Rewarding Learning

**ADVANCED**
**General Certificate of Education**
**2023**

# Digital Technology

Assessment Unit A2 1

*assessing*

Information Systems

**[ADT11]**

**MONDAY 12 JUNE, AFTERNOON**

# 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.

AVAILABLE MARKS

**1** **(a)** Software
Data/communications
(2 × [1]) [2]

**(b)**

| Network | Scope | Communication Technology |
|---|---|---|
| *MAN* | City/town [1] | Fibre optic [1] |
| *WAN* | Global [1] | Communication satellites [1] |

[4]

**(c)** **Switched hub**
Acts as a connection point for a number of nodes
Checks the destination/IP address of data packets
... and forwards them to the intended recipient
(3 × [1])
**Wireless access point**
A device that allows a Wi-Fi enabled device
… to connect to a network
… usually by connecting to a router
Wi-Fi hotspots use a WAP to support their Wi-Fi coverage area
(3 × [1])
**Media converter**
A device that allows two dissimilar media types or protocols
… to connect with each other
Example: connecting a fibre optic cable and a copper cable
(3 × [1]) [9]

**(d)** **(i)** All nodes are connected directly
… to the main cable/backbone)
Data can be transmitted in both directions
A node transfer data directly to another node
… by putting it onto the backbone
(4 × [1]) [4]

**(ii)** **Ring**
Each node is connected to two other adjacent nodes
The node in procession of the token can transmit data
The token is passed from node to node
Data travels in one direction only - no collision risk
**Star**
There is central fileserver
Each node is connected to the fileserver by its own cable
The file server controls all communication on the network
A node communicates with another node via the fileserver
**Comparison – adding a new node**
**Ring**
Adding a new node is relatively complicated
An existing cable has to be severed and the new node inserted
**Star**
Adding a new node is straightforward

The new node is simply connected to the hub provided there is a spare port

AVAILABLE MARKS

| Level | Marking Criteria | Marks |
|---|---|---|
| Band 2 | The candidate<br>• Describes each topology correctly and in detail<br>• Compares both topologies with respect to the addition of a new node with justification<br>• Uses the appropriate Digital Technology terminology accurately throughout the response<br>Presentation, spelling, punctuation and grammar are of a high standard. | [5]–[6] |
| Band 1 | The candidate<br>• Describes each topology correctly and in detail<br>• Uses some relevant Digital Technology terminology<br>Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear. | [3]–[4] |
| Band 0 | The candidate<br>• Briefly describes each topology correctly but the response lacks relevant detail<br>• Makes limited use of Digital Technology terminology<br>Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear. | [1]–[2] |

[6] 25

| | | | AVAILABLE MARKS |
|---|---|---|---|
| **2** | **(a)** | Rules<br>Technologies<br>Communicate<br>(3 × [1]) [3] | |
| | **(b)** | **(i)** Application<br>Presentation<br>Session<br>(3 × [1]) [3] | |
| | | **(ii)** Transport set [1] | |
| | | **(iii)** **Transport layer**<br>Splits data into packets<br>Packets are sent on different routes to their destination<br>Packets may arrive in a different order to which they were sent<br>Packets are then reassembled at their destination<br>Communicates with the Session layer above and the Network layer beneath<br>(4 × [1])<br>**Physical layer**<br>Convert bits (0s and1s) into a physical form for transmission<br>… such as light pulses<br>… radio signals<br>… electrical signals<br>Communicates with the Data Link layer above it<br>(4 × [1]) [8] | |
| | | **(iv)** If a manufacturer's devices comply with the standards<br>… they can be connected to other manufacturers' devices<br>(2 × [1])<br><br>Network users have greater choice in DT devices<br>… as compliant devices from different manufacturers will work together<br>(2 × [1]) [4] | |
| | **(c)** | **Ethernet**<br>Ethernet is a LAN protocol<br>… referred to as the IEEE 802.3 protocol<br>Ethernet also defines standards for physical plugs and sockets<br>Uses CSMA/CD<br>(4 × [1])<br>**Voice over Internet Protocol (VoIP)**<br>VoIP allows telephone calls<br>… to be made over computer networks<br>It converts analogue signals into digital data packets<br>It supports real-time conversations/two-way transmission<br>It supports call recording/caller ID/voicemail to email<br>(4 × [1]) [8] | 27 |

AVAILABLE MARKS

3 (a) **Bandwidth**

Bandwidth is a measure of the capacity of a communication channel
It is the range of frequencies available
Bandwidth may be a frequency range e.g. 3 kHz/measured in Hz
… or a transmission rate, e.g. 64 kbps or line speed e.g. 64k
(2 × [1])

**Broadband**

Broadband is wide bandwidth data transmission
… handling multiple signals and traffic types
Refers to high-speed Internet access that is always on
The popular name for Internet connection using DSL/co-axial/fibre
Used to describe a bandwidth in excess of 3 kHz/more commonly in excess of 300 MHz
(2 × [1]) [4]

