



*Rewarding Learning*

**ADVANCED**  
**General Certificate of Education**  
**2022**

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## **Software Systems Development**

Unit A2 1

Systems Approaches and Database  
Concepts

**[ADV11]**

**MONDAY 30 MAY, AFTERNOON**

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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) Document sampling:

- Paper-based documents give a good idea of what is happening in the current system.
- The order book is the central source for cake orders and needs to be examined to gather:
  - quantitative data, such as the average number of lines used for recording cake order details, or the average time taken from initial order date to order completion date.
  - frequency of errors (or potential errors). For example, how often cake types are handwritten, how often staff initials are omitted, how often extra sheets of paper have been used, how often payment details have been miscalculated or deposit details have been omitted.
  - current structure, such as the layout of the pre-printed template, to identify the fields that need to be added or amended (e.g. cake type, occasion), what calculations are needed.
  - Helps identify required inputs, processes and outputs.

**Interviews:**

Descriptions may include:

- Used to collect the information from groups or individuals.
- Rachel will select the people who are related with the cake ordering system for the interview. This will be Jane, the staff at the café (at least one full-time and one part-time), and ideally a customer; a range of users with differing roles will provide a global overview of the ordering process from a range of viewpoints. This allows Rachel to gather a much more accurate picture of the current ordering process.
- Rachel would sit face to face with the people identified and record their responses. This helps to identify areas of misunderstandings and the most common issues that arise, for example, café staff might frequently misinterpret customer requirements when taking a cake order by phone, or Jane might find it difficult to decipher the initials of the staff member who took a cake order.
- Rachel should also choose a suitable place and time which will be comfortable for the respondent, although this might be difficult given how busy the café is.
- Structured interview technique may be used – formal interview where fixed questions are asked, and specific information is collected.
- Unstructured interview – a more casual conversation where in-depth area and topics are covered and other information apart from the topic may also be obtained.

Other relevant fact-finding techniques may be considered if suitable justification is provided.

**Level 1 ([1]–[2])**

**Overall impression: Basic**

Candidate provides a basic answer demonstrating limited knowledge and understanding of relevant fact-finding techniques.

Candidate provides a basic explanation of how fact finding techniques could

be applied to the area of cake orders at Harpers.  
Candidate makes only a limited selection and use of an appropriate form and style of writing.  
The organisation of the 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]–[4])****Overall impression: Good**

Candidate provides a good answer demonstrating good knowledge and understanding of relevant fact-finding techniques and includes document sampling.  
Candidate provides a good explanation of how fact finding techniques, including document sampling, could be applied to the area of cake orders at Harpers.  
Candidate makes good 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 so the intended meaning is clear.

**Level 3 ([5]–[6])****Overall impression: Excellent**

Candidate provides an excellent answer demonstrating excellent knowledge and understanding of relevant fact-finding techniques and includes document sampling.  
Candidate provides an excellent explanation of how fact finding techniques, including document sampling, could be applied to the area of cake orders at Harpers.  
Candidate makes excellent selection and use of an appropriate form and style of writing.  
Relevant material is organised with a high degree clarity and coherence.  
There is excellent use of specialist vocabulary.  
Presentation, spelling, punctuation and grammar are used to a high standard so the intended meaning is clear. [6]

(b) Answers may include:

**Area: Café Orders**

**Technique and Reason:** Observation. Rachel will observe staff actually compiling the daily café order. This will provide her with a better understanding of the decision-making process and the factors that influence these decisions, e.g. any upcoming holidays, or Friday/Saturday orders should see an increase in food order requirements.

**Area: Customers**

**Technique and Reason:** Questionnaires. Rachel could use this technique to extract information from a number of people relatively quickly and inexpensively. Customers may be more willing to provide honest feedback on their experience at Harpers if they do not need to give their personal

information. Responses can help to identify important issues with the current system that might otherwise be missed, e.g. customers may be asked to comment on waiting times, experience of cake orders, customer service.

