Requirements Engineering
Exercises and Solutions
BCS Certificate in Requirements Engineering
Delegate Exercise Workbook

V7.6
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Section 1: Exercises

This set of exercises is designed to give you practice in the techniques explained in each session. In general they reflect the style and content of the BCS exam paper.
Case Study Scenario

Goatilicious, a small company based in Suffolk, has been making luxury goat milk ice cream for nearly ten years. Its owner and Managing Director, Warren Randall, runs the business from his farm where he and his staff rear the goats and make the ice cream which is sold to farm shops, delicatessens, restaurants and schools across the East of England.

The herd now comprises some 300 mainly Anglo-Nubian goats and is maintained by Head Goatherd, Malcolm Illingworth, and five other stock workers who also undertake the twice-daily milkings. Under the supervision of Production Manager, Rachel Scott, the team of ten food technicians manufacture the ice cream in over forty flavours (some as stock items and some made to order only) and package it in 5litre napolis, for serve-over counters, and retail tubs of 1litre and 500ml as well as ‘spoon in lid’ convenience tubs of 125ml. The ice cream is stored onsite in walk-in freezers at -29°C and, using the company’s own freezer vans, delivered to customers by the five drivers and Logistics Manager, Rhys Hawksby.

Ellie Martin (Office Supervisor) co-ordinates all of the company’s activities from the office onsite, where she and her two office staff process customer orders and invoices (and payments) and run the payroll as well as trying to keep on top of maintaining levels of consumables such as feed and bedding for the goats and the various added ingredients required to make the ice cream. Beyond a couple of simple spreadsheets and the COTS payroll system there is no automation in the office and, following the recent expansion of the company and in the light of Warren’s plans for the next year which include opening more channels to market and increasing sales by another 15%, Ellie has been expressing concerns over her team’s ability to cope.

Under some pressure from Ellie, Warren has agreed to look into the possibility of developing an integrated IT system to automate a lot of the office work and to assist with stock control (and, possibly, herd management). Having discussed this with the Management Team (MD, Production Manager, Logistics Manager, Office Supervisor), Warren has made a start on identifying requirements for the system but has quickly got out of his depth. He has decided to limit the system initially to handling customer orders and invoices and has now hired you as a Business Analyst to continue the work, known as the First Step project. The new system will need to take customer orders and produce invoices. It has occurred to Warren that it might drive up sales if customers could place orders online as well as by phone and this is now a top priority.

The requirements Warren has identified so far are:

1. All new customers need to be added to the system easily.
2. The system must record customer orders (not payments yet) up to about 50 per day. These need to be retained for five years.
3. Office staff can do 1. & 2. and so can customers themselves, via the website.
4. The system should generate (but not send) invoices automatically as orders are received.
5. Office staff (only) must be able to revise the details of an order and a new invoice should be generated as a result.
6. Weekly reports of unpaid invoices will be needed by the MD.
7. Office staff must be able to print invoices or email them to customers.
8. The Production Manager would like to be able to view all customer orders so that she can plan production.
9. It should be possible to vary the payment terms on the invoices
10. It all needs to interface with the payroll system (MD’s requirement)
Exercise 1 – Stakeholders and Elicitation Techniques

Introduction
As you will have seen from the course there are many methods available to us to approach requirements elicitation. Potentially we may also have dozens of stakeholders to talk to. The challenge is to optimise the interaction with each stakeholder by selecting an appropriate technique that will allow us to gather the information we require in the most efficient and effective way.

This exercise asks you to consider the stakeholders available to you at this stage and decide which techniques might be appropriate for gathering the information you might need.

Hint: thinking about what information you require (perhaps based on questions raised through reading the case study, may help your decision)

Having examined the initial requirements mentioned in the scenario you now have the opportunity to begin your investigation.

a) **Identify 5 stakeholders/groups of stakeholders** you think you would need to access

b) **Suggest suitable techniques** for eliciting and exploring their requirements, in each case **justify** your choice of stakeholder and elicitation technique.

15 marks

A sample answer can be found on the following page
## Sample Answer: Exercise 1 – Elicitation Techniques

