



Rewarding Learning

ADVANCED

General Certificate of Education

2016

Centre Number

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Candidate Number

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Software Systems Development

Unit A2 1

Systems Approaches and Database Concepts



A2S11

[A2S11]

MONDAY 16 MAY, AFTERNOON

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page. This paper is accompanied by a Pre-release Case Study. You must **not** use your own annotated copy of this Case Study. Write your answers in the spaces provided in this question paper. Answer **all ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100. Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question. Quality of written communication will be assessed in questions **1, 5 and 10**.

For Examiner's use only			
Question	Marks available	Marks	Remark
1	6		
2	4		
3	10		
4	5		
5	10		
6	18		
7	12		
8	9		
9	18		
10	8		
Total	100		

- 2 Adam is considering DSDM and XP as possible methodologies to use in the development process at Harris Electrical. He has identified one technique associated with each methodology.

Explain each technique and justify its application at Harris Electrical.

DSDM

Technique – Timeboxing

[2]

XP

Technique – Pair Programming

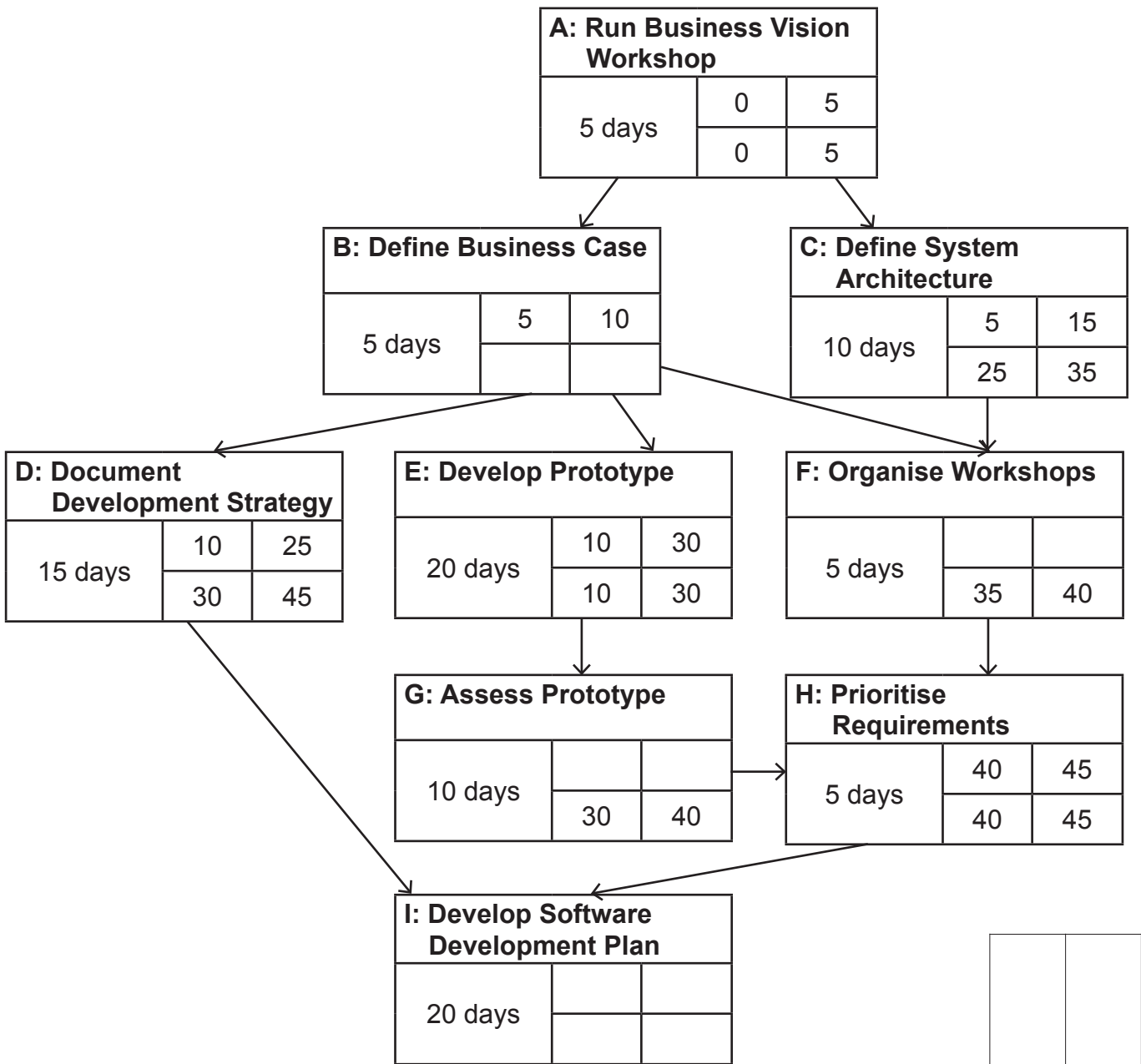
[2]

