time if there is a large number of items to sort	Only copes with lists of a small number of items	Requires more space than other sort methods	Takes a long time if there is a large number of items to sort	If list sorted it is not as efficient as bubble sorting
Limitation 2	Lots of processing power needed	Lots of processing power needed	Less efficient than other methods	Lack of efficiency compared to quick sort	Does not sort integers as well as other methods

19 Presence check – Checks data has been entered in a required field – Surname when registering for a driving licence
Length check – Data can only contain a specified number of characters – Phone number
Type check – The correct type of data has been entered – Age as an integer not text
Format check – Data must be a specific format – Email address must contain an @ symbol
Range check – Value must be within a range of set values – Number of bags for holiday between 0 and 2
Check digit – Used to check data has been received properly – Number of a barcode

20 **Across**

3. Concept
6. Integration
7. Unit
10. Performance
12. Five
14. Automated

Down

1. Security
2. RCA
4. Beta
5. Compatibility

8. Erroneous
9. Acceptance
11. System
13. Valid

Short-answer exam-style questions

1

- ***a*** Candidate number: Integer/Int (1)
  Candidate name: String (1)
  Planning phase complete: Boolean (1)
  Final mark: Integer/Int (1)
- ***b*** A data structure (1) that can store multiple examples of the same data type (1)
- ***c*** Line 1 declares a variable called award-grade, (1) which is based on the mark entered (1). When each mark is entered, a grade is given based on the mark. (1) If the mark is greater than 80 a Distinction is returned, over 60 a Merit and greater than 35 a Pass. (1)
- ***d*** A loop (1)

2

- ***a*** It loads a library of code into the program (1) that will create a random number when run (1)
- ***b*** A variable is created called total_turns, (1) which is set to 3 in line 9. (1) Then the total-turns increases by +1 in line 14 (1) until 3 is reached and the final score is output. (1)
- ***c*** Each time the dice is rolled the variable total_score (1) is added to by the roll_dice pre-defined function (1) where the roll of each dice is called result, which is turned into the total-score. (1)
- ***d*** This is an IF loop (1) that on turn 2 reduces the total score by 1 (1) and adds 2 to the score if it's the third role of the dice. (1)

3

- ***a*** It is an array (1) to store the values of the different toys that they manufacture. (1)
- ***b*** The loop looks for the value defined as x in the array. (1)
  The value for x is defined as "dog". (1)
  Once the loop gets to the value of x, the program stops. (1)
  The program prints all the values before the x value. (1)
- ***c*** The program would run until it found the value "wolf" in the array. (1)
  Then it would print all the values of the array apart from "wolf". (1)

4

- ***a*** RoomControl (1)
- ***b*** RoomControl (1) OR RoomControl (thermo)(1)

5

- ***a*** The program code is set to equal the weight, (1) so it would charge £3.00 for all parcels, (1) unless a package is exactly 200 g or 500 g in weight. (1) The cost of shipping 200 g is also wrong at £50.00. (1)
- ***b*** Possible solution:

```
If ParcelWeight =>200: (1)
    print (ParcelWeight, "The shipping cost will be £5.00") (1)
elif ParcelWeight > 499: (1)
    print (ParcelWeight, "The shipping cost will be £8.00")
else:
    print ("The shipping cost will be £3.00")
```

Long-answer exam-style practice questions

The level descriptors are shown in question 1 but apply to all long-answer questions worth 9 marks.

Question number	Marks	Answer
1	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Definition of compatibility testing ▶ Why compatibility testing is used ▶ Issues that can be addressed ▶ Issues that are missed if not carried out ▶ What can/should be tested
Level	**Marks**	**Descriptor**
	0	▶ No content worthy of credit
Level 1	1–3	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points ▶ Forming a superficial or unsupported conclusion
Level 2	4–6	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points ▶ Forming a partially supported conclusion
Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
2	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Definition of pre-written code ▶ Shorter development time ▶ Improved final product ▶ Know code works ▶ Security risks ▶ Lack of support ▶ Relevance to context

Question number	Marks	Answer
3	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Definition of beta testing ▶ Traditional beta testing ▶ Public testing ▶ Technical testing ▶ Focused testing ▶ Post-release testing ▶ Context of hire company staff being used for testing

Question number	Marks	Answer
4	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. The evaluation may include: ▶ Definition of RCA ▶ Why RCA is used ▶ When is RCA used ▶ What are its strengths ▶ The 5 'Whys' ▶ The process to follow.

Question number	Marks	Answer
5	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Why validation is important ▶ Techniques that could be used ▶ Why they would be used ▶ How fits into context of an account creation webpage ▶ Impact of not using the validation techniques

Question number	Marks	Answer
6	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Definition of a test plan ▶ What makes a good test plan ▶ What could/should be included in a test plan ▶ What a good test plan allows developers to know ▶ What issues can be missed if test plan is poor ▶ Impact of poor test plan on final product

Question number	Marks	Answer
7	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Comments used to record notes ▶ Comments used to explain code development ▶ Comments used to highlight issues ▶ Remote workers can see what others have written ▶ Remote workers can see what has not been done

3 Emerging issues and impact of digital

Recall activities

1

Term	Definition
Cultural	Ideas, customs and behaviour of a society
Ethical	Moral principles/rules that direct an individual's behaviour
Moral	Behaviour that is believed right or wrong
Social	Relates to an organised group of individuals, a society
Societal norms	Beliefs, attitudes and behaviours that are acceptable to a social group.

