



Rewarding Learning

**ADVANCED
General Certificate of Education**

Software Systems Development

Unit A2 1

Systems Approaches and Database
Concepts

[ADV11]

ASSESSMENT

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.

Annotation

- Annotation should be completed in red ink
- Record the marks in the marks column on the right hand side of the script
- Annotation should be clear and concise and specifically related to the mark scheme
- Marks for individual parts of questions should be clearly identified
- Marks should be totalled and circled at the top of each question

Stretch and Challenge Questions

- Read the response in its entirety and consider in which level the response should be included
- Marks should then be determined within that level depending on the content required
- Underlining may be used to highlight features of the response
- Teachers are encouraged to use the full range of available marks within levels

1 (a) Outline an example of how each of these issues might affect the business.

Appointments:

Examples may include:

- Errors in staff scheduling may result in double-booking. This may lead to missed appointments and consequently loss of earnings/poor client satisfaction/dissatisfied employees
- As the appointment booking system does not access client details, errors in address details may lead to late/missed appointments impacting profit and client satisfaction
- Incorrect calculation of travel time due may lead to late/missed/cancelled appointments which costs the business money and negatively impacts client satisfaction

Billing:

- Reminders for payment are not always sent or possibly sent in error, leading to delay in payment/missed payments/conflict with client
- Payment details are not always recorded accurately leading to potential loss of earnings or the client being over-charged
- Details from the manual document for farm visits can be inaccurate (for example, medicines used or duration) and lead to inaccurate invoices which may over/under charge clients leading to loss of earnings or client dissatisfaction
- Partial payments are difficult to manage, and payments can be missed by Rose leading to loss of earnings
- VAT calculation on previous bills may have been missed leading to loss of earnings

Credit any valid Appointment/Billing example and effect on the business

[1] each for any valid example and effect of Appointments and Billing [2]

(b) Explain the two most appropriate techniques the team might use to determine the extent of the concerns noted.

Technique 1: **Interviews**

Suitable because:

- Facilitates two-way exchange of information allowing for expansion and probing questions
- Interviewer can pick up on non-verbal cue which may lead to other areas of concern
- Enables a working knowledge of procedures to be determined. Identify deviations from expected procedures with possible explanations
- Determine difficulties encountered
- Investigate new ideas/suggestions for improvements
- Gain buy in from key personnel

Application to Shepherd's Veterinary:

As Rose is generally responsible for accounts, an interview with her could help the team gain an understanding of:

- how payments are recorded for farm visits
- how invoices are produced/data is transferred from farm visit forms
- difficulties she frequently encounters, e.g. checking correct VAT has been applied
- suggestions she has for improvement

[1] Identification of technique

[1] Suitability

[1] Application of Case Study

[3]

Technique 2: **Document Inspection**

Suitable because:

- Provides real-world examples of data entry which helps give a better understanding of the processes of the existing system
- Inconsistencies can be identified which can help inform the requirements for a new system
- The relationship between documents can be analysed to determine the data flow between different areas of the business

Application to Shepherd's Veterinary:

- Rose and Stephen's notebook could be compared in order to identify business practice and potential inconsistencies
- Farm Visit records can be analysed and may help identify patterns of concern, e.g. omissions on certain fields such as date or client name
- Sample invoices can be checked against Farm Visit records to determine if they are accurate

[1] Identification of technique

[1] Suitability

[1] Application of Case Study

[3]

8

Note: Credit follow-through of Suitability and Application of Case Study if inappropriate technique is chosen

2 Development process – missing words

- | | |
|-----------------------|----------------------|
| 1. Execution | 9. Controls/Monitors |
| 2. Closure | 10. Plan |
| 3. Terms of Reference | 11. Risks/Budget |
| 4. Objectives | 12. Resources |
| 5. Deliverables | 13. Execution |
| 6. Time/Budget | 14. Closure |
| 7. Budget/Time | 15. Stakeholders |
| 8. Monitors/Controls | 16. Evaluation |

[1] for each **two** correct answers (rounded up)

[8]

8

AVAILABLE
MARKS

3 Differences between traditional and agile methodologies

Candidates may include reference to the following:

Documentation

Traditional – extensive vs Agile – minimal

Customer involvement

Traditional – beginning and end vs Agile – continuous involvement

Team

Traditional – delegated by project manager vs Agile – self-directing, collaborative

Lifecycle

Traditional – incremental only vs Agile – iterative and incremental

Testing

Traditional – end of the Lifecycle vs Agile – throughout the project

Example links to case study:

If Peter knows exactly what he wants in the new system and does not foresee any significant changes in scope during development, a traditional methodology could be considered. Peter might prefer to know all the proposed requirements for a new system so that he can budget accordingly.

