Software Systems Development

Unit A2 1

Systems Approaches and Database Concepts

[A2S11]

MONDAY 16 MAY, 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.

1 Project Initiation

Reasons may include: decreasing the rest of operations/increasing efficiency; increasing customer base and revenue; embracing new technologies to increase competitive advantage; comply with increasing business/legal regulations; improve security and access; provide management information for strategic decision making. Support with examples.

Level 1 ([1]–[2])
Overall Impression: Basic
Candidate provides a basic answer demonstrating simple knowledge of the reasons for project initiation in Harris Electrical.
Candidates poorly describe a limited range of reasons for project initiation.
Candidate provides a limited number of poor examples relevant to Harris Electrical.
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 reasons for project initiation in Harris Electrical.
Candidates describe a range of reasons for project initiation.
Candidate provides some examples relevant to Harris Electrical.
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 reasons for project initiation in Harris Electrical.
Candidates clearly describe a good range of reasons for project initiation.
Candidate provides some good examples relevant to Harris Electrical.
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.

Other valid answers will be given credit. [0] awarded for a response not worthy of credit.
[AO1, AO3]   [6]   6

2   Methodologies

Examples of possible student answers are given below. Only one statement necessary for the award of one mark. Several statements are given as possible answers worthy of merit.

DSDM	
Techniques	**Justification**
Timeboxing: an agreed fixed period of time in which a task/goal or product must be produced with specified resources.	Delivers project on time by varying the number of requirements but not quality. Jack Harris has limited time and money for the implementation of the project and this will help to ensure that it is delivered on time and within budget.

XP	
Techniques	**Justification**
Pair Programming: All code is produced by two people working on one task on one workstation. One programmer has control over the workstation and is thinking about coding in detail. The other programmer is focused on the big picture and continually reviews the code. They swap roles periodically.	Focus on quality of code; fewer errors – testing performed by another person; easy access to support and help. The business needs error free software in order to operate successfully.

All other valid answers will be given credit.

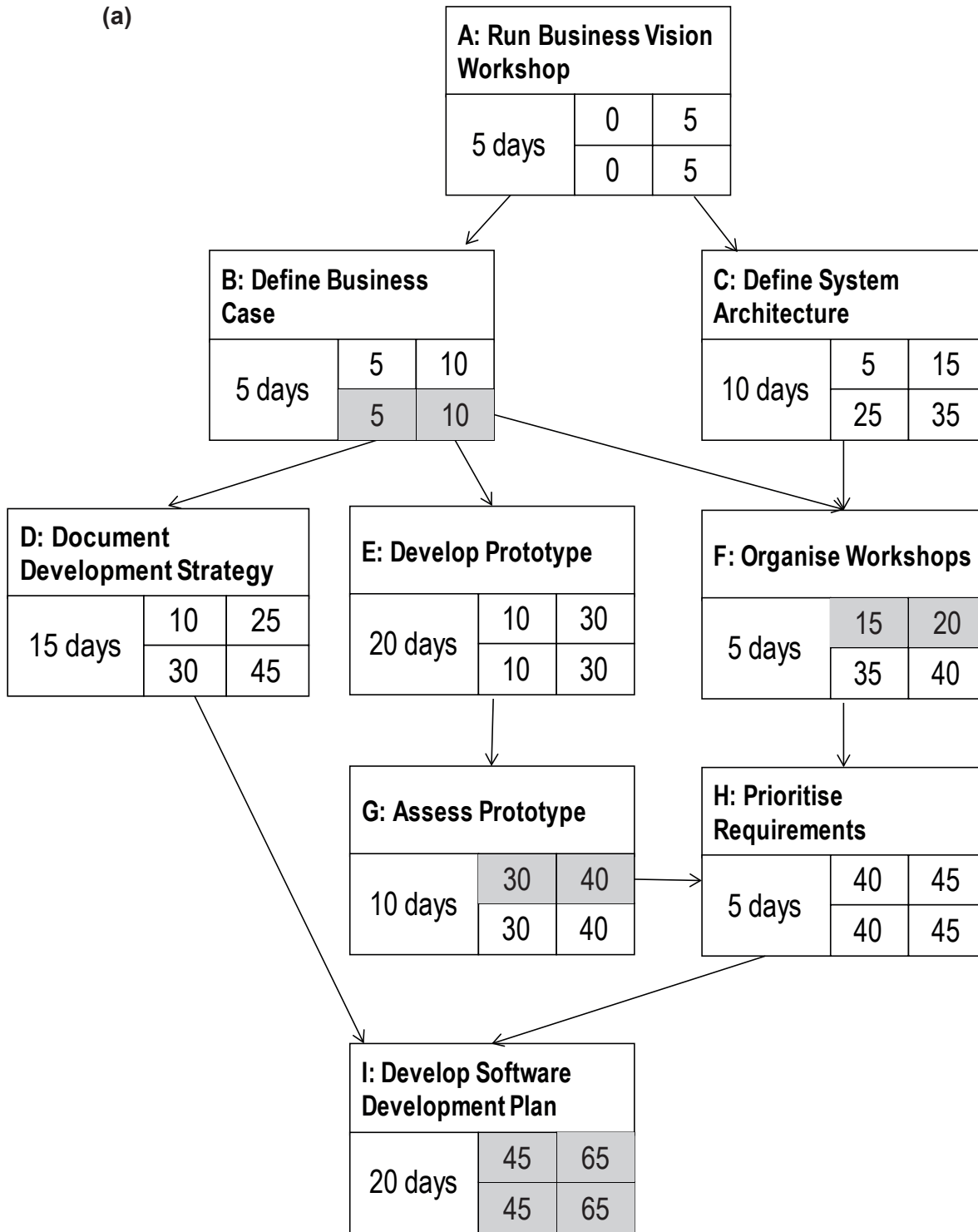[AO1], [AO3] [1] x 2 Techniques and [1] x 2 Justifications   [4]