[1] for each relevant area

[1] for each relevant technique with reasonable explanation

[4]

**AVAILABLE  
MARKS**

10

### Methodologies (DSDM)

2

Statement	true/false
Jane and the team will only be required at the beginning of the development.	False
Digital Advances will provide Jane with a prioritised list of requirements	True
Requirements are contained in the Product Backlog	False
Timeboxes should only contain essential requirements that Jane has	False
Planned releases are given to Jane in a series of increments	True

[1] for each correct true/false

[5]

5

## Methodologies (SCRUM)

AVAILABLE  
MARKS

3 Points may include some of the following (not all points are needed for level 3):

**Meetings** can be comprised of Sprint Planning, Daily Scrum, Sprint Review, Sprint Retrospective.

### Sprint Planning Meeting

- The purpose is to ensure the team is ready to perform the Sprint.
- Focuses on the question: “What are we going to work on and how are we going to do it?” The team at Digital Advances may decide the next sprint will deliver the Cake Order aspect of the business.
- Team will commit to achieving a shared goal and will have a list of items they plan to work on. The items from this list are broken down into tasks (around 2 day’s work each).
- The meeting typically lasts 8 hours for a 4-week Sprint.
- The meeting will include the Product Owner, a Scrum Master, and the whole development team.
- User stories are broken into smaller tasks and assigned accordingly to team members, to let everyone know what they’re doing.
- The team at Digital Advances could be split into those working on the database structure and those working on the user interface. Jane will have had input into the development of the user stories. One of the user stories for this sprint might be “as a staff member at the café, I want to see the payment history of a cake order, so that I can see the remaining balance for the customer”. This would subsequently be broken into manageable tasks and the development team will agree who is responsible for each.

### Daily Scrum Meeting (Daily Stand-up)

- 15-minute status update meeting involving the development team at Digital Advances, as well as the Scrum Master and Product Owner (if they are involved in the development). Ideally Jane or a representative from Harpers should be there.
- Aim is to inform team members about the progress across the team. It includes the three basic questions the interested parties should answer. These questions are:
  - What did we do yesterday? e.g. created the data dictionary for cake orders.
  - What will we do today? e.g. build the tables for the database.
  - What obstacles are in our way? e.g. staff member is ill.
- Benefits of daily scrum meetings include:
  - Adapting the daily plan and Sprint Backlog.
  - Identifying and removing development impediments.
  - Tracking progress.
  - Synchronisation of teamwork.
  - Improving team collaboration.

### Sprint Review Meeting

- Aimed to showcase to stakeholders all work completed by the team during the Sprint.
- Takes place at the end of each Sprint. It involves all team players, while the stakeholders of the project can attend optionally.
- Opportunity to demonstrate the value and functionality. It is also the time for feedback from the stakeholders and the Product Owner. Stakeholders

are able to see things sooner than later and they often inspect or adapt the product as it emerges.

- Jane and some staff members can offer important feedback, e.g. further modifications to the order form.

### **Sprint Retrospective Meeting**

- Allows the team to look back on their work that was just completed.
- Typically happens at the end of each Sprint. It usually lasts about 90 minutes and is aimed to help to incorporate continuous improvement into the team culture and into the Sprint cadence.

The attendees of the meeting are the Scrum Master and the development team. The Product Owner can also attend but it is not mandatory. During the event, they review how the team worked during the last Sprint, propose feedback and work together to make tweaks and improvements for the future Sprints.

### **Level 1 ([1]–[2])**

#### **Overall impression: Basic**

Candidate provides a basic answer demonstrating limited knowledge and understanding of the meetings involved in the SCRUM methodology.

Candidate may provide a basic explanation of how the meetings of the SCRUM methodology could be applied at Harpers.

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

The organisation of the 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]–[4])**

#### **Overall impression: Good**

Candidate provides a good answer demonstrating good knowledge and understanding of the meetings involved in the SCRUM methodology.

Candidate provides a good explanation of how the meetings of the SCRUM methodology could be applied at Harpers.

Candidate makes good 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 so the intended meaning is clear.

### **Level 3 ([5]–[6])**

#### **Overall impression: Excellent**

Candidate provides an excellent answer demonstrating excellent knowledge and understanding of the meetings of the SCRUM methodology.

Candidate provides an excellent explanation of how the meetings of the SCRUM methodology could be applied at Harpers.