2 AUP:

1. Use of facilities and equipment
2. Email communication protocols
3. Use of BYO (bring your own) devices
4. System password requirements

Internal organisational policies:

1. Whistle blowing
2. Health and safety
3. Maternity, paternity, and parental leave
4. Dress code

3

	Positive impact	Negative impact
Changes in societal norm	▶ Digital technology allows communication globally, so families can stay in touch more easily ▶ Continual self-education using the internet is now possible	▶ Negative comments are broadcast widely using social media ▶ Digital divide if some do not have access to technology
Changes in cultures in organisations	▶ Staff can work where they live, creating global workforce ▶ Reduction in need for premises	▶ More pressure from continual monitoring of employees ▶ Staff meet less, reducing interactions/collaboration
Environmental issues	▶ Increased monitoring of issues ▶ Remote working has reduced pollution due to less commuting	▶ Increased power requirements ▶ Increased requirement for rare and non-renewable resources
Globalisation	▶ Sourcing products from all over the world ▶ Reduction in cost of manufacturing	▶ Increased spread of misinformation ▶ Increased impact globally due to local disruptions
Inclusion and diversity	▶ Greater access to resources/events due to digital technology ▶ Greater access to flexible working to fit around life events	▶ Increased social digital divide ▶ Some views drowned out by the echo chambers of social media

4 1. Maintain reputation of members
2. Promote professional standards

5 Observing normal behaviour – Establishing a person's regular pattern of work by watching them in the working environment
Awareness of co-workers – Notice in the behaviour and emotions of others around you and how they may differ to their norm
Situational awareness – include people, buildings and events

6 **Across**
2. Pillars
6. Deep learning
7. Internet of things
8. Virtual reality

Down
1. People
3. Augmented reality
4. Data
5. Process
9. AI

Short-answer exam-style questions

1 Level 1: Hear/see by observing to increase awareness (1)
Level 2: Understanding of what you are aware of (1)
Level 3: Using understanding to inform future actions (1)
(Wording may differ)

2 Machine learning will allow the app to analyse data and improve its workings. (1) By recording and analysing what the user does (1) the app will be able to make personalised recommendations through the app (1). This means that users will not receive generic recommendations, so the app will be more effective for users.

3 AR allows data to be shown in the real-world situation. (1) Markers can be placed in the cab of the cranes which can include data about what the controls do. (1) While wearing a head set, operators can look around the crane cab and the AR will be triggered, providing information about how to operate the crane. (1)

4 The quantity of a product that the supermarket has in stock can be stored on a database (1). When an item of a product is sold, its barcode is scanned into the system. This will automatically reduce the stock level of the product by 1. (1) The stock database can be set so that once a minimum level of a product is reached, (1) an automated reordering process is triggered with suppliers being contacted (1).

5

a Software where the source code is made available to any person (1) so that they can edit and improve it to meet their own needs (1)

b 1. Some is difficult to set up and use. (1) This reduces customisation, meaning that they not user friendly. (1)
2. There can be compatibility issues with some hardware (1) which could mean that the open-source software may not work with an organisation's system. (1)

6 A strategic plan defines a company's purpose and scope. (1) This allows the company to set targets and measure their effectiveness against what it wishes to achieve. (1) This will also allow the company to prioritise the digital technologies that need to be developed. (1)

7 A social media policy aims to control what workers can post on social media. (1) This will be developed to ensure that the reputation of the organisation is not negatively affected (1) by something that a worker posts. Post content could be about the organisation itself or about the behaviour of the individual worker. (1)

8 Staff may feel they are not trusted by their employer to do their job. (1) This can lead to negative feelings about the company and workers leaving the organisation. (1)

Long-answer exam-style practice questions

The level descriptors are shown in question 1 but apply to all long-answer questions worth 9 marks. Level descriptors are shown in question 2 for a long-answer question worth 12 marks.

Question number	Marks	Answer
1	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Increase monitoring capability of environment ▶ Increased use of more sustainable processes ▶ Increased extraction of minerals ▶ Increased pollution from electronic waste
Level	**Marks**	**Descriptor**
	0	▶ No content worthy of credit
Level 1	1–3	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points ▶ Forming a superficial or unsupported conclusion
Level 2	4–6	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points ▶ Forming a partially supported conclusion
Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding

		• Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
2	12	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Personal data is collected ▶ Compliance with DPA ▶ Levels of access to the data ▶ Who has use of the data and for what purpose ▶ Ethics of continuously monitoring a user
Level	**Marks**	**Descriptor**
	0	No content worthy of credit
Level 1	1–4	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points Forming a superficial or unsupported conclusion
Level 2	5–8	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points ▶ Forming a partially supported conclusion
Level 3	9–12	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
3	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Safe working environment for training

		▶ Reduced costs (no need to travel to different locations) ▶ Reduced noise and distractions while learning ▶ Range of scenarios can be used to train for different eventualities ▶ Instant feedback and warning messages can be used to highlight issues/mistakes

Question number	Marks	Answer
4	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Automated processes can be used when ordering from tables ▶ Automated stock level monitoring when orders placed/cooked ▶ Automated reordering can be implemented ▶ Less wastage of resources leading to lower costs ▶ Heating/lighting usage can be monitored and adjusted

Question number	Marks	Answer
5	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Right to privacy ▶ Feeling of being pressured/bullied ▶ Who owns the devices staff are monitored on ▶ Who has access to monitoring data ▶ Individual has the right to see their own data ▶ Data only to be used for stated purpose(s)

4 Legislation and regulatory requirements

Recall activities

1 1. Analyse workstations and assess and reduce risks
2. Plan works to allow for breaks and changes in activity
3. Arrange and pay for eye test and glasses (if glasses are required)
4. Provide health and safety training and information

2 The following should be labelled:
1. Chair back support
2. Adjustable chair
3. Footrest or feet flat on floor
4. No obstructions under desk
5. Supported wrists
6. Arms level with desk
7. Top of monitor level with eyes

3

Term	Description
Information Commissioner's Office	The UK's independent authority that enforces compliance with the DPA
Data subject	Person who the data is about
Personal data	Information that can be used to identify a living individual
Data controller	Person in an organisation who is responsible for ensuring compliance with the DPA
Opt in/opt out	Action taken by the user to accept or reject a marketing request

4 1. Data must be processed fairly and lawfully
2. Data can only used for the specified purpose
3. Only relevant and not excessive data may be held
4. Data should be accurate and up to date
5. Data should be kept only for as long as necessary
6. Individuals have rights to access the data held about them
7. Data must be protected from unauthorised access
8. Data cannot be transferred outside the EU unless similar protections are in place

5 1. Unauthorised access to computer material – Maximum fine of £5000 and up to 6 months in prison
2. Unauthorised access with intent to commit further crime – Unlimited fine and/or up to 5 years in prison
3. Unauthorised modification of data – Unlimited fine and/or up to 5 years in prison
3A. Making, supplying or obtaining any articles for malicious use on a computer – Unlimited fine and up to 5 years in prison
3ZA. Unauthorised acts leading to serious risk or damage – Unlimited fine and up to 14 years in prison