Examiner Only	
Marks	Remark

3 Pauline, the Project Manager, has started the creation of a PERT chart for the Harris Electrical project.

Examiner Only	
Marks	Remark

(a) Complete her partial PERT chart below:



[5]

(b) Explain the term FLOAT, illustrating your answer with an example from the PERT chart above.

[2]

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(c) Identify the critical path in the PERT chart.

[1]

(d) Explain the impact on the project of reducing the duration of Activity G by 5 days.

[2]

Examiner Only	
Marks	Remark

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- 4 Following fact finding, Adam has identified some problems and their possible resolution with the implementation of a database solution. Complete the table below.

Problem	How a database solution resolves issue
	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.	
	A database server that can be accessed by geographically distributed user software.
Staff do not record required information.	
	Provide management reports showing staff utilisation. Select available staff for job scheduling.

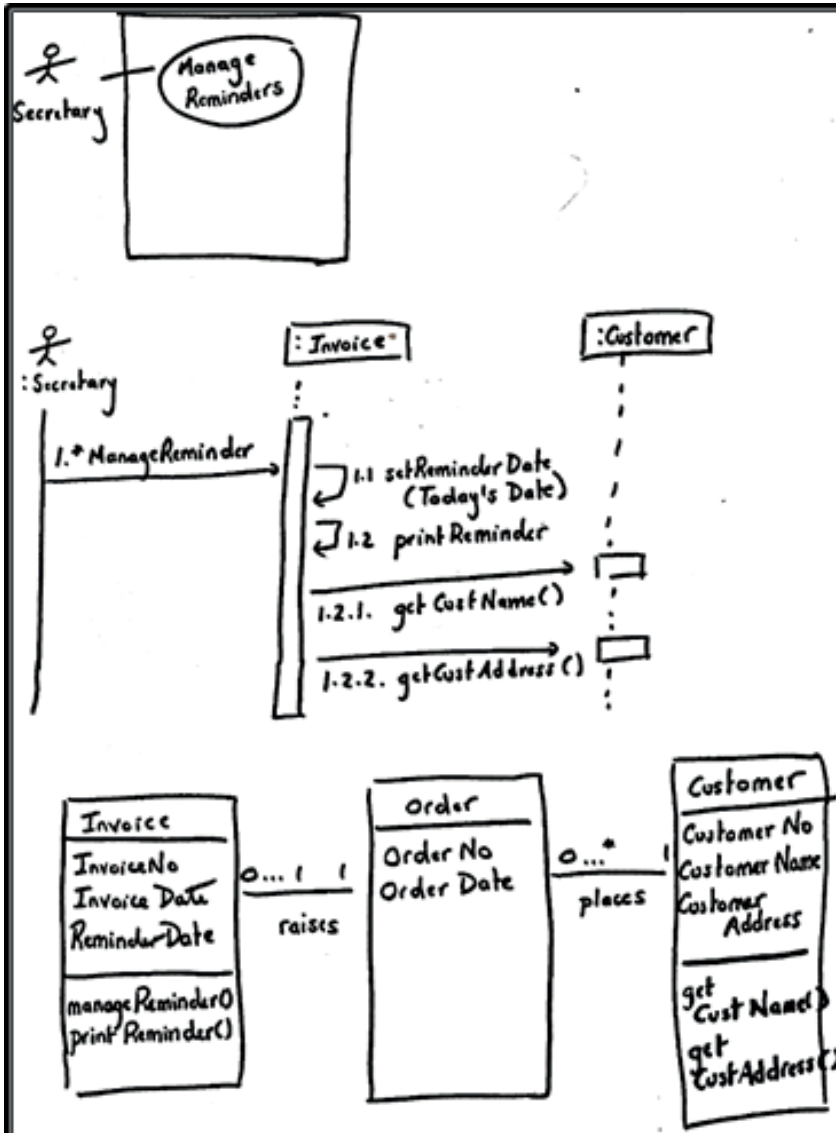
[5]

