



Rewarding Learning

ADVANCED
General Certificate of Education
2022

Digital Technology

Assessment Unit A2 1
assessing
Information Systems

[ADT11]
MONDAY 13 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.

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) LAN

Covers a restricted area/office/building
Uses cabling/wireless technology
(2 × [1])

MAN

Covers a highly populated area/serves a community
Uses fibre optic/wireless technology
(2 × [1])

WAN

Covers a large geographical area/a country or countries
Uses fibre optic/public telephone system/comm satellites/undersea cables
(2 × [1]) [6]

(b)

Network resource
Switched Hub
Repeater
Media converter
MAC address
Server
WAP

(6 × [1]) [6]

(c) Server-based network

The server manages resources
... and security
Multiple clients/dumb terminals
... request resources off the server
(3 × [1])

Peer-to-peer network

All computers have equal status
Each is a supplier
... and consumer of resources
Each computer controls how its resources are shared
(3 × [1]) [6]

(d) Features of Star topology

Each node is directly connected to the central hub by its own cable
 The hub controls all network communication
 The hub controls the transfer of data packets

Features of Ring topology

Each node is directly connected to two adjacent nodes
 There is no fileserver
 Data packets/tokens travel in one direction only from node to node
 No risk of collisions

Evaluation with respect to cable failure

Star – Only communication with the node connected by the cable will be affected

Ring – A broken cable will stop all communication around the network
 It may be possible to isolate the faulty node

Level	Marking Criteria
B2 [5,6]	The candidate <ul style="list-style-type: none"> • Provides a detailed description of both topologies • Evaluates both topologies with justification • Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard
B1 [3,4]	The candidate <ul style="list-style-type: none"> • Provides a detailed description of both topologies • Briefly evaluates both topologies • Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear
B0 [1,2]	The candidate <ul style="list-style-type: none"> • Provides a brief description of both topologies • Briefly evaluates one topology • Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear

[6]

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- 2 (a)** To ensure optimal, fair and rational use of the radio frequency (RF) spectrum
 To formulate recommendations for standardizing telecommunication operations worldwide
 To assist countries in developing and maintaining internal communication operations
 (3 × [1]) [3]
- (b)** A set of rules
 ... to allow different devices/resources to communicate coherently/using agreed standards
 (2 × [1]) [2]
- (c)**
- | | |
|--------------|-----------------|
| Application | Application Set |
| Presentation | |
| Session | |
| Transport | Transport Set |
| Network | |
| Data | |
| Physical | |
- (5 × [1]) [5]
- (d)** 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
 (3 × [1]) [3]
- Data
 Deals with functions such as error detection/error correction
 Creates data blocks/synchronising data blocks
 Converts each outgoing packet into a series of bits/a series of incoming bits into data packet
 (3 × [1]) [3]
- (e)** VoIP allows telephone calls
 ... to be made over digital computer networks
 ... including the Internet
 It converts analogue signals
 ... into digital data packets
 It supports real-time conversations
 ... and two-way transmission
 (6 × [1]) [6]

(f) RFID

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

Barcode

A barcode contains data in a machine-readable code
 It contains 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 and 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

Barcodes 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

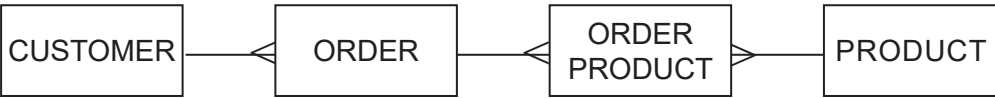
RFID tags have read/write capability

Barcodes are read-only and cannot be reused

Level	Marking Criteria
B2 [5,6]	The candidate <ul style="list-style-type: none"> Provides a detailed description of both technologies and provides a detailed evaluation of both technologies Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard
B1 [3,4]	The candidate <ul style="list-style-type: none"> Provides a detailed description of both technologies or provides a detailed evaluation of both technologies Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear
B0 [1,2]	The candidate <ul style="list-style-type: none"> Provides a brief description of both technologies or provides a brief evaluation of both technologies Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear

[6]

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- 3 (a) It contains a repeating group of attributes
ProdID, ProdName, Size, Cost, Quantity
(2 × [1]) [2]
- (b) Primary key
Uniquely identifies a record in a table/tuple in an entity
Example: OrderID
(2 × [1])
- Composite key
Consists of two or more keys
OrderID ProdID
(2 × [1]) [4]
- (c) ORDER-PRODUCT contains partial key dependencies
Example: ProdName
(2 × [1]) [2]
- (d) ORDER contains non-key dependencies/transitive dependencies
Example: CustName
(2 × [1]) [2]
- (e) **ORDER** (OrderID , OrderDate , CustID)
CUSTOMER (CustID , CustName , CustAddress)
[1] for new entity ORDER
[1] for new entity CUSTOMER [2]
- (f) Creates a link between two tables
Example: CustID links CUSTOMER and ORDER
(2 × [1]) [2]
- (g)  [4]
- Correct notation required
[1] for ORDER-PRODUCT
[1] for each of three relationships [4]

(h) SQL

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

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 generates SQL code

Comparison for creating a database and generating queries

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
B2 [5,6]	The candidate <ul style="list-style-type: none">Provides a detailed description of SQL and QBECompares both w.r.t. creating a database and generating queriesUses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard
B1 [3,4]	The candidate <ul style="list-style-type: none">Provides a detailed description of SQL and QBERefers to the suitability of one of these w.r.t. creating a database and generating queriesUses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear
B0 [1,2]	The candidate <ul style="list-style-type: none">Provides a description of SQL and QBE which is correct but lacks detailMakes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear

[6]

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AVAILABLE
MARKS

- 4 (a) To determine if a machine's behaviour
... is indistinguishable from a human's response
(2 × [1]) [2]
- (b) 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
(4 × [1]) [4]
- (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]) [3]
- 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]) [3]
- Heuristics
Rules of thumb
... derived from human experience/intuition
... not purely from logic
Requires judgement/estimation/evaluation
(3 × [1]) [3]
- (d) The consultants are the experts
They will provide the knowledge
...to the knowledge engineer
...during knowledge acquisition
... by describing their experiences/knowledge of life insurance
... and the rules
...heuristics they use
(6 × [1]) [6]

AVAILABLE
MARKS

- (e) Life insurance premiums depends on factors such as age, gender, smoking status, health
 The expert system will ask the applicant a series of health-related questions and use the answers with its inference engine and knowledge base to calculate the premium for that applicant

Benefits

The expert system can calculate premiums very accurately and consistently and can provide reasoning and probabilities

The calculations can be based on the experience of a large number of insurance consultants

Drawbacks

There is a risk of over reliance on technology

Consultants may become deskilled

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

Level	Marking Criteria
B2 [5,6]	<p>The candidate</p> <ul style="list-style-type: none"> Provides a detailed description of this use of an expert system Describes a benefit and a drawback of this use of an expert system Uses the appropriate Digital Technology terminology accurately throughout the response <p>Presentation, spelling, punctuation and grammar are of a high standard</p>
B1 [3,4]	<p>The candidate</p> <ul style="list-style-type: none"> Provides a detailed description of this use of an expert system Describes a benefit or a drawback of this use of an expert system Uses limited use of Digital Technology terminology <p>Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear</p>
B0 [1,2]	<p>The candidate</p> <ul style="list-style-type: none"> Provides a description of this use of an expert system which is correct or describes a benefit or a drawback of this use of an expert system Makes limited use of Digital Technology terminology <p>Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear</p>

[6]

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- 5 (a) The ability of a computer system to understand human interaction
 ... in spoken
 ... or written form
 (3 × [1])
- Alternatively**
 The ability of a computer system to analyse
 ... understand
 ... and generate human speech
 (3 × [1])
 (1 × [3]) [3]
- (b) Spam filtering
 To try to identify and block unwanted emails
 ... by scanning strings of text
 (2 × [1])
- Answering search engine questions
 ... using key words
 (2 × [1])
- Extracting key information
 ... using algorithms to evaluate stock market patterns
 ... to automatically decide buy/sell/hold decisions
 (2 × [1])
 (2 × [2]) for each of **two** uses [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 position measuring instruments, collect samples, assemble structures to protect humans
Autonomous rovers can move around the surface

Evaluation

Benefits:

They can operate in inhospitable conditions and withstand powerful launch and landing forces

The loss of a robot is preferable to that of an astronaut

They can perform repetitive tasks consistently and accurately

They can weigh very little and require little power

They do not require life support systems

Drawbacks:

They are expensive to design and produce

Radio signals from earth take a long time to reach a planet

Robots must be able to operate on their own but cannot show initiative or respond intuitively to unexpected situations

Level	Marking Criteria
B2 [5,6]	The candidate <ul style="list-style-type: none"> Provides a detailed description of this use of robotics Describes a benefit and a drawback of this use of robotics Uses the appropriate Digital Technology terminology accurately throughout the response Presentation, spelling, punctuation and grammar are of a high standard
B1 [3,4]	The candidate <ul style="list-style-type: none"> Provides a detailed description of this use of robotics Describes a benefit or a drawback of this use of robotics Uses some relevant Digital Technology terminology Presentation, spelling, punctuation and grammar are sufficiently competent to make the response clear
B0 [1,2]	The candidate <ul style="list-style-type: none"> Provides a description of this use of robotics which is correct but lacks detail Makes limited use of Digital Technology terminology Presentation, spelling, punctuation and grammar are such that the intended meaning is not completely clear

[6]

- (e) The region is divided up into cells each served by a base station and a number of phone masts

A cell is hexagonal in shape to maximise coverage

The caller's phone sends a signal to the nearest mobile mast

The mast receives the signal and transmits it to its base station

The base station manages transmission of the signal across the cell it controls

Calls are passed on through neighbouring base stations to the destination phone

If the caller is on the move, they may move between cells

The call is transferred from one base station to another in a process called handoff

The base stations connect to a mobile switching centre

(6 × [1])

[6]

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 shopping trends
 ... and forecast demand for products
 (2 × [1])
- To optimise prices
 ... by analysing demographic data/economic indicators/spending habits
 (2 × [1])
- To identify potential customers
 ... by analysing transactional records/loyalty cards
 (2 × [1])
 (2 × [2]) for each of two ways [4]
- (c)** The shopping habits/preferences data
 ...is stored about a customer
 ...could be used for unauthorised purposes/purposes for which the
 customer has not given permission
 ... or for purposes unknown to the customer
 (4 × [1]) [4]
- (d)** The organisation's data is managed/processed
 ... by a third party/a computer services company
 The data is stored on a global network of servers
 ... or data farms on the Internet.
 To provide services normally provided by a network
 (4 × [1]) [4]
- (e)** 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])
- Hosted instance
 A location of physical memory on a cloud server
 ... allocated to a particular client
 (2 × [1]) [4]
- (f)** 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?
 (4 × [1]) [4]

Total

**AVAILABLE
MARKS**

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150