<table>
<thead>
<tr>
<th>Role</th>
<th>Method</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD</td>
<td>Interview</td>
<td>Build rapport, set ToR and understand the objective. Explore the need for interface with payroll system. Investigate how he feels out of his depth and why the system should be limited to orders and invoices. Clarify the need for order retention for five years.</td>
</tr>
<tr>
<td>Office Supervisor</td>
<td>Interview</td>
<td>Understand her perspective and identify concerns over her team’s ability to cope. Ascertain what data is used. Investigate the need to vary payment terms.</td>
</tr>
<tr>
<td>Production Manager</td>
<td>Interview</td>
<td>Explore requirement 8: determine its priority and, if it is to be implemented, understand what information will be required and when, as well as how access should be provided.</td>
</tr>
<tr>
<td>Management Team and Head Goatherd</td>
<td>Workshop</td>
<td>Investigate requirements for communication between teams and impact of increased sales (milk volumes, manufacture, storage, distribution).</td>
</tr>
<tr>
<td>Office Staff</td>
<td>Workshop</td>
<td>Explore data entry requirements and usability constraints.</td>
</tr>
<tr>
<td>Office Staff</td>
<td>Observation</td>
<td>Determine the scope of the manual process and the use of the existing spreadsheets.</td>
</tr>
<tr>
<td>Office Staff and/or Office Supervisor</td>
<td>Prototype</td>
<td>Explore data entry requirements and usability constraints.</td>
</tr>
<tr>
<td>Production Manager</td>
<td>Prototype</td>
<td>Explore the information to be used in requirement 8.</td>
</tr>
<tr>
<td>Customers</td>
<td>Focus Group</td>
<td>Ensure we have a means of capturing and validating requirements and exchanging views with interested Customers.</td>
</tr>
</tbody>
</table>

NB: This list is not intended to be exhaustive.
Exercise 2 – Ticket Sales System

**Introduction**

When we first capture requirements, our focus is generally on gathering as much information as we can. It is likely therefore that when we sit down to analyse our requirements we will discover that we have a mix of requirements, perhaps some ambiguity and perhaps some functional and non-functional elements in one documented requirement.

The analysis phase allows us to refine our requirements into a set of clear, unambiguous, organised and sensible requirements which will ultimately help us to create a solution which fits the business needs.

This exercise looks at the set of draft requirements as shown below and where applicable separates out the different elements.

To get you started, here is an example:

- **Only registered loyalty members can access special offers on the system**

In this case there is a functional requirement: ‘…loyalty members can access special offers…’

This is a functional requirement because it is something the user needs the system to do for them and is a ‘read or retrieve’ requirement.

There is also a non-functional requirement: ‘Only registered loyalty members…’ can do this. This would fall under the ‘Access’ NFR category.

Hint: not every requirement contains both functional and non-functional elements. Some could be ‘pure’ functional or ‘pure’ non-functional requirements.

Below are some initial ‘raw’ requirements for an online ticket sales system (theatre, concert etc.).

**Identify any Functional and Non-Functional components in each sentence and, for the NFRs, state the category into which they fit.**

1. Users must be able to browse for events by name or date or venue.
2. Searching for events by keywords should also be possible.
3. User will select ticket price from those offered and also specify the number of tickets they require.
4. The system should display availability of the tickets within five seconds.
5. Users must be able to choose their seats and purchase tickets 24/7.
6. Only registered customers can buy tickets.
7. Daily reports of ticket sales must be generated. These must be retained for two years.
8. All data is to be backed up nightly.
9. It should not be possible to double-book tickets (i.e. buy a ticket that has already been sold).
10. Ad hoc reporting will be required, showing ticket sales over a week. It should be possible to vary that time span and look at any duration up to six months.

17 marks

A sample answer can be found on the following page
Sample Answer: Exercise 2 – Ticket Sales

1. Users must be able to browse for events by name or date or venue (FR).

2. Searching for events by keywords should also be possible (FR).

3. User will select ticket price from those offered and also specify the number of tickets they require (FR).

4. The system should display availability of the tickets (FR) within five seconds (NFR – performance).

5. Users must be able to choose their seats and purchase tickets (FR) 24/7 (NFR – availability).

6. Only registered customers (NFR – access) can buy tickets (FR).

7. Daily (NFR – availability) reports of ticket sales must be generated (FR). These must be retained for two years (NFR – archiving & retention).

8. All data is to be backed up nightly (NFR – backup).

9. It should not be possible to double-book tickets (i.e. buy a ticket that has already been sold) (NFR - robustness).

10. Ad hoc (NFR – availability) reporting will be required, showing ticket sales over a week (FR). It should be possible to vary that time span and look at any duration up to six months (FR).
Exercise 3 – Analysing Requirements

Introduction
As you have already seen, requirements when first captured can contain functional and non-functional elements. That’s not all: they can also contain ambiguity (vagueness), solutions (how the requirement should be implemented or managed) and conflicts (often where requirements disagree about scope).

This exercise asks you to consider the draft list and to identify the different elements as requested.

Another useful piece of information is to consider the objectives of the business. Understanding what the business is trying to achieve will be extremely helpful with negotiating and prioritising the requirements. Don’t worry about finding a SMART objective in this course, the idea is just to gain a general understanding of this to help your analysis.