Examiner Only	
Marks	Remark

5 During the analysis phase of the development Adam sketches Unified Modelling Language (UML) diagrams on a whiteboard. He records these diagrams using a digital camera. One of his initial photographs is shown below.

Discuss the role of UML diagrams during the analysis phase at Harris Electrical. Support your answer with examples from the photograph below.

Photograph of whiteboard



PARTIAL
USE CASE

SEQUENCE

CLASS

Source: Principal Examiner

Examiner Only	
Marks	Remark

6 (a) Complete the paragraphs below by selecting the correct words or phrases from the selection provided.

- | | | |
|--------------|--------------|--------------|
| cohesiveness | repeating | strength |
| one-to-one | foreign | partial |
| cardinality | zero-to-many | one-to-many |
| redundant | unnormalised | normalised |
| rogue groups | temporary | composite |
| transitive | objects | tables |
| unique | primary | many-to-many |

Entity-Relationship modelling is a top-down data-modelling process. An entity is a set of _____ or concepts about which data is stored. A relationship is a meaningful association between two entities.

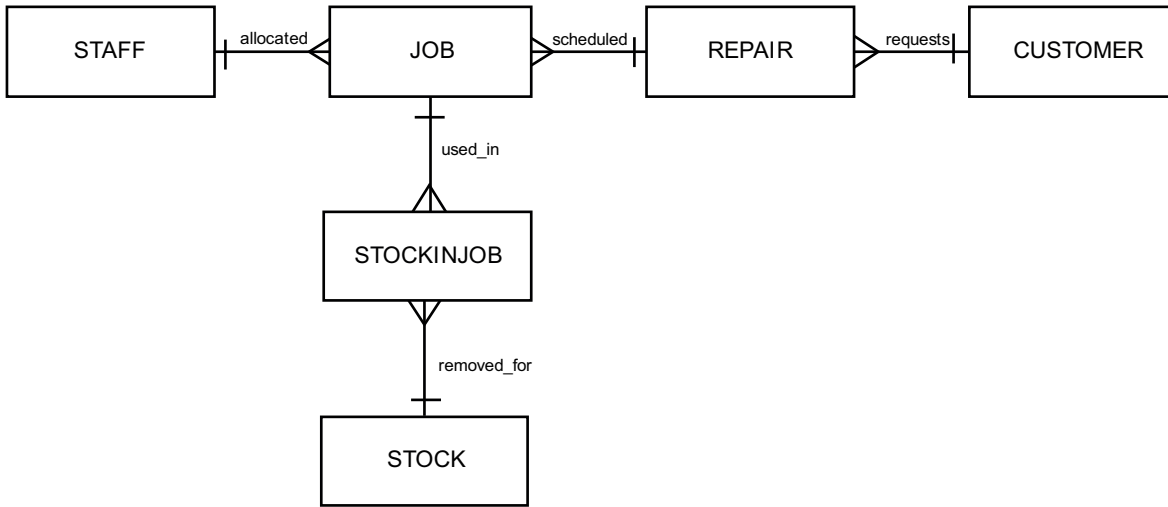
The _____ of a relationship may be _____ (e.g. 'Order raises Invoice'), _____ (e.g. 'Customer places Order') or many-to-many (e.g. 'Job uses Stock'). When designing tables for a relational database _____ relationships should be decomposed into two one-to-many relationships.