6 **Across**

2. Keylogger
3. ECPA
6. Patent
8. ECHR
9. GPS

Down

1. Intellectual
4. CCTV
5. Badges
7. EU

7 Protected characteristics:

- Age
- Disability
- Gender reassignment
- Marriage and civil partnership
- Pregnancy and maternity
- Race
- Religion or belief
- Sex
- Sexual orientation

8

a World Wide Web Consortium (W3C)

b Internet Engineering Task Force (IETF)

c HTTP

9

a Perceivable – Content should be available to everyone
1. Use of text as an alternative to images or sounds, etc.
2. Ensure content can be easily seen/heard by separating foreground from background content

b Operable – The UI and navigation components should work
1. Provide enough time for content to be read/accessed
2. Ensure navigation can take place without need to use mouse or keyboard

c Understandable – Operating the UI and the information provided should be understandable by its users
1. Make sure that pages appear and operate in a predictable manner
2. Help users to correct any mistakes that they make when using system

d Robust – Content must be able to be interpreted consistently and accurately, including using assistive technology
1. Screen readers must be able to read content in a meaningful manner
2. Components and roles should be easily determinable.

Short-answer exam-style practice questions

1 1. Check screen is positioned properly. (1)
2. Take regular breaks. (1)

2

- ***a*** To protect the sensitive data of individuals, (1) to ensure that that the data is only used by entities who are allowed access to the data. (1)
- ***b*** The individual who the stored data is about. (1)
- ***c*** 1. Appoint a Data Controller (1) who will be responsible within the organisation for ensuring compliance with the DPA. (1)
  2. Ensure that the data held is accurate and up to date (1) by carrying out periodic checks with the data subjects. (1)
- ***d*** 1. Data collected that is related to National Security. (1)
  2. Data collected in relation to taxes. (1)

3 A white hat hacker attacks a system to help develop its security features by finding its weaknesses. (1) A black hat hacker attacks a system to exploit it for malicious intent. (1)

4

- ***a*** GPS systems could be linked to vehicles, (1) allowing the positions of the vehicles to be continually monitored on their routes in real time. (1)
- ***b*** 1. The GPS system may have lost connection with the van due to a poor signal, so the position is not updated. (1) This would not be the fault of the employee and they may still be working to schedule. (1)
  2. The employee may have been on a break that they are entitled to take, (1) but could feel that they are under pressure to keep working. (1)

5 It protects an individual's right to expect their private live life to be respected. (1)

6 The positive decision by a data subject (1) who freely gives permission or denies permission for marketing material to be sent to them. (1)

7 To show the integrity of its members (1) by providing a code of ethics that members can follow. (1)

8 The IETF tries to ensure that consistent technology is used in the architecture of the internet, (1) so a company has standards that they can use to develop their product(s). (1)

Long-answer exam-style practice questions

The level descriptors are shown in question 1 but apply to all long-answer questions worth 9 marks. Level descriptors are shown in question 3 for a long-answer question worth 12 marks.

Key words in the question	How do these relate to your answer?
Discuss	Write about both sides – so include positives and negatives. Provide a conclusion.
Mobile phone manufacturer	This is the context of the question. Consider: ▶ Competition with other manufacturers ▶ Confidentiality of design and manufacture ▶ Designs before and after registration of patents
Monitor electronic communications	▶ Emails, both text and attachments – could contain information about new device ▶ Social media use and posts, even accidental images showing confidential information
Employees	▶ Working on devices ▶ Disgruntled employees not involved in development ▶ Employees annoyed at being monitored

Question number	Marks	Answer
1	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Confidential design and manufacture process ▶ Highly competitive market ▶ Competition with other manufacturers, so designs must be secret ▶ Monitoring for accidental and deliberate communications about new designs and devices ▶ Employees feeling spied on and not trusted
Level	**Marks**	**Descriptor**
	0	▶ No content worthy of credit
Level 1	1–3	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points ▶ Forming a superficial or unsupported conclusion
Level 2	4–6	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question

		▶ A good evaluation • Consideration of the different factors/events and competing points Forming a partially supported conclusion
Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
2	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Permitted access to the data by staff and partner organisations ▶ What data could also be used for ▶ Staff training • how to use data correctly • avoiding accidental or deliberate data disclosure ▶ Ensuring system accessible to all users ▶ Code of practice is mandatory

Question number	Marks	Answer
3	12	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Personal data collected • Data Protection Act ▶ Digital systems used • Computer Misuse Act ▶ Access to system for all users should be possible ▶ No discrimination • Equalities Act • ECHR
Level	**Marks**	**Descriptor**
	0	No content worthy of credit
Level 1	1–4	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points Forming a superficial or unsupported conclusion

Level 2	5–8	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points ▶ Forming a partially supported conclusion
Level 3	9–12	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
4	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Development of protocols for international use ▶ Ensuring consistency in language used to write/develop websites ▶ Increase and ensure accessibility to the internet ▶ Ensure that systems can 'talk' to each other

Question number	Marks	Answer
5	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Compliance with DPA ▶ Staff will better understand their roles ▶ Data entry and manipulation will be carried out consistently ▶ Use of devices will be consistent and in line with company requirements, i.e. not leaving machines unlocked ▶ Staff will be more award of threats such as social engineering attempts and hacking attacks

Question number	Marks	Answer
6	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Increased flexibility in working location as task completion can be monitored remotely ▶ Employees with high productivity can be identified and rewarded ▶ Employees feel stressed and under pressure due to continuous monitoring ▶ Employees may not feel trusted and empowered

Question number	Marks	Answer
7	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Environmental issues regarding sourcing and disposal of digital devices ▶ For collaborative work, considering use of printed materials and cloud based technologies ▶ Evaluation of provision for all potential customers and users ▶ The financial and resource impact on the business of ensuring codes of conduct are followed ▶ Impact on customers' levels of trust

5 Business context

Recall activities

1

	Primary sector	Secondary sector	Tertiary sector	Public sector
Definition of the sector	Extraction and production of raw materials	Transformation of raw materials into finished goods, such as in manufacturing and construction	Services (not products) for individuals, businesses and other organisations	Organisations that are owned and operated by government agencies
Example organisations or businesses	A Mining B Fishing C Farming	A Car manufacturing B House building C Clothes production	A Transport B Healthcare C Finance	A Education B Defence C Law enforcement
Examples of services provided	A Extraction of minerals B Deep-sea fishing C Planting crops	A Produce a car B Supply of building components C Fashion design	A Movement of goods B Hospital care C Banking	A Lessons B Defence of country C Keeping people safe
Examples of products produced	A Lithium B Cod C Wheat	A New car B House extension C Hoodie	A – B – C Bank account	A GCSE B – C –

2 1. Stock can be stored in a database, so you are aware of how many of each product you have.
2. Setting up and managing access rights to the stock database.