Agile methodologies can allow Peter, Stephen, Rose and other employees to become actively involved in the development process. Stephen and Rose can try out prototypes for appointment systems and offer suggestions for improvement which can be implemented in the next iteration.

Credit any other valid difference or link to case study

[8]

Level 1 ([1]–[2])

Overall impression: Basic

Candidate provides a basic answer demonstrating simple knowledge and understanding of the differences between traditional and agile methodologies. Candidate provides basic reference to how these differences may relate to the development of the new system at Shepherd's Veterinary.

Candidate makes only a limited selection and use of an appropriate form and style of writing.

The organisation of material may lack clarity and coherence.

There is little use of specialist vocabulary.

Presentation, spelling, punctuation and grammar may be such that the intended meaning is not clear.

Level 2 ([3]–[6])

Overall impression: Good

Candidate provides a good answer demonstrating good knowledge and understanding of the differences between traditional and agile methodologies. Candidate provides good reference to how these differences may relate to the development of the new system at Shepherd's Veterinary.

Candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence.

There is good use of specialist vocabulary.

Presentation, spelling, punctuation and grammar are used appropriately to ensure that meaning is clear.

Level 3 ([7]–[8])

Overall impression: Excellent

Candidate provides an excellent answer demonstrating thorough knowledge and understanding of the differences between traditional and agile methodologies.

Candidate provides strong reference to how these differences may relate to the development of the new system at Shepherd’s Veterinary.

Candidate selects and uses the most appropriate form and style of writing.

Relevant material is organised with a high degree of clarity and coherence.

There is excellent use of specialist vocabulary.

Presentation, spelling, punctuation and grammar are used to a high standard to ensure that meaning is clear.

**AVAILABLE
MARKS**

8

4 Complete the table below.

Statement	true/false
Use of a database demands more storage space than the use of conventional files.	false
In a network model, multiple parents are possible for each child.	true
In a relational model, each column in a table corresponds to a field that has a unique name holding multiple data types.	false
Many to many relationships in a relational database are decomposed using a link table.	true
The hierarchical model is the only model that requires knowledge of the physical storage of records in a file or memory.	false

[1] for each correct response

[5]

5

5 Evaluate the effectiveness of Gantt and Pert charts as project management tools and consider how each chart might be used to schedule the project and reschedule it in the event of changes to the scope.

GANTT:

- horizontal bar chart with time on the horizontal (*x*) axis and the tasks/activities on the vertical (*y*) axis
- Tasks are represented by horizontal bars, whose length represent the duration of that activity/task
- Milestones, scheduled events that indicate the completion of a deliverable, may be shown as a task with zero duration, possibly represented as a diamond
- Gantt charts provide a visual overview of the whole project and it is easy to quickly identify timelines and deadlines for tasks
- Relationships and dependencies between activities are easy to identify
- By identifying task dependencies, it is possible to anticipate potential risks and create contingencies in the event of scope increase
- Gantt charts are not as effective as PERTs at showing the priorities of individual tasks and the resources needed to complete it

PERT:

- Visualises a project’s timeline. Milestones are represented using rectangles and circles (nodes)
- Models the relationships among project tasks and enables the critical path to be found more easily
- Task precedence/prioritisation is easily identifiable
- Float/slack allow project managers to allocate resources appropriately in the event of changes in scope
- Allows “what-if” scenarios to be quickly modelled and contingencies to be created

Level 1 ([1]–[3])**Overall impression: Basic**

Candidate provides a basic answer demonstrating simple knowledge and understanding of GANTT and PERT charts.

Candidate provides basic reference to the effectiveness of each approach and how they may relate to the development of the new system at Shepherd's Veterinary.

Candidate makes only a limited selection and use of an appropriate form and style of writing.

The organisation of material may lack clarity and coherence.

There is little use of specialist vocabulary.

Presentation, spelling, punctuation and grammar may be such that the intended meaning is not clear.

Level 2 ([4]–[6])**Overall impression: Good**

Candidate provides a basic answer demonstrating good knowledge and understanding of GANTT and PERT charts.

Candidate provides good reference to the effectiveness of each approach and how they may relate to the development of the new system at Shepherd's Veterinary.

Candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence.

There is good use of specialist vocabulary.

Presentation, spelling, punctuation and grammar are used appropriately to ensure that meaning is clear.

Level 3 ([7]–[8])**Overall impression: Excellent**

Candidate provides an excellent answer demonstrating thorough knowledge and understanding of GANTT and PERT charts.

Candidate provides strong reference to the effectiveness of each approach and how they may relate to the development of the new system at Shepherd's Veterinary.