Normalisation is a formal bottom-up process. One large _____ table is created containing fields identified from business documentation. The table is split over a series of steps into smaller tables linked with primary and foreign keys. To achieve first normal form _____ groups (more than one value in cell) are removed. For second normal form _____ dependencies are removed; these are only present in tables with a _____ primary key. In third normal form _____ dependencies are removed; these involve fields which can be determined by other fields which are not part of the primary key.

[10]

Examiner Only	
Marks	Remark

(b) Adam has mapped part of his ER model to a relational database. He begins to define the tables and fields in a data dictionary.



Complete the data dictionary below by identifying the missing keys and additional fields.

DATA DICTIONARY

TABLE	Primary Key	Foreign Key/s	Two examples of additional fields
STAFF	StaffID	None	Surname
			StartDate
STOCK			Description
			UnitCost
CUSTOMER	CustomerNo	None	FirstName
			MobileNumber
REPAIR	RepairNo	CustomerNo	
JOB	JobNo		JobDate
			JobDescription
STOCKINJOB			

[8]

Examiner Only	
Marks	Remark

7 (a) Adam wishes to compare white box testing to black box testing.

(i) Describe **two** main differences between white box and black box testing.

Difference 1

_____ [1]

Difference 2

_____ [1]

(ii) Give **one** advantage of white box testing.

_____ [1]

(iii) Give **one** advantage of black box testing.

_____ [1]

Examiner Only	
Marks	Remark

(b) Adam considers the requirements for testing the management of invoice reminders. He must test the selection of appropriate invoices by designing test data for the following invoice fields:

- date invoice issued;
- date reminder sent;
- date payment received.

Complete the table below identifying clearly the additional invoices required for the minimum test data. Include your reason for the test data and your expected result.

Test Data	Reason for Test Data	Expected Result
Invoice 1 – invoice date less than 2 weeks old.	To ensure that invoice 1 is not selected.	Invoice 1 should be ignored.

[8]

Examiner Only	
Marks	Remark

- 8 Examine the Internal Spares Order Form used when customers want to order spare parts that are not stocked in the shop.

Harris Electrical Internal Spares Order Form				
Order No	<i>OR899</i>	Customer No	<i>CUST0011</i>	
Order Date	<i>24/01/2016</i>	Name	<i>George Goode</i>	
		Address	<i>73 Oak Heights, Belfast, BT35 7RT</i>	
		Telephone No	<i>02890555555</i>	
Stock ID	Description	Quantity	Unit Cost (£)	Total (£)
<i>FG88291</i>	<i>Grill Element</i>	<i>1</i>	<i>70.50</i>	<i>70.50</i>
<i>GH66277</i>	<i>Door Seal</i>	<i>2 metres</i>	<i>10.00</i>	<i>20.00</i>
<i>GH67778</i>	<i>Thermostat</i>	<i>1</i>	<i>35.50</i>	<i>35.50</i>
			GRAND TOTAL (£)	<i>126.00</i>
			DEPOSIT PAID (£)	<i>20.00</i>
			TOTAL DUE (£)	<i>106.00</i>

Adam starts the normalisation process with a representation of the form and its data.
 Normalise the data in the following steps, identifying both the primary and foreign keys for each table.

(a) Transform the data into **first** normal form.

[3]

Examiner Only	
Marks	Remark

9 Five tables have been added to the database with the design specification below.

SALES	
Field	Data Type
<u>SalesNo</u>	INT
SalesDate	DATE
SalesTime	TIME
LocationID	INT
StaffID	INT

SALESLINE	
Field	Data Type
<u>SalesNo</u>	INT
<u>StockID</u>	INT
Quantity	INT

STOCK	
Field	Data Type
<u>StockID</u>	INT
Description	VARCHAR(30)
UnitCost	DECIMAL(5,2)
StockLevel	INT
Price	DECIMAL(6,2)

LOCATION	
Field	Data Type
<u>LocationID</u>	INT
LocationName	VARCHAR(20)
TelephoneNo	VARCHAR(15)