3 A feasibility study is conducted during the **initiation** phase of a project. The feasibility study aims to determine if a project is **viable** or not. It will assess whether the project is viable and worth **investing** time and **money** in. During a feasibility study the project will be assessed to check that it is **logically** and practically possible using the **resources** available without contravening **legal** regulations.

4 Advantages
1. Allows analysis of possible project risks and rewards
2. Can help decide if project should proceed or not
Disadvantages
1. Expensive
2. Time consuming

5 **Across**
1. Skills
6. Education
7. Accessibility
8. Transitory
10. Personas

Down

2. Internal
3. Mobile
4. Trivial
5. Ubiquitous
9. Cost

6

Area	How IT can add value to a business
Overhead costs	Mistakes can be reduced, for example in manufacturing automated processes can make the same product repeatedly and reliably.
Improving efficiency	Documents can be moved quickly and effortlessly, reducing time dependencies and allowing for quicker project completion.
Facilitating growth	Cloud technologies allow faster scaling up of production.
Recruiting talent	Digital technologies allow communication over a wider area, meaning that workers can be employed from different locations depending on task requirements.

7 Developmental – The development or improvement of someone or something to become more effective.
Transitional – The movement from one version or product to another, leading to an updated or improved product.
Transformational – To improve a situation or product, leading to a better experience.

8 Risks of using digital technologies:

- security breach
- privacy breaches
- legal non-compliance
- audience exclusion

Impacts caused by the risks identified:

- reputation loss
- data loss
- commercial disruption
- financial loss

Short-answer exam-style practice questions

1

a A solar panel manufacturing company is part of the secondary sector (1) because it takes raw materials and converts them into a product. (1)

b 1. To track delivery of raw materials to factories, (1) to ensure that there is always stock in place to produce the solar panels (1)
2. To monitor the levels of manufactured product (solar panels), (1) so that when customers enquire about solar panels the company can respond with availability. (1)

2

a No product is manufactured by a cinema; it shows films made by other companies. (1) Therefore, cinemas provide a service to customers, which is the definition of a tertiary sector company. (1)

b 1. Data can be stored away from the cinema, reducing the need for storage facilities at the cinema. (1). This allows more space for confectionary and other income-generating stands. (1)
2. Another company could host the cloud facilities, (1) reducing the need for technical staff at the cinema, thus reducing their costs. (1)

c 1. By accessing the cloud, (1) there is a greater security risk of hackers intercepting the data. (1)
2. Access to the cloud depends on a stable internet connection, (1) which means that if the connection is lost access to cloud-based data is lost. (1)

d Any new system must be easy to use. (1) If a system in the cinema is not suitable for its customers and does not provide a good experience, then they will stop using the system (1) and may go to other cinemas. This will lead to a loss of revenue for the cinema. (1)

3

a 1. Identifying the resources (1) needed to complete each task to ensure there are no scheduling issues. (1)
2. Scheduling tasks and activities (1) to ensure that they are completed in a logical order. (1)

b 1. Time (1) – ensuring that the timescales for production can be met. (1)
2. Cost (1) – ensuring that there is suitable funding to deliver the product. (1)

c If the staff who are going to use the new system are not trained sufficiently (1) the introduction of a new system will fail. Staff will become disenchanted if they are not able to use the system fully. (1)

d 1. Reduced energy costs (1) – new technologies should be greener and use less energy than traditional methods of working. (1)
2. Increased efficiency (1) – automation speeds up processes and uses less resources (1)

Long-answer exam-style practice questions

The level descriptors are shown in question 1 but apply to all long-answer questions worth 9 marks.

Question number	Marks	Answer
1	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Parallel implementation • Strengths • Weaknesses ▶ Phased implementation • Strengths • Weaknesses ▶ Cloud-technologies ▶ Cinema-based ticket booking
Level	**Marks**	**Descriptor**
	0	No content worthy of credit
Level 1	1–3	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points Forming a superficial or unsupported conclusion
Level 2	4–6	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points Forming a partially supported conclusion
Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points Forming a well-supported conclusion.

Question number	Marks	Answer
2	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Smartboards ▶ Distance learning ▶ VLEs ▶ Mobile technologies ▶ Lack of finance ▶ Digital divide

Question number	Marks	Answer
3	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Key stakeholders can establish viability ▶ Pre-empts issues and problems ▶ Can establish whether a project should be delayed or implemented ▶ Can be time consuming ▶ Can be expensive

Question number	Marks	Answer
4	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Definition of a zero-day vulnerability ▶ Impact on a digital system ▶ How tracking systems are used on packages ▶ How tracking systems are used on vehicles ▶ How customers data can be compromised

Question number	Marks	Answer
5	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Data loss ▶ Lack of access to resources ▶ Customers cannot access services and products ▶ Increased vulnerability due to wider access to system

Question number	Marks	Answer
6	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Timescale for delivery ▶ Cost of resources ▶ Cost of systems ▶ Scope of project – what can be delivered ▶ Quality of product/service is ensured

Question number	Marks	Answer
7	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Change request form ▶ Implementation plan ▶ Decision log ▶ Test plan ▶ Tracks what has taken place ▶ Allows issue tracing ▶ Allows for rollback

Question number	Marks	Answer
8	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Positive** ▶ Customers can track packages ▶ Provision of accurate ETA ▶ Increased security of products ▶ Increased reputation **Negative** ▶ Loss of packages ▶ Loss of reputation ▶ Loss of money ▶ Inaccurate location data ▶ Increased stress on workers of continual monitoring

6 Data

Recall activities

1 data + [**structure**] + [**context**] + meaning

2 Data – Raw facts and figures that have not been processed
Information – Processed data that has a meaning and structure
Knowledge – The use of information to make decisions and judgements
Quantitative data – Data based on numerical values
Qualitative data – Data based on non-numerical values

3 1. To analyse market trends and patterns
2. To analyse and assess system performance
3. To monitor users' actions and performance
4. To target marketing strategies at specific audiences or locations
5. To inform organisational decision making
6. To assess threats to and opportunities for the organisation

4 **Human generated**

- emails
- posts on social media
- images
- audio
- documents such as letters, spreadsheets etc.

