New Specification

Rewarding Learning

ADVANCED
General Certificate of Education
2018

Digital Technology

Assessment Unit A2 1

assessing

Information Systems

[ADT11]

MONDAY 11 JUNE, MORNING

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) **MAN**
Covers a highly populated area
... using fibre optic/wireless technology
Provides services for the community
(2 × [1])

WAN
Covers a large geographical area
... using the public telephone system/communication satellites undersea cables
Provides services globally
(2 × [1]) [4]

(b) **Server**
Manages network resources
... such as storage
... files
... hardware devices/peripherals/printers
… communications/email
(2 × [1])

Switched hub
Acts as a connection point for a number of network computers/nodes
Checks the destination/IP address of data packets
... and forwards them to the intended recipient
(2 × [1])

Repeater
Regenerates data transmission signals
... that have been attenuated
(2 × [1]) [6]

(c) The IP address is set by the ISP
It is linked to the physical location of the device
This will change/update with the location of the device
Each device has a permanent/fixed MAC address
... set by the manufacturer
... and embedded on the network card
IP addresses use 32 bits/4 bytes
MAC address use 48 bits/6 bytes
(6 × [1]) [6]

AVAILABLE MARKS

(d) Star
Each device is connected to a central hub by its own cable

Bus
All devices are connected to a common cable/backbone

Comparison
Star If a cable fails, only a single device is affected
Bus If the backbone fails, all communication is affected
If a connecting cable fails, only that device is affected

Level	Marking Criteria	Marks
Band 2 **Excellent**	The candidate • Provides an accurate description of **both** types of network • Explains the impact of cable failure on **both** types of network • Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard.	**[5]–[6]**
Band 1 **Good**	The candidate • Provides an accurate description of **both** types of network • Explains the impact of cable failure on **one** type of network • Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.	**[3]–[4]**
Band 0 **Basic**	The candidate • Provides a description of **both** types of network which is accurate but which lacks some detail • Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.	**[1]–[2]**

[6] 22

AVAILABLE MARKS

2 (a) (i) To enable different devices to communicate using the same rules/ standards
Devices may differ in transmission speeds/character sets/error detecting methods/security levels
([1] + [1]) [2]

(ii) **Application**
Presents information/data to the end user
Deals with functions such as data transfer
... messaging
... distributed databases
... operating system functions
... the end-user interface
Interacts with the presentation layer
(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]) [6]

(b) **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])

Wi-Fi
Both must be connected to the same router/WAP
File sharing must be enabled on both the computer and device
The computer will display the devices on the network
The mobile device will be selected
Then the data will be transferred via the router
(3 × [1]) [6]

(c) **Fibre Optic**
Fibre optic consists of many strands of glass fibres inside an insulated casing
Data is transported using pulses of light

Metal
Copper wires are used to transmit electrical signals. The wires are encased by an insulating layer.

Data security
Fibre optic cable is not prone to interception
Metal cable can be tapped into using listening devices wrapped round it which does not interfere with the signal
Fibre optic cable is less susceptible to interception than metal cable

Level	Marking Criteria	Marks
Band 2 **Excellent**	The candidate • Provides an accurate description of **both** transmission media • Describes and compares the susceptibility of **both** methods to interception • Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard.	**[5]–[6]**
Band 1 **Good**	The candidate • Provides an accurate description of **both** transmission media • Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.	**[3]–[4]**
Band 0 **Basic**	The candidate • Provides an accurate description of **one** transmission medium **OR** addresses the data security issue for **one** transmission medium • Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.	**[1]–[2]**

[6]

AVAILABLE MARKS

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AVAILABLE MARKS

3 (a) **Logical data model**
Produced during the design of the database/is independent of the database software
It identifies the entities
... the relationships between entities
... the attributes for each entity
... the keys for each entity
(3 × [1])

Physical data model
Produced during implementation/defines the physical structure of the database
It creates the table structures
... the column names/field names/aliases
... the data type of each field
... the keys for each table
… validation rules
(3 × [1]) [6]

(b) 2NF
The data must be in 1NF/all repeating groups have been removed
Non-key attributes are fully dependent on the primary key/partial key dependencies are removed
(2 × [1])

3NF
The data must be in 2NF/there are no partial key dependencies
There are no non-key dependencies/there are no transitive dependencies/no non-key attributes depend on another non-key attribute
(2 × [1]) [4]

(c) **Data duplication**
A non-key attribute is stored more than once in the database
Any suitable example such as 'the TutorName Baggage appears 3 times'
(2 × [1])

Data inconsistency
An attribute for an entity has more than one value
Any suitable example such as Green's DOB has two values – 01/01/01 and 01/02/01
(2 × [1]) [4]