Candidate makes excellent selection and use of an appropriate form and style of writing.

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

There is excellent use of specialist vocabulary.

Presentation, spelling, punctuation and grammar are used to a high standard so the intended meaning is clear.

[6]

6

4 UML – missing words

1. rules/notations
2. notations/rules
3. structure/document
4. document/structure
5. requirements
6. Use Case
7. relationships/associations
8. associations/relationships
9. actors
10. actors
11. Customer (allow Baker)
12. Staff
13. use cases
14. Jane/Customer/Staff/Baker
15. Customer/Staff/Baker/Jane
16. place order
17. <<include>>
18. record customer details
19. <<extend>>
20. make payment/add decoration

[1] for each **two** correct answers

[10]

10

AVAILABLE  
MARKS

## Testing

AVAILABLE  
MARKS

5 (a) (i) User Requirements

(ii) Systems Requirements Specification

(iii) Systems Analyst/Rachel

(iv) Low level Design Specification

(v) Code

(vi) Programmer/Developer

(vii) Programmer/Developer

(viii) Developer (accept tester or Analyst)

(ix) Acceptance Testing

(x) User/user groups

[5]

(b) Testing: V-Model

Points may include some of the following (not all points are needed for level 3):

General:

- The V-Model can be considered an extension of the waterfall model.
- Based on the association of a testing phase for each corresponding development stage.
- Execution of processes happens in a sequential manner in a V-shape (also known as Verification and Validation model).
- For every phase in the development cycle, there is a directly associated testing phase that is planned in parallel.
- There are Verification phases on one side of the 'V' and Validation phases on the other side.
- The Coding Phase joins the two sides of the V-Model.

Unit Testing

- Unit tests designed in the module design phase are executed on the code during this validation phase. Unit testing is the testing at code level and helps eliminate bugs at an early stage, though all defects cannot be uncovered by unit testing, e.g. checking that payment details are correctly calculated on the cake order form.

System Testing

- System testing is directly associated with the system design phase. System tests check the entire system functionality and the communication of the system under development with external systems. Most of the software and hardware compatibility issues can be uncovered during this system test execution, e.g. checking that customer details are retrieved correctly when the ID is input.

**Level 1 ([1]–[2])****Overall impression: Basic**

Candidate provides a basic answer demonstrating limited knowledge and understanding of unit and system testing.

Candidate may provide a basic explanation of how the V-Model phases of unit and system testing could be applied at Harpers.

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

The organisation of the 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]–[4])****Overall impression: Good**

Candidate provides a good answer demonstrating good knowledge and understanding of unit and system testing.

Candidate provides a good explanation of how the V-Model phases of unit and system testing could be applied at Harpers.

Candidate makes good 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 so the intended meaning is clear.

**Level 3 ([5]–[6])****Overall impression: Excellent**

Candidate provides an excellent answer demonstrating excellent knowledge and understanding of unit and system testing.

Candidate provides an excellent explanation of how the V-Model phases of unit and system testing could be applied at Harpers.

Candidate makes excellent selection and use of an appropriate form and style of writing.

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

There is excellent use of specialist vocabulary.

Presentation, spelling, punctuation and grammar are used to a high standard so the intended meaning is clear. [6]

11

6 (a)

Constraint	Example	Risks	
Scope	Jane now wants to include an option for scheduling and costing that wasn't defined in the original requirements.	(i)	The project may go over budget as a result of amended requirements.
		(ii)	The project may be delayed to accommodate the new requirements.
Cost	Cost of equipment and the employment of new staff has been underestimated and the budget is very tight.	(i)	The contingency fund may become depleted and the project may go over budget.
		(ii)	Staffing may need to be cut, leading to an increase in overall workload and stress.
Time	Jane wants the software sooner rather than the initially agreed deadline.	(i)	Might have to increase the size of the development team or pay overtime.
		(ii)	Some of the lower priority features may need to be cut from the proposed solution to meet the deadline.

[1] for each correct word/example/risk

[8]

**(b) Budget**

Beth will need to identify resources such as staff, hardware and software. She will manage and control project budgets ensuring all expenditure, commitments and payments are properly authorised, in accordance with delegated authority requirements.

