



*Rewarding Learning*

**ADVANCED**  
**General Certificate of Education**  
**2022 Reserve Series**

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## **Digital Technology**

Assessment Unit A2 1  
*assessing*  
Information Systems

**[ADT11]**

**THURSDAY 23 JUNE, MORNING**

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**MARK  
SCHEME**

## **General Marking Instructions**

### **Introduction**

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

### **The Purpose of Mark Schemes**

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

### **COVID-19 Context**

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

- 1 (a) (i) LAN Wire cables/wireless  
MAN Fibre optic  
WAN Communication satellites  
3 × [1] [3]
- (ii) LAN Single building/cluster of buildings  
MAN Large populated area/city/town  
WAN Geographically remote  
3 × [1] [3]
- (b) Network card  
Connects a computer to a computer network  
... typically a LAN  
... so that it can exchange data with the network  
3 × [1]  
IP address  
A unique address  
... identifying a device on a network  
... allowing information to be sent between devices on the network  
3 × [1] [6]
- (c) Server-based network  
One computer as file server  
Providing resources/for all other dumb terminals Two mark points  
3 × [1]
- Peer-to-peer network  
All computers equal status  
Each can supply/and consume/request resources Two mark points  
3 × [1] [6]
- (d) Features of Bus and Ring topologies  
Evaluation: Bus – Main cable failure affects all data traffic, connector from  
node to main cable only affects that node  
Ring – The network can operate with a single cable failure

Level	Marking Criteria
<b>B2</b> <b>[6]</b>	The candidate <ul style="list-style-type: none"> <li>Provides a detailed description of both topologies</li> <li>Evaluates both topologies with justification</li> <li>Uses the appropriate Digital Technology terminology accurately throughout the response</li> </ul> Presentation, spelling, punctuation and grammar are of a high standard.
<b>B1</b> <b>[4]</b>	The candidate <ul style="list-style-type: none"> <li>Provides a detailed description of both topologies</li> <li>Briefly evaluates both topologies</li> <li>Uses some relevant Digital Technology terminology</li> </ul> Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.
<b>B0</b> <b>[2]</b>	The candidate <ul style="list-style-type: none"> <li>Provides a brief description of both topologies</li> <li>Briefly evaluates one topology</li> <li>Makes limited use of Digital Technology terminology</li> </ul> Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.

[6]

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- 2 (a) To lead the World Wide Web to its full potential  
 . . . by developing protocols and guidelines  
 . . . that ensure the long-term growth of the Web  
 To further W3C's vision of One Web  
 4 × [1] [4]
- (b) Presentation  
 Interacts with the Application/Session layers  
 Converts information to the correct video/audio format  
 Implements encryption  
 Compresses/decompresses information  
 3 × [1]  
Session  
 Interacts with the Presentation layer and the Transport layer  
 Opens a temporary 'channel' to allow for communication.  
 3 × [1]  
Data Link  
 Deals with functions such as error detection  
 . . . error correction  
 . . . creating data blocks  
 . . . synchronising data blocks  
 It converts each outgoing packet into a series of bits/a series of incoming  
 bits into data packet  
 Interacts with the Network/Physical layers  
 3 × [1] [9]
- (c) TCP/IP  
 TCP/IP dictates how information should be packaged and sent and received  
 The TCP layer handles file transfer between different computers . . . and  
 splits data into packets and allocates an address to each packet  
 The IP layer is responsible for transferring packets of data from node to  
 node using IP addresses  
 It verifies the correct delivery of data and detects errors  
 3 × [1]  
Ethernet  
 Ethernet defines the networking protocol  
 . . . and the physical connections used  
 Deals with the Physical and Transport layers of the OSI Model  
 3 × [1]  
Bluetooth  
 Both must be Bluetooth enabled  
 the computer will display the devices within range  
 . . . which are set to visible  
 The mobile device will be selected  
 The device may require pairing/a passcode  
 A piconet is created  
 3 × [1] [9]
- (d) An RFID tag contains data programmed into a small computer chip. The  
 tag is activated by radio waves emitted from an RFID reader. The tag sends  
 the data stored in its memory back to the reader. The tag can be active or  
 passive. A bar code contains data in a machine-readable code. Numbers  
 and a pattern of parallel lines of varying widths. The data is read by a  
 scanner using red light or a laser.