Hint: not every requirement contains functional, non-functional, ambiguity, solutions and conflicting elements.
Also make sure you are clear which parts of the requirements are at fault.

The requirements Warren has identified so far are:

1. All new customers need to be added to the system easily.
2. The system must record customer orders (not payments yet) up to about 50 per day. These need to be retained for five years.
3. Office staff can do 1. & 2. and so can customers themselves, via the website.
4. The system should generate (but not send) invoices automatically as orders are received.
5. Office staff (only) must be able to revise the details of an order and a new invoice should be generated as a result.
6. Weekly reports of unpaid invoices will be needed by the MD.
7. Office staff must be able to print invoices or email them to customers.
8. The Production Manager would like to be able to view all customer orders so that she can plan production.
9. It should be possible to vary the payment terms on the invoices.
10. It all needs to interface with the payroll system (MD’s requirement).

3.1
Briefly summarise the Business Objectives relevant to the First Step project. 2 marks
(This step is intended to get you thinking about the business objectives/goals. Don’t worry about making them SMART)

3.2
Examine the initial set of requirements (above) and identify which of them (or which parts of them) are Functional and which are Non-Functional. For the NFRs identify to which category they belong.
Also highlight any ambiguity in the requirements and any solution language that may be present.
If any requirements appear to be in conflict with one another, document that too.
27 marks. A sample answer can be found on the following page
Sample Answer: Exercise 3 – Analysing Requirements

2.1
There would appear to be 2 main business goals:

1. Cope with an increasing workload (assumed on the basis of increasing sales).
2. Provide new channels to market, in particular customer self-service.

You may have other business objectives and/or different wording – you will not be required to identify business objectives in the exam but it does help get to grips with the overall aims of the organisation.

Also note that the business objectives are not formalised, and therefore not SMART.

2.2

1. All new customers need to be added to the system (FR) easily (NFR – usability). "Easily" is ambiguous – needs quantification.
2. The system must record customer orders (not payments yet) (FR) up to about 50 per day (NFR – capacity). "About" is ambiguous – 50 or not? These need to be retained for five years (NFR – archiving and retention).
3. Office staff can do 1. & 2. and so can customers themselves (NFR – access), via the website (solution).
4. The system should generate (but not send) invoices (FR) automatically (NFR - availability) as orders are received (NFR – availability).
5. Office staff (only) (NFR – access) must be able to revise the details of an order (FR) and a new invoice should be generated as a result (FR).
6. Weekly (NFR – availability) reports of unpaid invoices will be needed by the MD (FR). This is in conflict with requirement 2 – payments are not recorded. Also need to clarify ‘unpaid’ as all invoices start off as unpaid!
7. Office staff (NFR – access) must be able to print invoices (Solution) or email them (Solution) to customers.
8. The Production Manager (NFR – access) would like to be able to view all customer orders (FR) so that she can plan production. ‘All’ is ambiguous - as presumably would not need fulfilled orders; how far ahead would be useful?
9. It should be possible to vary the payment terms on the invoices (FR). Ambiguous – not clear what this means or why it is needed.
10. It all needs to interface with the payroll system (MD’s requirement) (FR). Particularly ambiguous – exactly what needs to interface with the payroll system and why?
Exercise 4 – Prioritising Requirements

**Introduction**
Prioritisation of requirements is another helpful tool. This exercise requires you to prioritise the requirements as they are (i.e. in their draft format).

The focus should be on the functional requirements but for clarity the NFR components have also been prioritised in the sample answer and it may help you to do the same.

You will not have to separate them out in the exam.

**It might though help to establish the overall priority if you at least consider the requirement in its entirety.**

Use *MoSCoW* to prioritise the requirements from Warren, following on from your analysis in Exercise 3.

Justify your decisions briefly.

20 marks

Notes:
1. FR and NFRs can be assessed individually for prioritisation.

A sample answer can be found on the following page
Sample Answer: Exercise 4 – Prioritising Requirements

The table below shows the requirements prioritised into their component parts. The focus should be on the functional requirements but for clarity you can see that the NFR components have also been prioritised.

You will not have to separate them out in the exam.