4

3 Scheduling

(a)

A: Run Business Vision Workshop		
5 days	0	5
	0	5

B: Define Business Case		
5 days	5	10
	5	10

C: Define System Architecture		
10 days	5	15
	25	35

D: Document Development Strategy		
15 days	10	25
	30	45

E: Develop Prototype		
20 days	10	30
	10	30

F: Organise Workshops		
5 days	15	20
	35	40

G: Assess Prototype		
10 days	30	40
	30	40

H: Prioritise Requirements		
5 days	40	45
	40	45

I: Develop Software Development Plan		
20 days	45	65
	45	65

[AO2] [1] x 5   [5]

(b) Float: time an activity can be delayed from its earliest start without delaying project completion [1]
(Example: Activity D has a float of 20 days [1] or alternative example)

(c) A, B, E, G, H, I [1]

(d) Project duration: **5 days earlier** [1]
as it is on Critical Path [1]

10

4   Problems and Solutions

Problem	How a database solution resolves issue
Limited and disorganised storage of customer data.	Create a single customer table with a primary key and defined fields to hold individual data with data types.
Inconsistent stock information in two spreadsheets.	Create a stock system with concurrent access of a centralised database by multiple users.
Limited access to stock information except through secretary.	A database server that can be accessed by geographically distributed user software.
Staff do not record required information.	Use forms with prompts/reminders for inserting information and field validation.
Poor scheduling and allocation of jobs.	Provide management reports showing the utilisation of staff. Select available staff for job scheduling.

[AO3] [1] × 5 Solutions   [5]

5

All other valid answers will be given credit.

5   Analysis with UML

Answers may cover the areas and points below. Students are not expected to provide all the information below for full marks; they may cover some areas in more or less depth.

UML Diagrams	Discussion	Selected Examples
Overall	The Unified Modelling Language is a visual language which is used to develop models of a system. Informal and incomplete diagrams are often hand-sketched on whiteboards in client workshops to capture ideas and requirements in a simple fashion. These are developed into detailed design diagrams at a later stage. No reference yet made to software classes/components.	Diagrams: Use case, sequence, class, state, collaboration, package, deployment, etc.
Use Case	Collections of textual stories or scenarios that describe how an actor interacts with a system to meet goals resulting in either success or failure; describe the functional requirements of a system; specify what the system should do, not how.	The Secretary is an actor who needs to manage reminders (the use case). They expect the system to print out reminders for overdue invoices.
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.	The sequence diagram is for the use case manage reminders and it shows how the invoice and customer objects interact over time by passing messages – such as getCustName().
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.	The objects that are in the sequence diagram are shown in the class diagram. For example the Invoice object has attributes of InvoiceNo, InvoiceDate and ReminderDate and operations called manageReminder() and printReminder(). These operations are called in the sequence diagram.

Level 1 ([1]–[3])
Overall Impression: Basic
Candidate provides a basic answer demonstrating simple knowledge of the use of UML diagrams during analysis.
Candidates discuss a limited range of UML diagrams in little depth.
Candidates include few or no examples relevant to the Manage Reminders Use Case to support their answer.
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 ([4]–[7])
Overall Impression: Good
Candidate provides a good answer showing a reasonable understanding of use of UML diagrams during analysis.
Candidates discuss a range of UML diagrams and some of their components, possibly indicating the role of UML in the analysis stage.
Candidates include some examples relevant to the Manage Reminders Use Case to support their answer.
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 ([8]–[10])
Overall Impression: Excellent
Candidate provides an excellent answer showing thorough understanding of use of UML diagrams during analysis.
Candidates discuss the role of UML in the analysis stage.
Candidates discuss a good range of UML diagrams and some of their components, possibly even giving an indication of how they interconnect.
Candidates include a good selection of some examples relevant to the Manage Reminders Use Case to support their answer.
The candidate makes a reasonable selection and use of an appropriate form and style.
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.