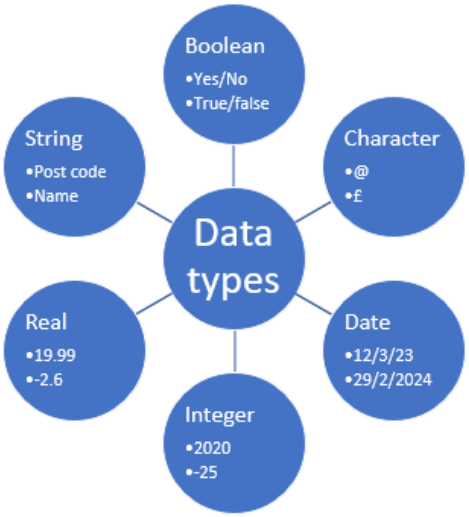
Transactional data

- payment at till
- order fulfilment
- stock levels
- sales forecasting

Sensors

- temperature
- speed of traffic
- number of people entering shop
- pressure on a sensor

5



6 Data wrangling is the **process** of **transforming** raw data into a more usable and **valuable** form. Data wrangling can help **prepare** data for **analysis**, visualisation, or machine **learning**.

7
1. Discovery
2. Structure
3. Cleansing
4. Enrichment
5. Validation
6. Output

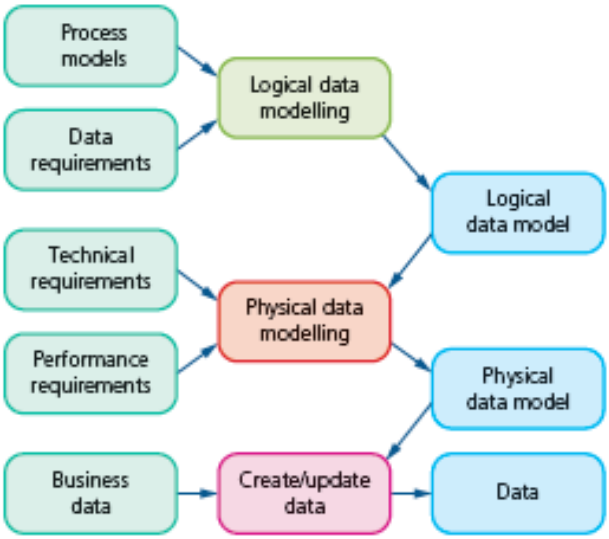
8

a Business intelligence software

b Financial planning and analysis software.

c Customer relationship management software (CRM)

9



10

V	Definition
Volume	The large amount of data generated
Variety	Origin and form of the data
Velocity	The speed at which the data is generated in real time; can also refer to how quickly the data changes and moves from location to location
Variability	The speed at which and the extent to which the data is processed and analysed
Value	The meaning of the data after it has been processed and analysed, in comparison to the predefined goal of the analysis
Veracity	Trustworthiness of the data, which impacts the confidence that the users have when processing and analysing the data

11 Data warehousing – Provide central storage of information that can be analysed
Data lakes – To provide a scalable storage solution for data generated and collected by organisations
Data mining – To analyse data to find out more about customers of an organisation and the effectiveness of the processes used
Data reporting – To collect and organise data from a range of sources into a structured and usable format.

Short-answer exam-style practice questions

1

a Boolean data has only two states, such as true/false. (1) The scheduling of a pickup would only allow a yes/no answer. (1)

b Qualitative data: The description of the package would use alphanumeric data, which is not measurable (1) but provides information about the package. (1)
Quantitative data: for example, the number of packages due to be collected as this is a quantity (1) which can be measured and used in calculations. (1)

c The data is generated using a sensor in a scanner (1), which collects the data from codes placed on the packages. (1)

d Transactional data is created when an item is scanned/collected/delivered. (1) It is created by each interaction between company and customer when a parcel is being shipped. (1)

e A file-based structure organises the data, which will be collected from a range of locations (1) so that it can be managed and used by different software packages in the delivery system. (1)

f The drivers would not have access to the collected data, so they would need a data summary that is relevant to their route for that day. (1) A report can provide them with relevant data only, so they can pick up and deliver specific packages. (1)

2

a A data warehouse allows collected data to be organised in a central location, (1) so that decision making is less complicated. (1)

b Data mining is analysis of the data collected. (1) The supermarket would use data mining to identify any trends and patterns in customers' shopping habits. (1)

c An API is a computer program that allows users to access and use data on a range of different platforms. (1) This means that they can use one account for multiple platforms. (1)

d Administrative metadata contains instructions stored with the data that restricts access. (1) With the data stored in the loyalty card system, administrative metadata sets permissions for who can access and use the data stored about customers. (1)

e By setting the access rights to the customers' personal data in the metadata, the principles of GDPR/DPA are met. (1) Only those users who are granted the correct access rights for the system would be able to access and use the data. (1)

Long-answer exam-style practice questions

The level descriptors are shown in question 1 but apply to all long-answer questions worth 9 marks.

Question number	Marks	Answer
1	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Customers use a range of devices to access the scheme ▶ Shop will enter data using scanning at till ▶ Supermarket company will review data on different devices ▶ All users can have one account/sign in to access system ▶ No need to remember different sign in details ▶ Ease of use
Level	**Marks**	**Descriptor**
	0	No content worthy of credit
Level 1	1–3	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points Forming a superficial or unsupported conclusion
Level 2	4–6	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points ▶ Forming a partially supported conclusion

Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
2	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Strategic decision making** ▶ Planning stock to carry in the future, based on what has been bought in the past ▶ Predictions of changes in habits **Tactical decision making** ▶ Increasing/decreasing the range of goods at specific times of year ▶ Increasing/decreasing the range of goods depending on the age profile of customers **Operational decision making** ▶ What needs to be reordered due to a surge in sales ▶ Discounting based on what is selling/not selling

Question number	Marks	Answer
3	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Text-based file format ▶ Based on JavaScript object syntax ▶ JavaScript is heavily used in websites ▶ Data can be converted to allow calculations to be made ▶ Data transfer between server and website is smoother for user experience than with other formats