Candidate selects and uses the most appropriate form and style of writing.

Relevant material is organised with a high degree of clarity and coherence.

There is excellent use of specialist vocabulary.

Presentation, spelling, punctuation and grammar are used to a high standard to ensure that meaning is clear.

6 (a) Complete the missing items.

- (1) Actor icon
- (2) VET
- (3) Login
- (4) <<includes>>
- (5) Verify Credentials
- (6) <<extends>>
- (7) Display Error
- (8) View Today's Appointments
- (9) <<extends>>
- (10) View Incoming Appointments
- (11) <<extends>>
- (12) View Historical Appointments
- (13) <<includes>>
- (14) Estimate Travel Time
- (15) <<extends>>
- (16) View Animal Records

[1] for any **two** correct answers [8]

Note: Use case and connection must be correct.

(b) features of **class** and **sequence** diagrams and how they may be used as part of the development of the proposed system.

Class:

Static Model: visualises the system's structure showing its classes (possibly attributes and operations) and the associations between them (with multiplicities at the association ends). Level of detail depends on stage of lifecycle. During analysis classes refer to places, events and things about which the system will capture information. Later during implementation classes can refer to software classes: windows, form and other objects used to build the system.

Class Example:

The Login object may have attributes such as userName, and password and operations such as validate()

Sequence:

Illustrate the objects that participate in a use case and the messages that pass between them over time – for one use case. An interaction diagram/dynamic model. Emphasis on time order.

Sequence Example:

A sequence diagram for Get Estimated Time shows how the Client and Vet objects interact over time by passing messages such as getClientPostCode()

Level 1 ([1]–[2])

Overall Impression: Basic

Candidate provides a basic answer demonstrating simple knowledge of the features of Class and Sequence Diagrams.

Candidate provides limited linkage to how Class and Sequence Diagrams may be used for the proposed appointments system.

The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence.

There is little use of specialist vocabulary.

Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

Level 2 ([3]–[4])

Overall Impression: Good

Candidate provides a good answer showing a reasonable understanding of the features of Class and Sequence Diagrams.
 Candidate provides reasonable examples of Class and Sequence Diagrams that are relevant to the proposed appointments system.
 The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence.
 There is some use of appropriate specialist vocabulary.
 Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Level 3 ([5]–[6])

Overall Impression: Excellent

Candidate provides an excellent answer showing thorough understanding of the features of Class and Sequence Diagrams.
 Candidate provides clear examples of both Class and Sequence Diagrams that are directly related to the proposed appointments system.
 The candidate successfully selects and uses the most appropriate form and style of writing.
 Relevant material is organised with a high degree of clarity and coherence.
 There is widespread and accurate use of appropriate specialist vocabulary.
 Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

All other valid answers will be given credit. [0] awarded for a response not worthy of credit. [6]

14

7 (a) State the three steps of the normalisation process

- 1NF: Remove repeating groups
- 2NF: Remove partial key dependencies
- 3NF: Remove non-key dependencies

[1] for each step description [3]

(b) With reference to the sample invoice, identify the repeating group, clearly identifying the type

Invoice:

{ServiceID, Service, {Medication, Qty, UnitPrice}} [2]
 [1] identify fields [1] correct repeating group

Group type:

Nested [1]

(c) 1NF:

INVOICE

(InvoiceNo, InvoiceDate, ClientID, ClientSurname, ClientForename,
ClientAddress1, ClientAddress2, ClientAddress3, ClientPostcode, AppDate,
FarmVisitYN, NoOfAnimals, Duration, FlatRate, CallOutFee)

Correct fields removed [1]

PK [1]

INVOICE_SERVICE

(InvoiceNo*, ServiceID, ServiceDesc)

CK & FK [1]

INVOICE_SERVICE_MEDICATION

(InvoiceNo*, ServiceID*, MedicineID, MedicineDesc, Qty, Price)

2NF:

INVOICE unchanged

INVOICE_SERVICE

(InvoiceNo*, ServiceID*)

SERVICE

(ServiceID, ServiceDesc)

INVOICE_SERVICE_MEDICINE

(InvoiceNo*, ServiceID*, MedicineID*, Qty)

MEDICINE

(MedicineID, MedicineDesc, Price)

SERVICE and MEDICINE correct [1]

Either new PK [1]

Either new FK [1]

3NF:

INVOICE_SERVICE, SERVICE, INVOICE_SERVICE_MEDICINE,
MEDICINE unchanged

INVOICE

(InvoiceNo, InvoiceDate, ClientID*, AppDate, FarmVisitYN, NoOfAnimals,
Duration, FlatRate, CallOutFee)

CLIENT

(ClientID, ClientSurname, ClientForename, ClientAddress1, ClientAddress2,
ClientAddress3, ClientPostcode)

Correct fields removed [1]

FK [1]

AVAILABLE
MARKS

14

- 8 (a) Name two main components of an ER Model
- Entity
 - Relationship/Cardinality
- [1] each (*Must include Entity. Accept either Relationship or Cardinality*) [2]

- (b) Describe **three** benefits of using ER models when developing relational databases.