(d) **1NF**
COURSE (CourseID, CourseTitle, TutorID, TutorName) [1]
COURSE-STUDENT (CourseID, StudentID, StudentName, DOB, StudentStatus, Result) [1]

2NF
COURSE (CourseID, CourseTitle, TutorID, TutorName)
COURSE-STUDENT2 (CourseID, StudentID, Result) [1]
STUDENT (StudentID, StudentName, DOB, StudentStatus) [1]

3NF
COURSE2 (CourseID, CourseTitle, TutorID) [1]
COURSE-STUDENT2 (CourseID, StudentID, Result)
STUDENT (StudentID, Studentname, DOB, StudentStatus)
TUTOR (TutorID, TutorName) [1]

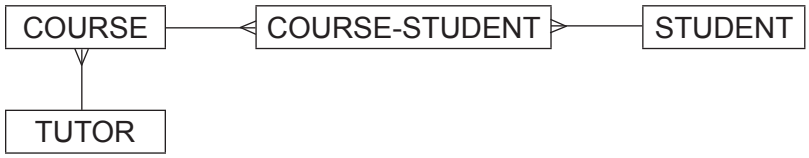
AVAILABLE MARKS

Alternative 1NF and 2NF

1NF
STUDENT (StudentID, StudentName, DOB, StudentStatus) [1]
STUDENT-COURSE (StudentID, CourseID, CourseTitle, TutorID, TutorName, Result) [1]

2NF
STUDENT (StudentID, StudentName, DOB, StudentStatus)
STUDENT-COURSE2 (CourseID, StudentID, Result) [1]
COURSE (CourseID, CourseTitle, TutorID, TutorName) [1] [6]

(e)



[1] for **all three** of COURSE, STUDENT and TUTOR
[1] for each of **three** correct relationships
[1] for composite entity COURSE-STUDENT or STUDENT-COURSE [5]

(f) **ER modelling** uses ER diagrams to represent real world objects and the links between them.
Normalisation is a technique of organising the data in the database to eliminate problems such as data redundancy and data inconsistency and improving data integrity.

Compare
Both methods can be used in the design stage. They both identify entities and relationships.

Contrast
ER modelling is a graphical approach to database design. Normalisation follows a set of decomposition rules.

Level	Marking Criteria	Marks
Band 2 **Excellent**	The candidate • Provides an accurate description of **both** methods • Explicitly compares **or** contrasts **both** methods • Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard.	**[5]–[6]**
Band 1 **Good**	The candidate • Provides an accurate description of **both** methods • Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.	**[3]–[4]**
Band 0 **Basic**	The candidate • Provides an accurate description of **one** method • Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.	**[1]–[2]**

[6]

AVAILABLE MARKS

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AVAILABLE MARKS

4 (a) (i) **Entity**
An object/subject about which data is/will be stored [1]

Attribute
Describes a data item within an entity [1] [2]

(ii) **Foreign key**
DepartmentID is the primary key in another entity
… and is not the primary key in the PRODUCT entity
(2 × [1])

Lookup
Attributes described as lookup are restricted to a list of values
The value of DepartmentID is selected from this list
(2 × [1]) [4]

(iii) When a new record is created/inserted into the Product table
... the value of its ReorderLevel is automatically set to 50
(2 × [1]) [2]

(b) (i) INSERT INTO Employee
VALUES (“E123”,“Black”,“Supervisor”,“Omagh”,“324531”);
[1] for INSERT INTO Employee
[1] for VALUES
[1] for correct values list after the word VALUE [3]

(ii) DELETE FROM Employee
WHERE Address != “Belfast” or <> or NOT “Belfast”
[1] for DELETE FROM Employee
[1] for WHERE
[1] for correct condition after the word WHERE [3]

(iii) **QBE**
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

SQL
SQL is a programming language for creating, accessing and manipulating databases
SQL provides commands to create tables and to insert, search, update, delete records
SQL consist of a large set of commands, each with its own syntax

Evaluation – for creating queries
QBE Employees will require minimum technical knowledge/skill
SQL Employees would require a high level of technical knowledge/skill

Level	Marking Criteria	Marks
Band 2 **Excellent**	The candidate • Provides an accurate description of QBE **and** SQL • Compares the impact on the company of using QBE instead of SQL • Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard.	**[5]–[6]**
Band 1 **Good**	The candidate • Provides an accurate description of QBE **and** SQL • Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.	**[3]–[4]**
Band 0 **Basic**	The candidate • Provides an accurate description of QBE **or** SQL • Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.	**[1]–[2]**

[6]