Question number	Marks	Answer
4	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Traffic to the home page can be measured ▶ Time spent on each website page can be measured ▶ Interactions with content can be measured ▶ Content can be ranked in popularity ▶ New content can be created which has a high chance of being popular ▶ Unpopular content can be removed

Question number	Marks	Answer
5	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Data at rest** ▶ Stored on the company server ▶ Details stored on customers' computers **Data in use** ▶ Pickup slots are placed on route plan ▶ Pickup and delivery data is added to report for driver **Data in motion** ▶ Data moves from customer computer through the website to company's server ▶ Report generated and sent to driver

Question number	Marks	Answer
6	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. The discussion may include: ▶ Data warehousing ○ Central store of stock records ○ Central store of sales records ○ Customer records ▶ Data lakes ○ Sales data stored ○ Stock stored ○ Customer search queries/ history ▶ Data mining ○ Analysis of data to provide insights ▶ Data reporting ○ Current sales ○ Current searches ▶ Projected products to stock or remove from stock

Question number	Marks	Answer
7	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Volume ▶ Variety ▶ Velocity ▶ Variability ▶ Value ▶ Veracity ▶ How these all interact

7 Digital environments

Recall activities

1

Computer system	Three characteristics	Three uses
Mobile device	▶ Portable ▶ Limited storage ▶ Touchscreen	▶ Remote control ▶ Note taking ▶ Contact on the move
Personal computer	▶ Fixed position ▶ Can be easily upgraded ▶ Used for a range of activities	▶ Word processing ▶ Managing budgets ▶ Photo editing
Server	▶ Powerful processing ▶ Used for specific purposes ▶ Costly	▶ Running printers ▶ Storage of documents ▶ Carrying out complex calculations
Smart device	▶ Connected to networks ▶ Can send and receive data ▶ Little processing done on device	▶ Tracking health ▶ Scanning stock ▶ Managing car engines

2 Batch OS – Collects programs and data together, to manage and execute jobs automatically in groups or batches without user intervention.
Multi-tasking/time-sharing OS – Allows a computer to run multiple tasks or processes at the same time. Resources are used more efficiently, as the OS switches between tasks so that the CPU is used at full capacity.
Real time OS – Manages hardware resources and host applications that process real-time data without delays, so that the computer appears to be doing everything at the same time.
Network OS – Manages and allows communication between computers and devices in a network; manages server(s), data, devices, user accounts, security and applications.
Mobile OS – Manages the hardware and resources on mobile devices to allow the different activities required to take place.
Utility software – Manages, maintains and optimises a computer system. Contains a range of programs that improve the efficiency of a computer system.

3

a Code editor
b Debugger
c Assembler or compiler
d Integrated development environment (IDE)

4

a Redundancy – The built in ability of a computer system to continue to operate, despite any issues that may arise
b Data striping – Technique for storing a file/consecutive data segments across different storage devices
c Parity – Checking to see if any data has been lost/written over when moved from one storage place to another

d Mirroring – Storage of data identically on different disks and other storage locations
e RAID – redundant array of independent disks; multiple disk drives are combined into one storage area (array)
f NAS – central storage point on a network
g SAN – A network of connected storage devices used by computers and servers.

5 1. Scalability
2. Load balancing
3. Latency
4. MAC
5. SSID
6. Server
7. Fibre optic
8. LAN
9. Bandwidth
10. Router

6 Physical topology is the structure of the devices, cables, routers etc. The logical topology is how the data moves on a network including the protocols.

7 Server – Centralises services such as storage, data, resources and client management
ISPs – Provide the internet backbone; provide access to the internet and resources on it
Router – Manages communication on a network between different devices; allows devices to access the internet
Network switch – Used to connect devices by ethernet cables; sends data to specific devices
Client – Devices used to access a network/internet by a user

8

7	Application	Upper layers	FTP, WWW, HTTP, TCP, NFS
6	Presentation		JPEG, MIDI, MPEG
5	Session		NFS, SQL, RPC
4	Transport	Lower layers	TCP, UDP, SPX, NetBEUI
3	Network		IP, PIX, RIP, ARP, ICMP, RARP, EGP, NetBEUI, DLC
2	Data link		HDLC, LLC, SLIP, PPP
1	Physical		No protocols

9

4	Application	Telnet, FTP, SMTP, DNS, RIP, NMP
3	Transport	TCP, UPD
2	Internet	IP, IGMP, ICMP, ARP
1	Network access	Ethernet, Token ring, Frame relay, ATM

10 Benefits
1. Efficient use of hardware
2. Continuous availability
3. Easier migration to the cloud

Limitations
1. Increased risk to data
2. Server sprawl
3. High startup costs

11

a Infrastructure as a service
b Platform as a service
c Software as a service
d Data as a service

12 The organisations and individuals who use cloud services, this tends to be arranged by paying an ongoing fee (subscription).

13 Companies that provide cloud services for a fee. They have different responsibilities depending on the type of delivery model used.

14 Data visualisation tools that show users all the data in a graphical format that is easier to understand.

15

a Data and system redundancy
Benefits
Extra system takes over, so no work lost
Additional software carries out same tasks concurrently
Limitations
More complex system
Increased costs of duplicate resources

b Back-up systems
Benefits
Data can be recovered
Whole system is backed up in case of natural disaster
Limitations
Timing of back-up could miss updated data
Can slow system when data is being backed up

c Hot, cold and warm sites
Benefits
Hot site runs parallel, allowing for immediate switch over
Cold site is cheaper as only used in critical situations
Limitations
Hot site run by third party is costly
Only stores the data, so system needs to be reconfigured when set up

d Data back-up and recovery procedures
Benefits
Backs up copies of all files and folders each time so nothing is lost
Mirror back-up takes copy of everything, including OS and apps
Limitations
Full back-up takes lots of resources
Incremental back-ups use more resources when comparing changes in versions of documents

e Device hardening
Benefits
Reduces active ports so fewer entry points
MFA used to increase security of system
Limitations
Removal of non-essential programs could cause issues in future
Time limits could lock people out when working

Short-answer exam-style practice questions

1

a A – Firewall (1)
B – Server (1)
C – Wireless Access Point (1)
D – Client (1)

b To connect devices in a network (1) and direct traffic to and from the intended devices (1)