**Scheduling**

Underestimation of time for tasks/activities can risk the project's agreed deadline. Unexpected events can occur that have an impact on timescale. Beth may want to build some buffer into the schedule to account for these unexpected events/risks.

**Monitoring Risks**

Risks are things that threaten the project and the achievement of the objectives. Risk management needs to be performed throughout the software development process. Risks are identified at an early stage of the project and throughout the life of the project. They can range from severe threats that would result in the whole project being cancelled or minor threats that might cause a small delay. the project manager should determine the most appropriate action (prevent/eliminate, reduce, accept or transfer?) bearing in mind cost and time. A plan for how the team records and reports risks should be made. A risk log may be implemented and reviewed by the project manager.

**Tools involved**

Beth may use software tools to create a schedule in the form of a Gantt and/ or PERT chart. These show the order of the tasks/phases, important dates, dependencies between tasks, frequent milestones and the critical path.

Budgetary Control Systems: These will enable Beth to monitor and record costs. Approval may be required before funds are spent. Beth will create reports for stakeholders and information will feed into the end of year accounts.

**Level 1 ([1]–[2])****Overall impression: Basic**

Candidate provides a basic answer demonstrating limited knowledge and understanding of a project plan and its associated features outlined in the question.

Candidate may provide a basic explanation of how the project plan and its associated features could be applied at Harpers.

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

The organisation of the 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]–[4])****Overall impression: Good**

Candidate provides a good answer demonstrating good knowledge and understanding of a project plan and its associated features outlined in the question.

Candidate provides a good explanation of how the project plan and its associated features could be applied at Harpers.

Candidate makes good 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 so the intended meaning is clear.

**Level 3 ([5]–[6])****Overall impression: Excellent**

Candidate provides an excellent answer demonstrating excellent knowledge and understanding of a project plan and its associated features outlined in the question.

Candidate provides an excellent explanation of how the project plan and its associated features could be applied at Harpers.

Candidate makes excellent selection and use of an appropriate form and style of writing.

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

There is excellent use of specialist vocabulary.

Presentation, spelling, punctuation and grammar are used to a high standard so the intended meaning is clear.

[6]

14

7 (i) Explain what is meant by a data dictionary.

Explanation can include:

- A stored record of all the elements of the database
- i.e.:
  - Attribute/Field name
  - Data type
  - Field size
  - Format
  - Default value
  - Entity/table name
  - Identification of keys
  - Validation rules
  - Index(es)
  - Input masks

Example:

- Entity name: CUSTOMER
- Sample Field, data type, key: CustNo, INT, PRIMARY KEY

[1] description with named element

[1] suitable example

[2]

(ii) Explain what is meant by data redundancy.

Explanation can include:

- Data redundancy is a data organisation issue that allows the **unnecessary** duplication of data.
- A change or modification, to redundant data, requires that changes are made to multiple fields of a database.
- The data relationships should allow maintenance of a single data field, at one location, and make the database's relational model responsible to port any changes, to that data field, across the database.
- Redundant data wastes valuable space and creates problems with database maintenance. Normalisation is a method of organising data to prevent redundancy.

[1] suitable explanation

[1] suitable example

[2]

(iii) Explain what is meant by data integrity.

Explanation can include:

- Data integrity is the overall completeness, accuracy and consistency of data.
- This can be indicated by the absence of alteration between two instances or between two updates of a data record, meaning data is intact and unchanged.
- Data integrity is usually imposed during the database design phase through the use of standard procedures and rules.

- It is maintained through the use of various error-checking methods and validation procedures.

Example:

All records of payments need to reflect reality, including accurate deposits and any calculations made to determine overall price.