Evaluation

- RFID tags can be read from much further away
- Direct line of sight not required
- RFID tags can be read in harsh environments
- RFID tags are more impervious to damage/dirt
- RFID tags can be dynamically updated
- The information stored in a barcode is fixed
- Bar codes usually require human intervention RFID tags do not
- Barcodes must be visible on the outside of the packaging RFID tags can be placed inside the packaging
- More data can be stored in an RFID tag than on a barcode
- RFID tags have read/write capability
- Barcodes are read-only and cannot be reused

**AVAILABLE MARKS**

Level	Marking Criteria
<b>B2</b> <b>[6]</b>	The candidate <ul style="list-style-type: none"> <li>• Provides a detailed description of both technologies</li> </ul> <b>AND</b> Provides a detailed evaluation of both technologies <ul style="list-style-type: none"> <li>• Uses the appropriate Digital Technology terminology accurately throughout the response.</li> </ul> Presentation, spelling, punctuation and grammar are of a high standard.
<b>B1</b> <b>[4]</b>	The candidate <ul style="list-style-type: none"> <li>• Provides a detailed description of both technologies</li> </ul> <b>OR</b> Provides a detailed evaluation of both technologies <ul style="list-style-type: none"> <li>• Uses some relevant Digital Technology terminology</li> </ul> Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.
<b>B0</b> <b>[2]</b>	The candidate <ul style="list-style-type: none"> <li>• Provides a brief description of both technologies</li> </ul> <b>OR</b> Provides a brief evaluation of both technologies <ul style="list-style-type: none"> <li>• Makes limited use of Digital Technology terminology</li> </ul> Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.

[6]

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- 3 (a)** A group of fields/attributes appearing more than once in a record  
**ProdID, ProdName, Size, Cost, Quantity**  
 2 × [1] [2]
- (b)** Primary key  
 Uniquely identifies a record in a table/tuple in an entity  
 Example ProdID, ProdName, Size, Cost  
 2 × [1]
- Foreign key  
 A key field in a table which is not the primary key in this table but which defines a link to another table  
 Example CustID  
 2 × [1] [4]
- (c)** **INVOICE** (InvoiceID, InvoiceDate, CustID, CustName, CustAddress)  
**INVOICE-PRODUCT** (InvoiceID ProdID, ProdName, Size, Cost, Quantity)  
 [2]

- (d) **INVOICE** (InvoiceID, InvoiceDate, CustID, CustName, CustAddress)
- INVOICE-PRODUCT** (InvoiceID ProdID, Quantity)
- PRODUCT** (ProdID, ProdName, Size, Cost) [3]
- (e) **INVOICE** (InvoiceID, InvoiceDate, CustID)
- INVOICE-PRODUCT** (InvoiceID ProdID, Quantity)
- PRODUCT** (ProdID, ProdName, Size, Cost)
- CUSTOMER** (CustID, CustName, CustAddress) [3]
- (f) Standard format ERM showing  
 CUSTOMER 1:m INVOICE 1:m INVOICE-PRODUCT m:1  
 PRODUCT  
 [1] for all four entities  
 [1] for each of three relationships [4]
- (g) Features  
 SQL is a programming language for creating, accessing and manipulating databases  
 It provides commands to create tables and to insert, search, update, delete records  
 It consists of a large set of commands, each with its own syntax  
 QBE provides a graphical way of querying a database  
 The user enters commands, example elements and conditions into a blank template/form to specify fields and values to be used in a query  
 QBE generate SQL code  
Comparison  
 SQL was designed for creating databases and generating queries  
 The retailer would require a high level of technical knowledge/skill  
 QBE was designed for generating queries, not for creating databases  
 The retailer will require minimum technical knowledge/skill

Level	Marking Criteria
<b>B2</b> <b>[6]</b>	The candidate <ul style="list-style-type: none"> <li>Provides a detailed description of SQL and QBE</li> <li>Compares both w.r.t. creating a database <u>and</u> generating queries</li> <li>Uses the appropriate Digital Technology terminology accurately throughout the response</li> </ul> Presentation, spelling, punctuation and grammar are of a high standard.
<b>B1</b> <b>[4]</b>	The candidate <ul style="list-style-type: none"> <li>Provides a detailed description of SQL and QBE</li> <li>Refers to the suitability of one of these w.r.t. creating a database <u>and</u> generating queries</li> <li>Uses some relevant Digital Technology terminology</li> </ul> Presentation, spelling punctuation and grammar are sufficiently competent to make the response clear.
<b>B0</b> <b>[2]</b>	The candidate <ul style="list-style-type: none"> <li>Provides a description of SQL or QBE which is correct but lacks detail</li> <li>Makes limited use of Digital Technology terminology</li> </ul> Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.