STAFF	
Field	Data Type
<u>StaffID</u>	INT
Surname	VARCHAR(30)
Forename	VARCHAR(30)
Position	VARCHAR(15)
Salary	DECIMAL(8,2)

Write a SQL script to:

- Create the SALESLINE table as shown above. Ensure that all fields have data;

[5]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Software Systems Development

Unit A2 1

Systems Approaches and Database Concepts

Case Study

[A2S11]

AVAILABLE TO CANDIDATES – WEDNESDAY 16 MARCH 2016

Pre-release Case Study

Instructions to Candidates:

The A2 1 Systems Approaches and Database Concepts examination is based on this pre-release Case Study.

You should familiarise yourself with the content of this pre-release Case Study.

You should not take this pre-release Case Study or any associated material into the examination with you.

A clean copy of this pre-release Case Study will be provided along with the question paper.

HARRIS ELECTRICAL

HARRIS ELECTRICAL is an electrical supply and repair business operating from two locations, one based in Armagh city centre and the other in an outlet in an industrial estate outside the city. The original business occupied the premises in the centre of town for many years but with changing customer requirements and parking restrictions, along with a business that was growing, the owner Jack Harris decided to expand outside of town.

The business sells electrical appliances, supplies spare parts and in more recent years has developed a very well established repair service. The repair aspect of the business has been extremely successful and there is an ever increasing, geographically dispersed customer base. Jack now employs eight fully trained engineers to conduct the repair aspect of the business alone. He has secured the repair franchise from several major companies and is keen to maintain and develop this part of the business. The engineers are fully utilised but are stretched to the limit given the area they are now required to cover.

Jack maintained all stock for the retail section of the business in the shop showroom in the centre of town for many years. However over the last three years, stock for all large items such as washing machines, dishwashers and fridges is stored in the outlet outside of town where there is much more space. He continues to stock smaller items like toasters, hair dryers and kitchen appliances in the city centre premises. Jack retains one display item of each of the larger products for sales purposes as well. There is also a small 'spares' section in the shop.

The city centre shop and the outlet are managed between Adam Hanna the Manager and Claire Forbes the Assistant Manager. Jack prefers both of these staff to be aware of the business practices at each location. However, recently Claire seems to be mostly located in the shop and Adam in the outlet. While this arrangement suits them both, each has their own idea about certain procedures and this has caused some difficulties.

There are three sales staff, two full-time and one part-time, in the city centre shop. The shop is open Monday to Thursday 9.00 am–5.30 pm, Friday 9.00 am–7.00 pm and on Saturdays 9.00 am–1.00 pm.

The outlet employs five staff members with two staff required for deliveries after 2 pm each day except Saturday. The outlet is open Monday to Friday, 9.00 am–6.00 pm and Saturday 9.00 am–1.00 pm.

Jack has two full time secretaries both based in the outlet.

HARRIS ELECTRICAL previously operated using a totally paper based approach. Stock lists were retained on paper and stock checks conducted manually on a weekly basis with reconciliation between orders, deliveries and sales done as often as possible. Jack used a diary system to record each of these. Only very basic customer information was recorded relating to sales of spare parts and appliances.

The same situation applied to repairs. Requests were accepted by telephone or in person and recorded in a diary. Engineers were allocated jobs as they were received with no attention paid to location or priority.

As the business grew, these procedures became inadequate and keeping everything up to date was extremely difficult.

Jack invested in two computers for the office staff two years ago, thinking that the problems arising in the business would be instantly resolved. He managed to get a friend to create a basic spreadsheet for all his stock items and attempted to record all sales and deliveries on a daily basis. However, this still depended on paper documents being used to record everything and then used for entering data onto the spreadsheet. Customer records were maintained in a Word document with limited organisation and few details. The spreadsheet was copied daily onto the two computers in the office so that either could be used. This compounded the problem as no one really knew which version was current throughout the day and major errors began to arise.

As the business grew this became virtually impossible to sustain and the stock records became hopelessly inaccurate.