2

a 1. May lose power when battery runs down, so the device cannot be used until recharged/plugged in. (1)
2. Requires cellular or Wi-Fi connection to access data, which may not be available or incur extra cost. (1)

b 1. Touch screen keyboard that can be used for typing emails (1)
2. Digital camera that can be used to scan paper documents into the system (1)

c To manage the resources on the mobile device, (1) so that the user can perform the tasks required (1)

3

a RAID 10 (1)

b To use multiple disks to store data (1) in a more reliable way and with increased speed of read and write. (1)

c Data striping stores consecutive data across multiple devices/drives, (1) while mirroring stores all data on one drive but copies it to another. (1)

d 1. Setting up a network can be costly as it requires hardware and technical staff. (1)
2. There is an increased security risk as there are more points where access to data can be gained. This requires a higher level of security to be implemented, which can be costly. (1)

4

a To provide user-friendly access to the network, (1) by manipulating data and presenting it in an easy-to-access manner (1)

b Assigning of logical addresses on a network (1) to the devices that are using the network (1)

c To provide the ability to transfer data from a client (1) to a server on a network (1)

d 1. TCP (1)
2. SPX (1)
3. UPD (1)

5

- ***a*** Where data from various sources is brought together (1) for processing (1)
- ***b*** The research company will gather data from several sources when assessing markets for a product (1). Data virtualisation allows the data to be processed and used efficiently in the business. (1)
- ***c*** To reduce the hardware cost of multiple servers (1) by using only one physical server. (1)
- ***d*** A hypervisor sets up and manages virtual machines (1) by allocating resources on demand to different virtual machines when needed. (1)

6

- ***a*** Cloud computing allows the company to purchase only the resources it needs, (1) instead of purchasing the wrong quantity of hardware. (1)
- ***b*** SaaS provides software irrespective of where a user is working (1), which means that multiple copies or licenses would not be needed. (1)
- ***c*** A collection of data used to measure the performance of the cloud computing facilities. (1) This can be used to manage the cloud computing facilities and make relevant business decisions. (1)

Long-answer exam-style practice questions

The level descriptors are shown in question 1 but apply to all long-answer questions worth 9 marks.

Question number	Marks	Answer
1		Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Increased security control within each VLAN ▶ Each VLAN that is isolated from others increases security across network ▶ Scaling up/down on each VLAN can be done independently ▶ Issues can be found more easily if isolated to a VLAN ▶ Expensive to set up as increased number of routers required over multiple campuses ▶ Planning can take time due to complexity of setting up ▶ Maintenance needs to follow VLAN structure, leading to some VLANs being neglected/weakened
Level	**Marks**	**Descriptor**
	0	No content worthy of credit
Level 1	1–3	▶ A basic analysis of the situation • Superficial break down of the different aspects into component parts ▶ A basic application of knowledge and understanding • Partially relevant to the context of the question ▶ A basic evaluation • Partial consideration of the different factors/events and competing points Forming a superficial or unsupported conclusion

Level 2	4–6	▶ A good analysis of the situation • A good break down of the different aspects into component parts ▶ A good application of knowledge and understanding • Relevant to the context of the question ▶ A good evaluation • Consideration of the different factors/events and competing points ▶ Forming a partially supported conclusion
Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts ▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
2	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Mesh** ▶ Dedicated links lead to minimal data traffic conflicts ▶ Data is more secure on dedicated lines ▶ Error issues arise on defined locations, so are easier to isolate ▶ Complex installation due to all the direct connections between rooms and devices ▶ Cost of large-scale wiring, installation and maintenance **Tree** ▶ Existing networks can be expanded ▶ If one node falls over, other nodes are not affected ▶ Hierarchical structure allows for increased access control on devices ▶ Highly dependent on backbone cable ▶ Large network in school is hard to configure ▶ Performance can be slow due to number of nodes on network ▶ Overall traffic speed could be slow due to central cable loading

Question number	Marks	Answer
3	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Customers can book tickets online ▶ Customers can purchase refreshments with minimal waiting ▶ Environment can be controlled using sensors ▶ Increased security risk

Question number	Marks	Answer
4	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Magnetic storage** ▶ Low cost in comparison ▶ Corruption of data risks ▶ Can be heavy for use in laptops ▶ Moving parts that can break **Solid-state storage** ▶ No moving parts, so robust in a laptop ▶ Lightweight ▶ More expensive than other storage devices **Optical storage** ▶ Low cost ▶ Drives are robust ▶ Media are not as robust

Question number	Marks	Answer
5	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Centralised resources on server ▶ Reduced maintenance on client device ▶ Client devices are lower cost due to being less powerful ▶ Client can only run authorised applications, so cannot install others on network ▶ Resource hungry applications may run slowly as processing is done remotely ▶ High bandwidth needed in network to allow fast and consistent data transfer

Question number	Marks	Answer
6	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Resources and data are managed centrally ▶ Data can be accessed anywhere in the hospital at any time ▶ Access control to system is securely set at server level, which benefits the hospital as confidential data is held ▶ Back-up of system is easier to maintain and carry out ▶ High reliance on central server, which if down will impact whole system ▶ All clients are affected by poor server performance ▶ High server loads can cause bottlenecks on network

Question number	Marks	Answer
7	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Ease of adding new devices ▶ Allows data access, wherever workers are located in the retail park ▶ Allows customers to access the network with their own devices ▶ Customers can be targeted with advertisements on their devices ▶ Buildings can interfere with signals ▶ Security issues can occur if not secured properly

Question number	Marks	Answer
8	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ DaaS can be scaled up or down as needed, based on research being carried out ▶ Low start-up costs based on per-user fees when subscribing to access resources ▶ Device compatibility supported ▶ Virtual desktops hosted in the cloud, allowing for easier disaster recovery ▶ Learning how DaaS works is a steep learning curve for IT teams in a market research company ▶ Heavy reliance on third party supplier ▶ Limited control over updates and security

Question number	Marks	Answer
9	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Redundancy is the inclusion of duplicate hardware/software in system ▶ Increases resilience as workload/data can be accessed from duplicate parts/system when needed ▶ Decreases chances of business up-time being lost ▶ Lack of redundancy can lead to data loss

Question number	Marks	Answer
10	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Reliable connection as not affected by other signals ▶ High transfer speeds ▶ Increased security as difficult to intercept data ▶ Some structures may be difficult to cable through ▶ Warehouse workers may be required to move around, so wired devices could limit working processes ▶ Cables could be damaged in the warehouse by heavy objects/vehicles