- ER models allow the designer to easily identify entities, view their attributes and to identify the relationships they have with others
- ER models allow the designer to identify mistakes and potential design flaws, and to correct these before executing the changes in database
- ER models can evolve into physical database model that aids the creation of relational database
- The database designer gains a better understanding of the information to be contained in the database

Credit any other valid purpose

[1] each for any three benefits [3]

5

- 9 (a) For the Animal table name and describe the constraint that must be applied

Field	Constraint / Description
AnimalID	PRIMARY KEY. Each Animal record needs to be uniquely identifiable.
BreedID	FOREIGN KEY. Breed details reside in the BREED table and need to be referenced there.
AnimalDOB	CHECK constraint. Ensure that date is not in the future.

[1] each [3]

- (b) SQL script for tomorrow's non-farm visit appointments

```
SELECT a.AppDate, a.AppTime, a.VetID, v.VetSurname, v.VetForename,
a.ClientID, c.ClientForename, c.ClientSurname, c.ClientTelNo,
a.NoOfAnimals, a.Duration
```

```
FROM APPOINTMENT a
```

```
JOIN VET v on a.VetID = v.VetID
```

```
JOIN CLIENT c on a.ClientID = c.ClientID
```

```
WHERE a.FarmVisitYN = 'n' AND a.AppDate = DATEADD(day,1,(cast
(GETDATE() as date)))
```

```
ORDER BY v.VetSurname, v.VetForename, a.AppTime
```

[1] SELECT includes at least 5 relevant fields including NoOfAnimals and Duration

[1] if fields come from at least 2 tables

[1] FROM table

[1] for **each** of the two joins (ignore order)

[1] WHERE FarmVisitYN = 'n'

[1] AND

[1] WHERE uses DATEADD() (*or equivalent*)

[1] WHERE determines tomorrow's date

[1] ORDER BY includes VetSurname and AppTime [10]

- (c) Write SQL script that will create a list for non-farm visits showing those vets whose total number of hours exceeded 150 in the last calendar month

```
SELECT a.VetID, v.VetSurname, v.VetForename, sum(Duration) as
TotalHours
FROM APPOINTMENT a
join VET v on a.VetID = v.VetID
WHERE FarmVisitYN = 'n' AND month(AppDate) = month(DATEADD(month,
-1, GETDATE()))
GROUP BY a.VetID, v.VetSurname, v.VetForename
HAVING sum(Duration)>150
```

[1] **each** for correct SELECT, FROM, JOIN, GROUP BY, HAVING

[1] WHERE FarmVisitYN = 'n' AND

[1] Last month correct

[7]

20

10

Test data	Reason for test data	Expected outcome
Appointment details: AppDate 3/06/2020 AppTime 14:30 Duration 1.5hrs VetID 12 ClientID 0051 NoOfAnimals 2 FarmVisitYN N (animal ID's D156, D157)	Insert valid appointment details for VetID 12 ending between 3:00 and 5:00 pm	Appointment 1046 details added to AppAnimal table with AppID (Vet 12 will NOT be available)
Appointment details: AppDate 3/06/2020 AppTime (Insert any time between 15:00 and 17:00) [1] Duration 1hr VetID 11 [1] ClientID 0052 NoOfAnimals 2 FarmVisitYN N (animal ID's B111, B112)	Insert valid appointment details for VetID 11 starting between 3:00 and 5:00 pm	Appointment 1047 [1] details added to AppAnimal table with AppID (Vet 11 will NOT be available) [1]
Appointment details: AppDate 3/06/2020 AppTime 13:00 Duration 2hrs VetID 13 ClientID 0066 NoOfAnimals 3 FarmVisitYN N (animal ID's R1804, R1905, R1906)	Insert valid [1] appointment details for VetID 13 ending at 3:00 pm [1]	Appointment 1048 [1] details added to AppAnimal table with AppID (Vet 13 will be available) [1]
Appointment details: AppDate 3/06/2020 AppTime 15:00 Duration 2hrs	Check that only free vets are available for selection from grid	Vet 10 and 13 [1] are available [1]

[2] per box, as indicated

[10]

10

Total

100