[6]

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- 4 (a) To determine if a machine's behaviour  
... is indistinguishable  
... from a human's response  
3 × [1] [3]
- (b) The human  
To answer questions from experience/knowledge  
The machine  
To answer questions as programmed  
The player  
To ask questions  
3 × [1] [3]
- (c) Shell  
This is the software development environment for creating an expert system  
It contains the components of an expert system  
... such as a knowledge acquisition system/knowledge base/inference engine/user interface  
These components can be populated/configured for the particular application  
3 × [1]
- Fuzzy logic  
Fuzzy logic uses probabilities/degrees of truth  
... instead of true & false/1 & 0/Boolean logic/formal logic  
Decisions can be made with incomplete data/uncertain data  
Computers can mimic human reasoning  
Fuzzy logic is designed to solve problems by making the best possible decision given the input  
3 × [1]
- Knowledge engineer  
Collects the information  
... for the knowledge base  
... and formulates it as a set of rules and facts  
3 × [1] [9]
- (d) The mechanics are the experts  
They will provide the knowledge  
... to the knowledge engineer  
... during knowledge acquisition  
... by describing their experiences/knowledge of car engine faults  
... and the rules  
... heuristics they use  
6 × [1] [6]
- (e) The expert system will ask the user a series of questions about the vehicle and use the answers with its inference engine and knowledge base to diagnose the fault  
Benefits  
The expert system can produce a diagnosis which is very accurate and consistent and can provide reasoning and probabilities  
The diagnosis will be based on the experience of a large number of mechanics  
Drawbacks  
There is a risk of over reliance on technology  
Mechanics may become deskilled

AVAILABLE  
MARKS

A mechanic can take into account special circumstances which the expert system may overlook

AVAILABLE  
MARKS

Level	Marking Criteria
<b>B2</b> <b>[6]</b>	<p>The candidate</p> <ul style="list-style-type: none"> <li>• Provides a detailed description of this use of an expert system</li> <li>• Describes a benefit <b>and</b> a drawback of this use of an expert system</li> <li>• Uses the appropriate Digital Technology terminology accurately throughout the response</li> </ul> <p>Presentation, spelling, punctuation and grammar are of a high standard.</p>
<b>B1</b> <b>[4]</b>	<p>The candidate</p> <ul style="list-style-type: none"> <li>• Provides a detailed description of this use of an expert system</li> <li>• Describes a benefit <b>or</b> a drawback of this use of an expert system</li> <li>• Uses some relevant Digital Technology terminology</li> </ul> <p>Presentation, spelling punctuation and grammar are sufficiently competent to make the response clear.</p>
<b>B0</b> <b>[2]</b>	<p>The candidate</p> <ul style="list-style-type: none"> <li>• Provides a description of this use of an expert system which is correct <b>OR</b> Describes a benefit <b>or</b> a drawback of this use of an expert system</li> <li>• Makes limited use of Digital Technology terminology</li> </ul> <p>Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.</p>

[6]

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5 (a) To input spoken words

... digitise them

... and convert them into computer commands/instructions

3 × [1]

[3]

(b) Pattern matching

The words spoken by the user are recognised in their entirety

These types of systems are often used by business with automated switchboards

The user will be presented with questions with limited responses

(e.g. Yes/No)

The computer will analyse the input from the user and try to match it with a list of potential sound patterns

2 x [1]

Pattern and feature analysis

Here the spoken input is recorded by a microphone

... and then digitised using an ADC

This digital data is then analysed and compared to a stored dictionary

... which can then be used to identify what the user has said.

2 x [1]

Statistical analysis

This applies the rules of grammar

... to help predict words to support speech recognition

... in instances when the spoken word was not entirely clear.