[AO1, AO3]   [10]   10

6   Data Modelling and ER Modelling

(a)

objects
cardinality
one-to-one
one-to-many
many-to-many
unnormalised
repeating
partial
composite
transitive

[AO1] [1] x 10 Blanks   [10]

(b)   Data Dictionary

TABLE	Primary Key	Foreign Key/s	Two examples of additional fields
STAFF	StaffID	None	Surname
			StartDate
STOCK	StockNo	None or SupplierID	Description
			UnitCost
CUSTOMER	CustomerNo	None	FirstName
			MobileNumber
REPAIR	RepairNo	CustomerNo	Description
			Date Received
JOB	JobNo	StaffID, RepairNo	JobDate
			JobDescription
STOCKINJOB	Composite key JobNo StockNo *	JobNo StockNo	Quantity
			Date completed

[AO2, AO3] [1]
STOCK [1] each Primary/Foreign Key
REPAIR [1] for 2 correct fields
JOB [1] both correct Foreign Keys
STOCKINJOB [1] both correct Foreign Keys
[1] 2 correct fields
[2] correct composite key
* StockInJobNo allowed   [8]
All other valid answers will be given credit.

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7   Testing

(a) (i) • White box testing involves examining code/analysing algorithms – compared to looking at inputs and outputs only.
   • White box testing needs a programmer with knowledge of the coding – users can even perform black box testing.
   • Mainly applied only at unit testing - black box which is often used at all levels.

[AO3] [1] x 2 differences   [2]
All other valid answers will be given credit.

(ii) • The exact code error can be pinpointed for later correction.
   • Inputs can be designed to execute every line of code/paths of execution.

[AO3] [1] x 1 advantage   [1]
All other valid answers will be given credit.

(iii) • Discovers missing functionality.
   • Can help with user acceptance of the product.
   • Considers unexpected input not considered by programmers.

[AO3] [1] x 1 advantage   [1]
All other valid answers will be given credit.

(b)

Test Data	Reason for Test Data	Expected Result
Invoice 1 – invoice date less than 2 weeks	To ensure that Invoice 1 is not selected.	Invoice 1 should be ignored.
Invoice 2 – invoice date over 2 weeks and less than 6 weeks, reminder date already recorded	To ensure that multiple reminders are not sent.	Invoice 2 should be ignored.
Invoice 3 – invoice over 2 weeks and payment date recorded	To ensure that a reminder is not sent as it is paid.	Invoice 3 should be ignored.
Invoice 4 – invoice date over 2 weeks, payment date and reminder date not recorded	To ensure that Invoice 4 is selected for update of reminder.	Reminder date set as current date and reminder issued.
Invoice 5 – invoice date over 6 weeks, payment date not recorded, reminder date not updated to final reminder date	To ensure final reminder sent.	Reminder date updated as current date and final reminder sent.

[AO1, AO3] [1] x 8   [8]   12
[2] marks allocated for a suitable date condition well supported by a reason for test data and expected result.
All other valid answers will be given credit.

8   Normalisation

Answer shows each field identified with the first letter of each word/part of word and # to stand for number or ID. Foreign keys are represented with *. Repeating groups are contained within {}. Students may name the tables differently and use different notation.

Unnormalised Table: InternalOrder (<u>O#</u>, OD, C#, CN, CA, CT, {S#, D, Q, UC}, DP)

1st Normal Form [Remove Repeating Groups – in {}]	**2 tables, 2 primary keys, 1 foreign key** **InternalOrder** (<u>O#</u>, OD, C#, CN, CA, CT, DP) **OrderLine** (<u>O#*</u>, <u>S#</u>, D, Q, UC)	[1] for removing Orderline fields in InternalOrder Table and inserting into OrderLine Table. [1] for identifying primary key of Internal Order. [1] for identifying primary and foreign keys in OrderLine.
2nd Normal Form [Remove Partial Dependencies].	**3 tables, 3 primary keys, 2 foreign keys** **InternalOrder** (<u>O#</u>, OD, C#, CN, CA, CT, DP) **OrderLine** (<u>O#*</u>, <u>S#*</u>, Q) **Stock** (<u>S#</u>, D, UC)	[1] for removing Stock fields in OrderLine Table and inserting into Stock table. [1] for identifying primary key in Stock table. [1] Associated foreign key in OrderLine.
3rd Normal Form [Remove Transitive Dependencies].	**4 Tables, 4 primary keys, 3 foreign keys** **InternalOrder** (<u>O#</u>, OD, C#*, DP) **OrderLine** (<u>O#*</u>, <u>S#*</u>, Q) **Stock** (<u>S#</u>, D, UC) **Customer** (<u>C#</u>, CN, CA, CT)	[1] for removing Customer fields in InternalOrder and inserting into Customer Table. [1] for identifying primary key in Customer table. [1] Associated foreign key in InternalOrder.

All parts [AO2]   [9]   9

9 SQL

```
CREATE Table SALESLINE
(
    SalesNo INT  NOT NULL
    ,StockID INT  NOT NULL
    ,Quantity INT  NOT NULL
    ,PRIMARY KEY(SalesNo, StockID)
    ,FOREIGN KEY(SalesNo) REFERENCES Sales
    ,FOREIGN KEY(StockID) REFERENCES Stock
)
```

[1] Column names and data type
[1] NOT NULL on all column names provided
[1] PRIMARY KEY
[2] FOREIGN KEYS (needs (SalesNo) and (StockID) in MySQL)

[AO2]   [5]


```
SELECT stock.StockID, description, quantity
FROM STOCK INNER JOIN SALESLINE
        ON STOCK.StockID =SALESLINE.StockID
        INNER JOIN SALES
        ON SALESLINE.SalesNo=SALES.SalesNo
        INNER JOIN LOCATION
        ON SALES.LocationID=LOCATION.LocationID
WHERE locationname='Outlet'
        AND salesdate='2016/01/29'
        AND salestime BETWEEN '13:00' AND '15:00'
```

[1]   SELECT statement
[1]   INNER JOIN SALESLINE
[1]   INNER JOIN SALES
[1]   INNER JOIN LOCATION
[1]   WHERE locationname criteria
[1]   AND salesdate criteria
[1]   AND salestime criteria

[AO2]   [7]


```
UPDATE STOCK
SET price=price*1.1
```

[1]   UPDATE STOCK
[1]   SET price=price*1.1

[AO2]   [2]

```
SELECT StaffID, COUNT(SalesNo) FROM Sales
    GROUP BY StaffID
    HAVING COUNT(SalesNo)>1000
    ORDER BY COUNT(SalesNo) DESC
```

[1]   SELECT statement
[1]   GROUP BY statement
[1]   HAVING statement
[1]   ORDER BY statement

[AO2]   [4]   18

10 SCRUM

Answers may cover the areas and points below. Students are not expected to provide all the information below for full marks; they may cover some areas in more or less depth.

Process Element	Characteristics	Justification
Product Backlog	Ideas/vision of customer transformed into a tangible set of features/user stories (may also contain issues, bugs or technical tasks). Prioritised and dynamic.	Product owner in charge – allowed to remove/add/update – sense of ownership/control/involvement. More likely to meet needs.
Sprint Backlog	Features selected from Product Backlog to be included in the sprint. Breaks down user stories into manageable blocks of work.	Will work on and deliver the important features first -deemed to be most beneficial to the owner.
Sprint	1 week - month. Time-boxed. Burndown Charts. 4 MAIN EVENTS: • Sprint Planning: team meets with the product owner to select set of features that will be delivered during a sprint. • Daily Scrum – 15 min stand-up – same time same place – What have I done, what am I going to do, what problems do I have. • Sprint Review and Demo – working product shown to product owner. • Sprint Retrospective – inspect and adapt process – people, relationships, tools. Everyone speaks. Suggest improvements.	More likely on time and to budget. Good feedback, collaboration and communication. Problem solving. Reflection and improvements suggested to process.
Usable Increment	Release of usable product.	The users can see, use and test part of the overall system and begin to gain immediate benefits. Tangible milestones showing progress.

Level 1 ([1]–[2])
Overall Impression: Basic
Candidate provides a basic answer demonstrating simple knowledge of the SCRUM process.
Candidates briefly describe some elements of the SCRUM process.
Candidates provide little or no justification for using SCRUM in the Harris Electrical project.
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]–[5])
Overall Impression: Good
Candidate provides a good answer showing a reasonable understanding of use of the SCRUM process.
Candidates describe several elements of the SCRUM process and some events within the sprint.
Candidates provide some justification for using SCRUM in the Harris Electrical project.
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 ([6]–[8])
Overall Impression: Excellent
Candidate provides an excellent answer showing thorough understanding of use of the SCRUM process.
Candidates describe most elements of the SCRUM process in depth and most events within the sprint.
Candidates provide a good justification for using SCRUM in the Harris Electrical project.
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.

[AO1, AO3]   [8]

8

Total   **100**