8 Security

Recall activities

1 Privacy – The right of an individual or organisation to keep information secret
Confidentiality – The requirement for an individual or organisation to keep data/information secure from others who are not officially given access
Vulnerabilities – Possible threats to a digital system that could be exploited, leading to security breaches

2

Description of context	Technical threat or vunerability
Network of private computers that hackers have infected with malicious software that is controlled remotely	Botnet
Interface between software applications that lacks up to date security measures	Insecure API
Network of computers used to flood a targeted server or network with excess traffic	DDoS
Network that allows individual devices to communicate directly with each other	Ad hoc/open networks
Unauthorised access to a digital system	Hacking
The interception of data between two devices by a hacker who places themselves in the middle of the communication channel	Eavesdropping/MITM
A piece of software designed specifically to steal data, damage or destroy a digital system	Malware
The art of manipulating people to find out information leading to a digital compromise	Social engineering

3 Integrity – data is protected from unauthorised changes ensuring that it is reliable and correct
Confidentiality – digital systems, data and information are all protected from unauthorised access
Availability – authorised users have access to the digital systems, data and information that they require, when they require it

4 The aim of digital security is to protect **digital** systems together with the **data** and information that they hold. By applying **security** measures to a digital system, the chances that a threat will be successful is **reduced**. This is because the **vulnerabilities** to a system, human, **physical** and technical have been **identified**. This has then led to **mitigation** being put in place that **reduces** those chances of the vulnerabilities being compromised. The application of security to a digital system helps ensure that the **CIA** triad is maintained.

5

Threat	Mitigation method
Accidental data modification by a junior member of staff	▶ User access rights with different levels of permission ▶ Password protection of files
Attempted theft of company plans by external individual	▶ Firewall ▶ Encryption at rest ▶ Air gapping of storage device
Attempted theft of money from an online bank account	▶ Multi-factor authentication ▶ Username and password ▶ Passkeys
Interception of communications	▶ Encryption in transit ▶ Monitor connections ▶ Physical authentication to access communications, e.g. biometrics, token
Damage to digital system through flooding	▶ Placement of system above water level ▶ Back-up of system off-site ▶ Remote storage
Ransomware attack on stored data	▶ Firewall ▶ Anti-virus ▶ Back-up of data in secure location

Short-answer exam-style practice questions

1

- ***a*** Personal details (1), salary (1), perks (1)
- ***b*** The company could be fined for breaking the DPA (1) as they have not kept personal data secure and confidential. (1)
- ***c*** A former employee could attack the company system (1) and delete or steal important data. (1)
- ***d*** The employee's user rights could be cancelled. (1) This would stop them accessing the system with any malicious intent. (1)

2

- ***a*** APIs allow two different software applications to communicate with each other, (1) so the firm's software and the software on customers' devices can work together. (1)
- ***b*** One of the APIs could have a low level of authentication, (1) which would lead to sensitive data being compromised. (1)
- ***c*** In a man-in-the-middle attack (1) the connection between the device and the company system is not secure, so the data could be intercepted and stolen. (1)

3

- ***a*** The VPN creates a secure connection with the company's offices, (1) which means that data transferred between them is more secure. (1)
- ***b*** It reduces the chance of a phishing attack being successful (1) as the attacker would need the second form of authentication to access the data. (1)
- ***c*** To reduce the chance of brute-force attack being successful, (1) as the passwords are only valid for a set period of time. (1)

4

a 1. A targeted attack by hackers seeking to gain access to the data and system for malicious purposes (1)
2. Former employees who access the system to carry out retribution for their loss of employment (1)

b An authorised attempt to attack a system (1) with the aim of finding any vulnerabilities in the system and suggesting possible mitigations. (1)

c Two from:
- Network penetration testing
- Social engineering penetration testing
- Physical penetration testing (2)

Long-answer exam-style practice questions

The level descriptors are shown in question 1 but apply to all long-answer questions worth 9 marks.

Question number	Marks	Answer
1	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Botnet attack on the card system ▶ DDoS attack on servers to prevent access or storing data ▶ Attempted hacking ▶ Social engineering of staff for credentials to access system ▶ Malware attack from customer devices if they use their mobile device to shop
Level	**Marks**	**Descriptor**
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Level 3	7–9	▶ A thorough analysis of the situation • Comprehensive break down of the different aspects into their component parts

		▶ A comprehensive application of knowledge and understanding • Consistently relevant to the context of the question ▶ A thorough evaluation • Comprehensive consideration of the different factors/events and competing points ▶ Forming a well-supported conclusion.

Question number	Marks	Answer
2	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ DDoS • Prevents/reduces access to server • Heavy traffic by number of devices using app to order meals • Each customer has own device so possible to have many orders at a time ▶ Monitor system 'normal' demand ▶ SYN cookies to manage traffic ▶ Username and accounts to order meals ▶ Firewalls

Question number	Marks	Answer
3	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Financial costs** ▶ Loss of business ▶ Fine by regulator ▶ Legal costs ▶ Incident investigation and recovery cost **Reputational costs** ▶ Loss of reputation ▶ Loss of customers **Legal costs** ▶ Fines ▶ Legal costs

Question number	Marks	Answer
4	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ Back-up of data ▶ Antivirus/anti-malware ▶ Encryption of data in transit and at rest ▶ SYN cookies for secure sessions when ordering

		▶ Firewalls ▶ MFA – possibly by financial organisations for payment ▶ Username and password accounts

Question number	Marks	Answer
5	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. ▶ System location in shop • Environmental – dust, dirt, heat, humidity – Fire and flood • Access to server – who can gain access ▶ Mitigation • Air conditioning • Positioning away from other activities • Environmental monitoring – Sensors – Cameras • Access control (locks, RFID, biometrics) • Level of access on server, user rights

Question number	Marks	Answer
6	9	Learners might refer to some or all the following in their responses. Learners should be rewarded for other context relevant answers. **Policy enforcement** ▶ Ensure staff read the policy ▶ Ensure staff are clear about responsibilities ▶ Ensure staff are clear about new processes **Training** ▶ Initial training in new processes and policy requirements ▶ Training based on job roles and requirements ▶ On-going training ▶ Refresh on policies and processes ▶ Updates based on new threats and requirements