**It might though help to establish the overall priority if you at least consider the requirement in its entirety.**

<table>
<thead>
<tr>
<th>FR</th>
<th>Priority</th>
<th>Comment</th>
<th>NFR</th>
<th>Priority</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Add Customer</td>
<td>Must</td>
<td>Vital to be able to record orders against the customers</td>
<td>Easily</td>
<td>Must</td>
</tr>
<tr>
<td>2</td>
<td>Record Order</td>
<td>Must</td>
<td>This is the whole point of the system so it is a Must</td>
<td>50 per day Retain for 5 years</td>
<td>Must</td>
</tr>
<tr>
<td>3</td>
<td>This one must be prioritised against the NFR components</td>
<td>Must</td>
<td>Access for Office Staff</td>
<td>Access for Customers</td>
<td>Must</td>
</tr>
<tr>
<td>4</td>
<td>Generate Invoice</td>
<td>Must</td>
<td>Key contributor to the business objectives</td>
<td>Automatically, as orders are received</td>
<td>Could</td>
</tr>
<tr>
<td>5</td>
<td>Revise Order</td>
<td>Must</td>
<td>Orders will inevitably need changing, including cancellation</td>
<td>Office Staff only</td>
<td>Must</td>
</tr>
<tr>
<td>6</td>
<td>Report on unpaid invoices</td>
<td>Want</td>
<td>Can’t be done unless we increase the scope to include recording payments</td>
<td>Weekly</td>
<td>Can’t really classify the frequency as the main requirement is out of scope</td>
</tr>
<tr>
<td>7</td>
<td>Produce printed Invoice</td>
<td>Overall a Must</td>
<td>Minimum required in view of the business objectives</td>
<td>Office Staff</td>
<td>Must</td>
</tr>
<tr>
<td></td>
<td>Send Invoice to Customer</td>
<td>Should</td>
<td>Not vital via the system in the first release</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Requirements Engineering

<table>
<thead>
<tr>
<th>FR</th>
<th>Priority</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>View Customer Orders</td>
<td>Could</td>
</tr>
<tr>
<td>9</td>
<td>Vary Invoice terms</td>
<td>Want</td>
</tr>
<tr>
<td>10</td>
<td>Integrate with payroll</td>
<td>Want</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NFR</th>
<th>Priority</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Manager access</td>
<td>Could</td>
<td>Not clear why access to this report needs to be especially restricted.</td>
</tr>
</tbody>
</table>

Your assessments may be different to these, provided you justify your choices.

**Tip:** requirements language from the stakeholders often includes ‘must’, ‘should’ etc phrases, and these may indeed be their priorities.

The BA however during the work of refining the requirements should write the requirements in a way that doesn't imply a priority in the requirement's expression itself.

Thus for example requirement 2 which states 'The system *must* record customer orders ...' should be re-phrased as 'The system *will* or *shall* record customer orders ...' and then assign 'must' as the priority.

Another thing to note is that we are only picking out IT functionality; any non-IT requirements should be built into the Business Process specifications.
Exercise 5 – Document Management System

Introduction
Use Case diagrams are a really useful tool in checking the requirements. Using a diagram in this way is much more effective than loads of text.
This exercise asks you to consider some requirements and draw a use case diagram to reflect what is being requested.

Hint: ID the actors and what they need to do. Remember that a Use Case diagram shows functionality that users require from the system.

Some initial requirements for an online document management system have been captured below:

“The system must be available 24/7. Anybody will be able to browse the catalogue but will need to provide their membership details (user names and passwords) if they wish to download or upload documents. User names will usually be email addresses and passwords will be eight characters long. If the details do not match any existing members they will be given the opportunity to register. Users should also be able to register even when they do not want to download or upload. It should be possible for the admin team to cancel membership but members should not be able to do this themselves. The interface must comply with Disability Access legislation. A weekly report of all registered members must be produced.”

i. Identify the functionality required and draw a use case diagram to show this and the primary actors who will trigger each use case. (10 marks)

ii. Revise your diagram to show any <<include>> and <<extend>> (4 marks)

A sample answer can be found on the following page
Sample Answer: Exercise 5 – Document Management System

Part (i)

- Anybody will be able to browse the catalogue
- Shown as Public to Browse Catalogue. As Members can also be classified as ‘Anybody’ they too have access to Browse Catalogue.
- Admin will also have access to Browse Catalogue but this is not shown on the diagram
- If upload or download document is required then they will need to provide membership details
- Shown as Member to Download Document and Upload Document.
- If details do not match existing members they will be given the opportunity to register
- Not shown yet
- Users should be able to register when they don’t wish to upload or download
- Shown as Public to Register Member
- It should be possible for the admin team to cancel membership
- Shown as Admin Team to Cancel Membership
- A weekly report of all registered members must be produced
- Shown as Time to Generate Report
Part (ii)

Include:

- Every time a user wishes to upload or download a document they need to provide their membership details
- Member to Download Document and Upload Document, with include to Authenticate Member

Extend:

- If entered details don’t match existing members they will be given the opportunity to register
- The use case Authenticate Member is extended by Register Member on the condition that the user is not registered
Exercise 6 – Use Case Diagram

Introduction
Use Case diagrams are a really useful tool in checking the requirements. Using a diagram in this way is much more effective than loads of text.