AVAILABLE MARKS

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AVAILABLE MARKS

5 (a) **Artificial intelligence**
Artificial intelligence considers all aspects of intelligence
... and models these using computer systems
The aim is to create intelligent machines
... which can function/react like humans
... by learning and adapting
(3 × [1])

The Turing test
A test to determine if a machine's behaviour is indistinguishable from a human's response
The test involves a player, a human and a machine
The player does not know which is the human and which is the machine
The player asks questions of the human and the machine
... and tries to discover which is the human
(3 × [1]) [6]

(b) A neural network models the human brain
It consists of a collection of nodes
... linked by one-way/two-way connections
Each node calculates the weighted sum of its inputs
... and provides an output
Backward propagation may be used
(3 × [1]) [3]

(c) 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
(4 × [1]) [4]

(d) Expert systems 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])

Knowledge engineer
Obtains the knowledge/facts/rules required for the expert system
... using structured/unstructured interviews/problem solving/concept maps
Structures the knowledge into a database
Validates/verifies the knowledge
(3 × [1])

Life insurance consultants
They will provide the knowledge
... by describing their experiences/knowledge of life insurance
... and the rules
… heuristics they use
(3 × [1]) [9]

AVAILABLE MARKS

(e) Robotics

Robotics concerns the design, construction, operation and application of robots which are computer-controlled mechanical devices

Uses of robots

Robots can perform repetitive tasks, can work in hazardous conditions. Robots are reliable, consistent and accurate

Evaluation 'A new version of a car'

Industrial robots can be reprogrammed for the new version of the car. Humans will require re-training, skills updating. Re-programming can take time as the new programs require testing.
Humans can be more flexible, can use judgment and intuition

Level	Marking Criteria	Marks
Band 2 **Excellent**	The candidate • Explains what is meant by **robotics** • Describes the general use of **robotics** • Makes a comparison between the use of humans and **robotics** in this case • Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard.	**[5]–[6]**
Band 1 **Good**	The candidate • Explains what is meant by **robotics** • Describes some general uses of **robots** • Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.	**[3]–[4]**
Band 0 **Basic**	The candidate • Refers to some general uses of **robots** • Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.	**[1]–[2]**

[6] 28

AVAILABLE MARKS

6 (a) **Offence**
Unauthorised access
... to computer material
(2 × [1])

Penalty
Up to two years in prison and/or a fine [1]

Offence
Unauthorised access with intent to commit
... or facilitate commission of further offences
(2 × [1])

Penalty
Up to five years in prison and/or a fine [1]

Offence
Unauthorised modification
... of computer material
(2 × [1])

Penalty
Up to ten years in prison and/or an unlimited fine [1] [9]

(b) **Information Commissioner**
Responsible for enforcing the Act/appointed by the Government
Promotes good practice for the responsible processing of personal data
Informs the general public about their rights under the Act
Maintains a register of organisations storing personal data
(2 × [1])

Data controller
The nominated person within an organisation
... who determines the purposes
... for which personal data is stored/processed
Informs employers about their responsibilities under the Act
(2 × [1])

Data subject
The person/individual
... about whom personal data is stored
(2 × [1]) [6]

(c) **Automated decision making**
Who are the beneficiaries of the decision?
What is the impact of the decision on the individual?
Is the decision based on information over which the individual has no control?
Is the decision based on biased data?
(2 × [1])

Online censorship
How is the individual's right to freedom of expression/access to information protected?
What right have governments/organisations to restrict/monitor internet use?
Who owns information/data published on the Internet?
Who regulates the online environment across national/regional boundaries?
(2 ×[1]) [4]

AVAILABLE MARKS

(d) Data mining involves analysing/sorting
... large data sets/big data
... to identify patterns/relationships
... to predict future trends
(4 × [1]) [4]

(e) **Cloud computing**
An organisation's data is managed by a third party. The data is stored on a global network of servers/data farms on the Internet.

Advantages of using cloud computing for data storage
The organisation requires fewer resources. The third party provides the hardware and software resources required to store and retrieve the data.

Data security issues
The third party is responsible for data security. The organisation is reliant on the third party for data security.
With cloud computing, most data access involves data transmission over the Internet which increases the risk of unauthorised access.

Level	Marking Criteria	Marks
Band 2 **Excellent**	The candidate • Provides an accurate description of cloud computing • Describes the advantage of using cloud computing for data storage • Describes an implication for data security of using cloud computing for data storage • Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard.	**[5]–[6]**
Band 1 **Good**	The candidate • Provides an accurate description of cloud computing • Describes the advantage of using cloud computing for data storage • Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear.	**[3]–[4]**
Band 0 **Basic**	The candidate • Provides an accurate description of cloud computing • Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear.	**[1]–[2]**

[6] 29

Total **150**