(b) (i) **Fibre optic** [1]

**Description**

Uses very fine glass strands
… to transmit modulated light beams
… at very high speed over long distances
… providing interference-free, secure data transmission
A single cable consists of multiple strands in two bundles
… one for forward pulses, one for return pulses
Each strand is unidirectional
(4 × [1]) [5]

(ii) **Metal cable**

Different types of copper cabling is used to transmit electrical signals
… over relatively short distances
Coaxial cable/twisted pair/unshielded twisted pair
Shielding protects from interference

**Wireless**

Wireless covers a range of possible methods of data transmission using radio waves
Bluetooth for short ranges using low power radio waves to connect devices
Wi-Fi to connect to a LAN

**Evaluation of data security**

**Metal Cable**

Security weak – data can be intercepted via listening devices without affecting transmission

**Wireless**

Encryption and the use of passwords can ensure security

| Level | Marking Criteria | Marks |
|---|---|---|
| Band 2 | The candidate<br>• Provides an accurate description of both transmission media<br>• Compares both methods with regard to security with justification<br>• Uses the appropriate Digital Technology terminology accurately throughout the response<br>Presentation, spelling, punctuation and grammar are of a high standard. | [5]–[6] |
| Band 1 | The candidate<br>• Provides an accurate description of both transmission media<br>• Uses some relevant Digital Technology terminology<br>Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear. | [3]–[4] |
| Band 0 | The candidate<br>• Briefly describes each transmission medium but the response lacks relevant detail<br>• Makes limited use of Digital Technology terminology<br>Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear. | [1]–[2] |

[6]

**(c) (i)** The leftmost bit is the parity bit
It is set to 0 or 1 to make the number of bits in the byte even
The received byte has odd parity so the error is detected
(3 × [1]) [3]

**(ii)** A checksum is appended to a block of data before transmission
… and recalculated after transmission
The data block is divided by a fixed number/a hashing algorithm is used
The remainder is the checksum
If the checksum is incorrect, the source of the error may be detected and corrected automatically
… or the data may need to be re-transmitted
(6 × [1]) [6]

AVAILABLE MARKS

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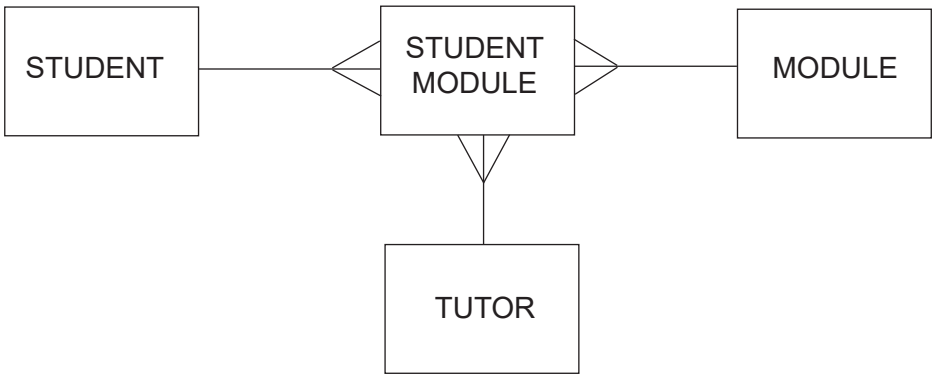
| | | | AVAILABLE MARKS |
|---|---|---|---|
| 4 | (a) | **Data duplication**<br>The same the same piece of data<br>… is stored in two or more separate tables<br>(2 × [1])<br><br>**Referential integrity**<br>A foreign key<br>… must correspond to a valid/existing primary key<br>(2 × [1]) | [4] |
| | (b) | It contains a repeating group<br>ModID,MName,TutorID,TutorName<br>(2 × [1]) | [2] |
| | (c) | STUDENT<br>(**StudentID** , StudentName , Address , DOB , OverallGrade)<br>STUDENT_MODULE<br>(**StudentID** , **ModuleID** , ModuleName , TutorID , TutorName , Mark )<br>(2 × [1]) | [2] |
| | (d) | STUDENT<br>(**StudentID** , StudentName , Address , DOB , OverallGrade)<br>STUDENT_MODULE<br>(**StudentID** , **ModuleID** , TutorID , TutorName , Mark )<br>MODULE<br>(**ModuleID** , ModuleName )<br>(3 × [1]) | [3] |
| | (e) | STUDENT<br>(**StudentID** , StudentName , Address , DOB , OverallGrade)<br>STUDENT_MODULE<br>(**StudentID** , **ModuleID** , TutorID , Mark )<br>MODULE<br>(**ModuleID** , ModuleName )<br>TUTOR<br>(**TutorID** , TutorName )<br>(4 × [1]) | [4] |
| | (f) |  <br><br>[1] for each of 4 entities<br>[1] for each of 3 correct relationships | [7] |
| | | | 22 |