This exercise asks you to consider some of the requirements from the case study and draw a use case diagram to reflect what is being requested.

Hint: ID the actors and what they need to do.
Remember that a Use Case diagram shows functionality that users require from the system.

Examining requirements 1 – 8 only, draw a use case diagram to summarise the functionality required and the actors who trigger each use case.

If you spot any opportunities for ‘includes’ or ‘extends’ then document them too.
12 marks

A sample answer can be found on the following page
Sample Answer: Exercise 6 – Use Case

1. All new customers need to be added to the system easily.
2. The system must record customer orders (not payments yet) up to about 50 per day. These need to be retained for five years.
3. Office staff can do 1. & 2. and so can customers themselves, via the website
   Shown as Customer and Office Staff and association to Record Order
4. The system should generate (but not send) invoices automatically as orders are received.
   Shown as include to Generate Invoice from Record Order
5. Office staff (only) must be able to revise the details of an order and a new invoice should be generated as a result.
   Shown as Office Staff to Revise Order and also include to Generate Invoice
6. Weekly reports of unpaid invoices will be needed by the MD
7. **Office staff must be able to print invoices or email them to customers.**
   Shown as Office Staff to Send Invoice (could also have split into Print Invoice and Email Invoice)

8. **The Production Manager would like to be able to view all customer orders so that she can plan production**
   Shown as Production Manager to View Customer Orders

Note: the links between the requirements and the use case are illustrative only. You will not be required to describe these.
Exercise 7 – At the Vet

Introduction
Class diagrams are another powerful tool in the Business Analyst's armoury.
This exercise asks you to consider the requirements listed and validate them against the class diagram.
Note that requirements can be either ‘supported’ or ‘not supported’.

Hint: remember the method for reading a class diagram and make a sentence from what you have in front of you.
You may find it beneficial to check each requirement against the class diagram in turn.

A Veterinary Surgery is implementing a new IT system.
Initial requirements have been captured and a data model produced.
Validate the class diagram against each requirement in turn and identify any requirements that are not fully supported, explaining the problem in each case.

1. Once animals are on the system any appointments they need can be booked.
2. The system must record the name and date of birth of the animal and the Vet that they will be seeing.
3. Vets often write prescriptions and the system must record the drug and quantity as well as the animal for which the drug is prescribed.
4. It should be possible to see which Vet wrote which prescription and when.

8 marks. A sample answer can be found on the following page.
Sample Answer: Exercise 7 – At the Vet

1. *Not Supported.* The diagram shows Animal associated with one or more Appointments. This means an Animal cannot be added to the database without at least one Appointment.

2. *Not Supported.* The class Animal is missing the attribute name. Appointment is associated with zero or more Vets. This means that one Appointment could be with several Vets or none, whereas the requirement suggests this should only be one.

3. *Supported.* The labels are confused here: Animals do not write Prescriptions! However, while this may affect our understanding of the diagram it does not actually affect the data. It is an error in the diagram but the requirement is still supported. It’s not a mandatory requirement to label relationships.

4. *Not Supported.* Even if we correct the labels, there is a problem here as Prescription may be associated with one or more Vets. A particular Prescription will be written by only one Vet, of course, so the multiplicity must be changed. In addition to this, we cannot know when the Prescription was written because the class has no suitable attribute.
Exercise 8 – Class Diagram

Introduction
Class diagrams are another powerful tool in the Business Analyst's armoury.

This exercise asks you to consider the requirements listed for the case study and validate them against the class diagram.

Note that requirements can be either 'supported' or 'not supported'.

Hint: remember the method for reading a class diagram and make a sentence from what you have in front of you.

You may find it beneficial to check each requirement against the class diagram in turn.

Hoping to raise the priority of herd management in Warren’s IT plans, Malcolm Illingworth (Head Goatherd) has drawn up some initial requirements and his daughter, who is studying the UML at school, has put together a class diagram that she believes will support them.

Warren has asked you to check that the data model does indeed support the requirements and to identify where – if at all – this is not the case.

The requirements are as follows:

1. We need to record the tag number, date of birth, date of purchase and breed of every goat.
2. Users must be able to set the status for each goat (details to follow).
3. The system needs to keep track of all matings: i.e. which female was mated with which male and on what date.
4. We need to know when male goats are transferred to another farm and which stock worker authorises the transfer.
5. A stock worker can authorise up to twelve goats per transfer.

10 marks. A sample answer can be found on the following page.
Sample Answer: Exercise 8 – Class Diagram and Requirements

1. Not Supported: **GoatFemale** is missing the attribute **breed**.

2. Not Supported: **GoatMale** is missing the attribute **status**.

3. Not Supported: “Which female was mated with which male” requires that a **Mating** is between one **GoatFemale** and one **GoatMale** but the diagram shows a **Mating** associated with many **GoatMales**. There is an additional problem in **GoatFemale** being associated with one or more **Matings**: this means a **GoatFemale** cannot be added to the database without at least one **Mating**.