2 x [1]

Artificial neural networks (ANN)

... can be used to support voice recognition

They can be trained through the use of examples to recognise spoken input  
 ... to improve the accuracy of voice recognition applications.

2 × [1]

2 × [2]

[4]

(c) The combination of a range of disciplines

Computer science/Mechanical engineering/Electrical engineering

To support the design, production and operation of robots

Incorporates sensors and feedback

4 × [1]

[4]

(d) Robots can support or replace humans

They can fetch car parts and assemble cars on assembly lines

They can paint car parts

Evaluation

They can operate in conditions dangerous for humans

They can perform repetitive tasks consistently and accurately

They can be re-programmed to perform new tasks

They are very expensive to design and produce

They cannot show initiative or respond intuitively to unexpected situations

Level	Marking Criteria
<b>B2</b> <b>[6]</b>	The candidate <ul style="list-style-type: none"> <li>• Provides a detailed description of the use of robotics</li> <li>• Describes a benefit <b>and</b> a drawback of this use of robotics</li> <li>• Uses the appropriate Digital Technology terminology accurately throughout the response</li> </ul> Presentation, spelling, punctuation and grammar are of a high standard.
<b>B1</b> <b>[4]</b>	The candidate <ul style="list-style-type: none"> <li>• Provides a detailed description of this use of robotics</li> <li>• Describes a benefit <b>or</b> a drawback of this use of robotics</li> <li>• Uses some relevant Digital Technology terminology</li> </ul> Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.
<b>B0</b> <b>[2]</b>	The candidate <ul style="list-style-type: none"> <li>• Provides a description of this use of robotics which is correct but lacks detail</li> <li>• Makes limited use of Digital Technology terminology</li> </ul> Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.

[6]

(e) Mobile phone masts

Large high-powered antennae

Which can send radio signals over large distances

... from base stations

2 × [1]

Cell

The area covered by a mobile phone operator is divided up into smaller areas called cells

Each cell is hexagonal

... and is served by its own masts and base station

2 × [1]

Handoff

A mobile phone call must be transferred from one cell to another without interruption

The network automatically switches handling of the call from one base station to another

2 × [1]

[6]

AVAILABLE  
MARKS

23

- 6 (a)** Data mining involves analysing/sorting  
 ... large data sets/big data  
 ... to identify patterns/relationships  
 ... to predict future trends  
 4 × [1] [4]
- (b)** To predict health trends  
 ... and forecast demand for services/resources  
 2 × [1]  
 To optimise efficiency/effectiveness of treatments  
 ... by analysing demographic data/social indicators/lifestyle habits  
 2 × [1]  
 To identify people suitable for screening  
 ... by analysing medical records  
 2 × [1] [4]
- (c)** Health records  
 ... that the health organisation stores about patients  
 ... could be used for unauthorised purposes/purposes for which the patient  
 has not given permission  
 ... or for purposes unknown to the patient  
 4 × [1] [4]
- (d)** Virtualisation  
 A number of virtual servers  
 ... each running on a physical server platform  
 Separates the physical infrastructures  
 ... to create dedicated resources  
 ... running multiple OS and applications on the same server  
 2 × [1]
- Clustering  
 Groups of dedicated hardware  
 ... will be hosted at each data centre  
 ... and used to provide specialised services and processes for clients  
 2 × [1] [4]
- (e)** Email  
 Web based email services allow users to access their email from the cloud  
 using any browser or hardware platform  
 Emails sent and received via the client's account are stored on the service  
 provider's server rather than being stored on the user's own computer  
 2 × [1]
- Backup  
 Clients can store their data on the internet using a storage service provider  
 rather than storing data locally on a physical hard drive or other device.  
 Data can be stored to the cloud on a scheduled basis or cloud syncing can  
 be used to ensure files will automatically be backed up any time changes  
 are made to them  
 2 × [1] [4]

- (f) Should extreme violence and other inappropriate content ... be blocked by Internet Providers/governments  
 Should governments be able to pressurise IPs ... to block what they see as unfavourable content  
 Does this violate democratic rights ... such as the right to free speech  
 4 × [1]

[4]

**Total**

**AVAILABLE  
MARKS**

24

**150**