[1] suitable explanation

[1] suitable example

[2]

AVAILABLE  
MARKS

6

## Normalisation

AVAILABLE  
MARKS

8 (a) 1NF:

### ORDER

OrderNo, OrderReceived, OrderFor, CustID, CustFname, CustSname,  
CustAddComp, CustTel, PaidYN, CollectedYN

[1] Correct order details and atomic values included

### ORDER\_ITEM

OrderNo\*, ItemID, Desc, ItemCost

[1] Correct Item details

[1] Composite Key

### ORDER\_ITEM\_SEQ

OrderNo\*, ItemID\*, SeqNo, Qty

[1] Correct Sequence details

[1] Composite Key

### ORDER\_ITEM\_SEQ\_FILLING

OrderNo\*, ItemID\*, SeqNo\*, FillingID, FillingCost (accept Filling)

[1] Correct Filling Details

[1] Composite Key

[1] For any two correct foreign keys across INF (must be distinct) [8]

(b) 2NF:

**ORDER** – Same

### ORDER\_ITEM

OrderNo\*, ItemID\*

[1] New foreign key

### ITEM

ItemID, Desc, ItemCost

[1] Correct fields in new Item table, including PK

**ORDER\_ITEM\_SEQ** - Same

### ORDER\_ITEM\_SEQ\_FILLING

OrderNo\*, ItemID\*, SeqNo\*, FillingID\*

[1] New foreign key

**FILLING**

FillingID, FillingCost

[1] Correct fields in new Filling table, including PK

[4]

(c) 3NF:

**ORDER**

OrderNo, OrderReceived, OrderFor, CustID\*, PaidYN, CollectedYN

[1] New foreign key

**CUSTOMER**

CustID, CustFname, CustSname, CustAddComp, CustTel

[1] Correct fields in new table including PK

[2]

AVAILABLE  
MARKS

14

SQL

AVAILABLE MARKS

- 9 (a) CREATE TABLE CAKEORDERDETAILS(  
 cakeOrderID INT FOREIGN KEY REFERENCES  
 CAKEORDER(cakeOrderID),  
 cakeTypeID INT FOREIGN KEY REFERENCES CAKETYPE(cakeTypeID),  
 noLayers INT NOT NULL)
- [1] CREATE TABLE  
 [1] FK for cakeOrderID  
 [1] FK for cakeTypeID  
 [1] noLayers INT [4]
- (b) (i) Only those cakes that have decoration added will be returned [1]
- (ii) LEFT/RIGHT/Outer JOIN [1]
- (c) SELECT co.CustID, CustSName, CustFName, CustTel, orderStaffID,  
 collectedStaffID, cakeType, occasion, writing, decoration
- FROM CAKEORDER co
- join Customer c on co.CustID = c.CustID  
 join CAKEORDERDETAILS cod on co.cakeOrderID = cod.cakeOrderID  
 join CAKETYPE ct on cod.cakeTypeID = ct.cakeTypeID  
 join OCCASION o on co.occasionID = o.occasionID  
 outer join CAKEORDERDECOR codr on co.cakeOrderID = codr.  
 cakeOrderID
- where dateRequired = cast(getdate() as date)
- [1] SELECT includes CustSName, CustFName, collectedStaffID, cakeType,  
 occasion  
 [1] for **each** table that fields are taken from in SELECT (max[3])  
 [1] FROM  
 [1] for **each** of three joins (ignore order and join type)  
 [1] WHERE  
 [1] dateRequired  
 [1] cast(getdate() as date) (accept getDate()) [11]
- (d) Cakes with more than one type in the current year, ordered by month
- SELECT co.cakeOrderDate, cod.cakeOrderID, COUNT(cod.cakeTypeID) as  
 Type  
 FROM CAKEORDERDETAILS cod  
 JOIN CAKEORDER co ON cod.cakeOrderID = co.cakeOrderID  
 WHERE YEAR(cakeOrderDate) = YEAR(Getdate())  
 GROUP BY co.cakeOrderDate, cod.cakeOrderID  
 HAVING COUNT(cod.cakeTypeID)>1  
 ORDER BY DATEPART(month, co.cakeOrderDate)

- [1] SELECT includes dateRequired/cakeorderDate
- [1] Count of Types in SELECT
- [1] FROM or Correct JOIN
- [1] WHERE uses YEAR for OrderDate
- [1] Correct GROUP BY
- [1] Correct HAVING
- [1] Correct ORDER BY (must include month cost)

[7]  
**Total**

AVAILABLE MARKS
24
<b>100</b>