4. Not Supported: We cannot know when goats are transferred without a **date** attribute for **Transfer**. The diagram allows for up to twelve **StockWorkers** per **Transfer**, so we cannot know which **StockWorker** authorises each **GoatMale**; limiting this to one **StockWorker** per **Transfer** would resolve this issue. A final problem is that the diagram shows that for every **GoatMale** there must be one **Transfer**, meaning that we can’t put the goat on the database until it has been transferred (which rules out mating, of course).

5. Supported: Since a **Transfer** may be associated with up to twelve **GoatMales** this requirement is fully supported.
Exercise 9 – Use Case Description

**Introduction**

Use Case Descriptions give us the information we need about the steps within the Use Case itself. We can establish the intended dialogue between the actor and the system.

Identifying and documenting the scenario in this way helps us to understand exceptions and alternate flows as well.

Use Case Descriptions are also highly valuable to testers as they are used to determine test scripts and the required sequence.

Hint: You are creating a use case description flow only. You do not need to worry about the pre-conditions etc.

Rachel Scott has proved difficult to get hold of but she has sent you an email explaining how she thinks customer orders should be captured on the new system.

Create a ‘happy day’ use case main flow description for Record Order (NB: main flow only) using the information she has provided.

In addition, suggest 3 alternate flows that could be invoked from the main flow, with a brief description of how each alternate should be dealt with.

Email received from Rachel Scott:

*Sorry I couldn’t make the meeting today but thanks for the ToR you sent – it’s at least enabled me to put together the information below for you.*

*Currently customers ring us up with their order. First we look up the customer on our file cards. Obviously we need this to be done by the IT system in future. And, of course, Warren wants customers to be able to do all of this themselves in future so no more file cards! So, I guess, we’d better identify customers by their reference number.*

*We need to present the customer with a list of our standard flavours (assuming they don’t want to order something unusual that we don’t keep in stock) and let them choose what they want. Then they’ll need to select the size tubs they want and the quantity, obviously. N.B. not all flavours come in every size tub. Once that’s all done and as long as the items are actually in stock we’ll let the customer know how much we’re charging them and get them to confirm their order. Finally they’ll select their delivery date. We run vans in different directions each day so, depending on where the customer is, we can deliver only on particular days of the week, if you see what I mean. Tuesdays are Norwich, Bury and Felixstowe – that sort of thing.*

*Any questions, let me know.*

*Rachel*

15 marks

A sample answer can be found on the following page
Sample Answer: Exercise 9 – Use Case Description

Use Case: ‘Record Order’ - Happy Day Scenario

1. System requests customer ID
2. Customer enters ID (A1)
3. System displays customer details
4. System displays standard flavours (A2)
5. Customer selects flavour from list
6. System displays tub size options and quantity selection (A3)
7. Customer selects tub size and quantity
8. System confirms availability, calculates cost and requests confirmation
9. Customer confirms order
10. System displays delivery date options
11. Customer selects delivery date
12. System records order and use case ends

Additional flows

- A1: Customer ID not recognised – request re-key 2 more times and then direct the Customer to contact Customer Services. UC ends.
- A2: Customer requires non-standard flavour – provide “special order” options.

A tabular layout of the dialogue Actor/System is also an acceptable answer.
Section 2: Sample Exam
Practice Paper

Instructions

You will have fifteen (15) minutes reading time before the examination starts. Do not write, mark, highlight or underline anything during this time.

This is an open-book examination. This means you can refer to written material in addition to the examination paper itself.

Attempt ALL questions.

Start each question on a new page.

You must answer the questions in English, using only blue or black ink; pencil or highlighter must not be used.

Answers which are simply copied or quoted from reference material will receive no credit.

If you think a question is unclear or incorrect, write the reason why you believe the question to be faulty and your interpretation.
Scenario

Acme engineering is a general light engineering company that specialises in metallic fixtures and fittings. It manufactures various products to customer order, and also has long term contracts to supply manufactured products to other companies. Acme is a “jobbing shop” involving craftspeople making specialised complete products – it is not a production line operation. The craftspeople work on early (6am – 2pm) and late (2pm – 10pm) shifts 5 days a week, and sometimes do overtime on Saturdays. The factory is always closed on Sundays. Each shift has a supervisor. The management team consists of the Managing Director, Accountant and Sales Manager. They are assisted by two Administrative Assistants who work Monday to Friday, 8.30am to 5.30pm.