At present when a customer buys spare parts in the shop, the sale is recorded on a 'spares' carbon copy sales book. The customer receives the receipt of sale carbon copy and the item. The duplicate carbon copies are collected for each day of the week and sent to the outlet so that items can be deducted from the totals on the spreadsheet for individual items. A till receipt is also issued for the customer and a copy of this on the till roll is used for reconciliation of cash and sales at the end of each day at both locations. If the shop does not have the item available and the customer is prepared to wait, then the item is recorded on an internal spares order form so that it can be obtained from the outlet for the customer to collect at the shop. The customer should pay a deposit but this does not always happen and indeed it is often not recorded on the form. Customers will sometimes pay fully in advance. Deposits and payments are marked on the internal spares order form and the details transcribed onto an internal delivery docket that should be returned to the shop with the ordered items. This does not always happen and can lead to disputes regarding balances due. The internal spares order forms should be collected and dealt with on a daily basis so that a customer in town should not have to wait longer than 24 hours for the item. Sometimes customers order the item through the shop and then decide to collect it themselves at the outlet. This really does cause problems as on many occasions the staff at the outlet think that it is just an ordinary sale and the internal spares order form is not returned to the shop marked as complete.

When a customer wishes to buy an item stocked in the shop, there is no issue if it is available. The same procedure is followed for the spare parts. The sale is recorded on an 'appliance' carbon copy sales book. The customer receives the receipt of sale carbon copy and the item. A till receipt is also issued and reconciled in the same way as for the spare parts at the end of the day. The sales copies are sent with the other documents to the outlet for processing on a daily basis. If an item is not available then again an internal item order form is raised and processed in the same way as for the spares. Again, customers must pay a deposit, or if they wish, the full amount for the item. Similar problems arise regarding payments and this is extremely difficult to manage.

Items ordered using the internal ordering system are delivered on a next day basis with a delivery docket attached. Customer details from the internal item order forms are transcribed onto the delivery dockets. This is not at all reliable. On many occasions items arrive at the shop with no documentation at all or with illegible detail and often no mention of deposits or payments.

There is no way of knowing what is actually in stock at the outlet unless phone calls are made. The secretaries are not always available to take calls and can only check stock from the last entry in the spreadsheet. This is highly unsatisfactory.

The repair service is run from the outlet. When a customer requests a repair by telephone or in person, details are recorded in a 'repair' book. These details include the date and time of the call, the name, address and telephone number of the customer and the nature of the repair.

Repairs are scheduled by Jack or the Manager every morning and afternoon. Job sheets are issued with customer and job details included. Although every effort is made to react as quickly as possible to each request, it can sometimes be up to three days before some repairs are assessed. This is because of the sheer volume of work and the difficulty in prioritising and scheduling. Every repair has a basic call out fee of £30 even if no fault is found. Customers are required to pay this fee to the engineer regardless of the cost of the overall job.

When an engineer is assigned a job, he is given the job sheet. Based on the information in the job sheet, he may take stock from the store to enable completion of the job. Any stock removed should be recorded on a stock removal sheet and the sheet should be given to the secretary for update and billing purposes. This is not a reliable process and stock removal sheets are frequently not completed. If the engineer does not use the stock items, they are supposed to be returned and a stock returns form completed. For the engineers, this is all very tedious given their workload. The result is that the system is always behind and reordering from suppliers is haphazard resulting in over or understocking.

Engineers must submit the call out fee collected from customers so that this can be deducted from their final bills. It is extremely important that this is submitted along with the completed job sheet. Again, if there is no one available in the office, engineers sometimes leave the money on the desk and do not add a note of explanation. This is clearly unsatisfactory and can lead to confusion.

Customers are invoiced for payment for repairs as soon as they are completed. This process can be difficult because the warranty on items and insurance cover must be thoroughly validated before invoices can be sent out. Payments are reviewed on a weekly cycle. A customer who has not paid according to the terms of the invoice is sent a reminder after two weeks and if necessary, a final reminder after six weeks. After that time accounts are reviewed and legal action may follow.

It is clear to Jack that the business could run much more efficiently. He has contacted Alpha Consultancy for advice on the possible development of a new computer-based system.

Source: Chair of Examiners