AVAILABLE MARKS

**5** **(a)** **(i)** It creates a table named Contacts
… with a field called ContactName of type varchar, 255 characters long
… and Email of type varchar, 50 characters long
… and Tele of type varchar, 15 characters long
(4 × [1]) [4]

**(ii)** It inserts a record into Contacts
… with the field values given
(2 × [1]) [2]

**(iii)** It inserts a record into Contacts with the field values given
The Tele field will have a null value
(2 × [1]) [2]

**(iv)** It lists/returns the ContactName and Email values
…for all the records whose ContactName is 'Green'
(2 × [1]) [2]

**(b)** **(i)** User interface
Inference engine
(2 × [1]) [2]

**(ii)** **Factual knowledge**
Knowledge about the domain which is widely agreed
… by all experts in that field
… and not varying from expert to expert
MAX (2 × [1])
**Heuristic knowledge**
Consists of rules of thumb
… derived from human experience/intuition
… not purely from logic
Requires judgement/estimation/evaluation
MAX (2 × [1]) [4]

(**iii**) **The expert system**
The knowledge base contains facts and rules about a wide range of illnesses gathered by the knowledge engineer from medical consultants/doctors/physicians
The user interface will query the patient's symptoms
The inference engine will apply the rules to the user's responses and suggest a range of diagnoses
**Evaluation**
The knowledge base will contain the knowledge of many experts including facts about rare illnesses which individual doctors cannot have
The expert system will justify its conclusions
The knowledge base can be regularly updated efficiently
Its use may lead to deskilling
An incorrectly designed ES will produce incorrect results which may be difficult to detect

| Level | Marking Criteria | Marks |
|---|---|---|
| Band 2 | The candidate<br>• Provides an accurate description of the expert system<br>• Evaluates its use in diagnosing illnesses with justification<br>• Uses the appropriate Digital Technology terminology accurately throughout the response<br>Presentation, spelling, punctuation and grammar are of a high standard. | [5]–[6] |
| Band 1 | The candidate<br>• Provides an accurate description of the expert system<br>• Uses some relevant Digital Technology terminology<br>Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear. | [3]–[4] |
| Band 0 | The candidate<br>• Briefly describes the expert system without providing relevant detail<br>• Makes limited use of Digital Technology terminology<br>Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear. | [1]–[2] |

[6]

**(c) (i)** The words spoken are digitised using ADC
The digital data is analysed
... and compared to a stored dictionary
… to activate options/programs/tasks
(4 × [1]) [4]

**(ii)** Statistical analysis
Artificial neural networks
(2 × [1]) [2]

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AVAILABLE MARKS

| | | | | AVAILABLE MARKS |
|---|---|---|---|---|
| 6 | (a) | (i) | **Hosted instance**<br>The virtual server for a particular client<br>… with its own allocation of processing and storage<br>(2 × [1])<br>**Clustering**<br>Clustering involves a group of virtual servers and other resources<br>… acting as a single system<br>… to provide cloud computing services<br>… using load balancing and parallel processing to meet real-time demand<br>(2 × [1]) [4] | |
| | | (ii) | **Data storage**<br>Data is saved on an off-site storage system<br>… in a remote database<br>… provided by a third party<br>… and accessed via the Internet<br>… instead of on the users' storage<br>(4 × [1])<br>**Remotely hosted applications**<br>Clients can access their business applications<br>… as an instance on a virtual desktop<br>… which supports multiple concurrent access by the client's employees<br>The relevant software and data are stored on a remote server<br>(4 × [1]) [8] | |
| | (b) | (i) | Designed to prevent crimes involving unlawful access to information systems or data files<br>**Offences**<br>Unauthorised access to computer material<br>Unauthorised access with intent to commit or facilitate commission of further offences<br>Unauthorised modification of computer material<br>It identifies specific crimes such as deliberately planting viruses in a computer system/hacking into someone's computer system/data theft/ fraud<br>(6 × [1]) [6] | |
| | | (ii) | He/she is the data subject in the legislation/It refers to personal data<br>… which must be fairly and lawfully processed<br>… processed for limited/specified/lawful purposes<br>… adequate, relevant and not excessive<br>… accurate/up to date<br>… not be kept for longer than is necessary<br>… be processed in line with the rights of the data subjects<br>… be kept secure<br>… not transferred to other countries without adequate protection<br>you have the right to find out what information is stored about you<br>... how your data is being used<br>... have incorrect data updated/erased<br>... object to how your data is processed in certain circumstances<br>(6 × [1]) [6] | 24 |
| | | | **Total** | **150** |