The management team has decided that, in order to become more competitive, it needs more and better information on the costs involved in manufacturing. It wants to build up a database of time and cost information per manufacturing job, so that future work can be priced more accurately. This will involve recording the time spent on each manufacturing job, the costs of materials used, and the overhead costs.

One problem is that Acme’s craftspeople have always had a free hand to carry out their work however they like, as long as the finished fixtures and fittings conform to specification and meet deadlines.

The MD has engaged an IT consultancy company to analyse the requirements and design a system to meet them. The team will include a consultant with extensive experience of implementing manufacturing control systems. Acme has provided the following list of requirements to the consultancy company:

1. **The system is to log the craftsperson, start and finish time and materials used for each manufacturing job. This must be possible on all shifts, including overtime.**
2. **The data for time and materials used is to be captured on touch screens next to the machines on the factory floor so that the craftsperson’s work is not disrupted. This facility is to be usable in a noisy and dirty workshop environment.**
3. **The system is to calculate material costs and overhead costs incurred for each manufacturing job.**
4. **The system is to provide a “time spent” analysis (time to set up, time per step, rework time) report of the work done by each craftsperson.**
5. **The managing director would like a data mining type function to drill down on historic data and look at costs in total, or per product range, or per product type, or per craftsperson, over a flexible period of time, or for an individual piece of work.**
6. **The sales manager has asked for secure remote access via VPN using a laptop to the historic data on the system when working away from the office.**
Question 1

From requirements 1 to 6 (or parts thereof) on the previous page, give examples of each of the following, justifying your selection in each case:

- Two functional requirements
- Two non-functional requirements
- Two solutions
- Two ambiguous requirements
- Two requirements in conflict with each other (i.e. one conflict across 2 requirements)

(11 marks)

Question 2

Identify three (3) different stakeholders or stakeholder groups whose requirements must be explored. In each case, identify which elicitation technique would be appropriate and provide a justification to support your selection.

(9 marks)

Question 3

Use the MoSCoW system to classify the 6 requirements from the scenario, justifying your classification in each case. If you think a requirement cannot be classified, say why.

(12 marks)

Question 4

The class diagram below has been produced to represent the data requirements of the new system. Review it against the requirements, and identify three (3) errors or inconsistencies where the requirements are not supported.

(9 marks)
See over the page for q5
Question 5

Email to you, the Business Analyst, from the Richard Acme, Managing Director:

“I would like you to include an additional requirement to the six you have already been investigating.

It is a main objective of this development to produce precise costs for product manufacturing to enable more accurate pricing and so I would like the system to produce a weekly report on all jobs completed that week, detailing for each job: Craftsperson, Time Material Cost, and Total Cost.

The report should be available by 08.30 each Monday and should only be sent to myself and Tony Pound, the Accountant. Please liaise with Tony regarding exact content, sign-off and acceptance testing.”

Produce a Requirements Catalogue entry for this requirement. Your entry should include the following headings:

(9 marks)
Sample Exam Answers

Question 1 – total 11 marks

NB This list is not exhaustive – award marks for suitable alternatives.

Functional – 1 mark for each valid Functional Requirement

“The system is to log the craftsperson, start and finish time and materials used for each manufacturing job”

“The system is to calculate material costs and overhead costs incurred for each manufacturing job”

“The system is to provide a “time spent” analysis (time to set up, time per step, rework time) report of the work done by each craftsperson”.

Non-Functional – 1 mark each valid Non-Functional Requirement, plus half a mark for correct category

“This facility is to be usable in a noisy and dirty workshop environment” (usability) or

“This must be possible on all shifts, including overtime” (availability).

Solution – 1 mark each for two of the below.

“The time and materials used data is to be captured on touch screens next to the machines on the factory floor”.

“The sales manager has asked for secure remote access via VPN using a laptop to the historic data on the system when working away from the office”.

Ambiguous – 1 mark each for two of the below with appropriate justification.

“The system is to provide management with a data mining type function to drill down on historic data.”

- Different people may have different ideas of ‘a data mining type function’ would include, or what ‘drilling down’ means, or how far back historic data goes, etc.

Conflicting – 2 marks for the below

“The system is to log the craftsperson, start and finish time and materials used for each manufacturing job” and “The system is to provide a “time spent” analysis (time to set up, time per step, rework time, etc.) report of the work done by each craftsperson”

- The system cannot provide the required analysis if it only logs start and finish times.
Question 2 – total 9 marks

3 marks for each different stakeholder with appropriate technique and justification. Only 3 are to be marked. Award no marks if no technique is identified. The following are suggested answers; alternative answers may be allowed if supportable from the supplied information.

MD (the project sponsor) – Interview - we need to clarify the Terms of Reference, establish a rapport, and identify any “politics”; there may also be some confidential issues to explore. We need, also, to investigate the MD’s ‘data mining type function’.

Sales Manager – Interview - to explore Requirement 6 and understand why remote access is needed and what is meant by “historic data”.

Accountant – Interview – to understand the financial reporting requirements and clarify what are regarded as “overhead costs”.

Management Team - Workshop to explore business objectives and/or reporting requirements. Helps to ensure ownership of the objectives/requirements, check levels of commitment identify differing views. Clarify Sales Manager’s remote access need.

Craftspeople from each shift and the shift leaders – Workshop - as a team to help ensure buy-in and explore data input requirements. Their commitment in this area is essential to success.

Craftspeople – Observation - to understand the usability requirements and the steps in a typical job (for costing).

Craftspeople - Prototyping of the user interfaces to develop the usability requirements. They are probably not used to thinking in concepts and we don’t seem to have any current computer system, so presenting a mock-up could avoid expensive mistakes.
Question 3 – total 12 marks

2 marks for each valid classification and justification. If no justification is given but the classification matches the sample answer then award ½ mark. Alternative answers may be allowed if justified by information from the scenario.

<table>
<thead>
<tr>
<th></th>
<th>MUST</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MUST</td>
<td>Unless we start to capture the data there can be no system! It is directly linked to the main objective (better costing information for future jobs).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Decline to classify first part until it is rewritten as a requirement not a solution. The second part (non-functional) either SHOULD or COULD.</th>
<th>A manual workaround is possible in the second part. Priority depends on that assigned to the first part.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>MUST</td>
<td>This is the whole point of the system. If it cannot do this then there is no point in capturing the data.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>MUST</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>MUST</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>COULD</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>COULD</td>
<td>It’s not obvious that it is directly aimed at the principle objective (knowledge of costs) because it’s specifically about analysing time spent. The system would still achieve its main aim without this reporting.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Either decline to classify, or COULD or WANT</th>
<th>As currently expressed it’s rather a jumbled mess of lots of “requirements” which need to be clarified and dealt with separately.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Either decline to classify until it is rewritten as a requirement not a solution, or allow SHOULD or COULD</td>
<td>The system would still achieve its objective without remote access, but it would enable the Sales Manager to provide more accurate quotations for clients having access to this data when on the client’s site. On the other hand, this may be about working from home (by the pool, with a gin!).</td>
</tr>
</tbody>
</table>

Question 4 – total 9 marks

3 marks for each of the following. Only the first 3 answers are to be marked. Alternative answers may be allowed if supportable from the information supplied in the scenario. Do not award any marks for any item where the problem does not relate to a requirement.

- The scenario states that we should record which materials are used in each job, but the class model says each job only uses one material
- Requirement 1 states we must record the start and finish times for each Job, but there are no attributes for these in Job
- The class model shows that more than one Craftsperson may work on each Job, but the requirements imply it is only 1
- There is no data held to allow the system to calculate overhead costs to meet requirement 3, or material quantities used to allow calculation of material costs
# Question 5 – total 9 marks

Allow marks for each correct answer as below:

<table>
<thead>
<tr>
<th>ID</th>
<th>R007 (or something similar)</th>
<th>1 mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority</td>
<td>MUST (or M)</td>
<td>1 mark</td>
</tr>
<tr>
<td>Rationale</td>
<td>to produce precise costs for product manufacturing to enable more accurate pricing</td>
<td>1 mark</td>
</tr>
<tr>
<td>Source</td>
<td>Richard Acme – Managing Director</td>
<td>Half a mark for name Half a mark for role</td>
</tr>
<tr>
<td>Owner</td>
<td>Tony Pound - Accountant</td>
<td>Half a mark for name Half a mark for role</td>
</tr>
<tr>
<td>Description</td>
<td>The system is to produce a weekly report on all jobs completed that week, detailing for each job: Craftsperson, Time Material Cost, and Total Cost.</td>
<td>1 mark</td>
</tr>
<tr>
<td>NFR</td>
<td>To be available by 08.30 each Monday Only to be sent to MD and Accountant</td>
<td>1 mark for each = 2 marks max</td>
</tr>
<tr>
<td>Related</td>
<td>R001 (or Requirement 1 in same format as above ID)</td>
<td>Half a mark</td>
</tr>
</tbody>
</table>
Section 3: Appendices (QA++)
Class diagrams

The following show how the class diagrams should have looked if they had been drawn correctly. This is to help your understanding of the subject but you must be aware that the purpose of the question is for you to identify where the class diagram does not support the requirements and you will never need to redraw the class diagram…
At The Vets

You won’t have to correct the class diagram but those who are curious, a corrected version might look like this:
Goatilicious

You won’t have to correct the class diagram but those who are curious, a corrected version might look like this: