Requirements Engineering
Exercise Workbook
## Contents

Exercise Workbook – Structure and How to Use ................................................................. 3
Activity 1 – Ticket Sales System .......................................................................................... 4
Activity 2 – Document Management System ....................................................................... 6
Activity 3 – At the Vet ......................................................................................................... 9
Sample Exam Questions ................................................................................................... 11
Case Study Scenario ......................................................................................................... 20
Case Study Exercise 1 – Stakeholders and Elicitation Techniques ................................... 22
Case Study Exercise 2 – Functional and Non-Functional Requirements ........................... 24
Case Study Exercise 3 – Prioritising Requirements ........................................................... 26
Case Study Exercise 4 – Use Case Diagram .................................................................... 29
Case Study Exercise 5 – Class Diagram ........................................................................... 32
Case Study Exercise 6 – Use Case Description ................................................................ 34
Revised Class diagrams .................................................................................................... 36
Exercise Workbook – Structure and How to Use

This workbook contains all of the activities that will be referred to as you work your way through the course manual.

Each activity is numbered and referenced in the table of contents.

The Case Study and related exercises are grouped together at the back of the workbook to make it easier to locate them.

The Practice Paper follows on from the activity section.

About the sample answers

The sample answers to each of the activities and exercises are after the question to make it easier to navigate this document.

Note that the answers given are samples and meant to provide an indication of the types of answers expected and in most cases facilitate discussion.

Please therefore use these as a guideline and raise any concerns with your instructor who will be happy to discuss.
Activity 1 – Ticket Sales System

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

Identify the 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.

A sample answer can be found on the next page.

(17 marks)
Class Exercise 1 – Ticket Sales: Sample Solution

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).
Activity 2 – Document Management 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.

ii. Revise your diagram to show any <<include>> and <<extend>>

A sample answer can be found on the next page (10 marks)

A sample answer can be found on the next page (+ 3 marks)
Class Exercise 2 – Document Management System: Sample Solution

(i)

1 mark for each valid use case and actor, appropriately associated

- **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
- **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
(II)

+ 1 mark for the additional use case, 1 mark for the extend and ½ mark for each include

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
Activity 3 – At the Vet

A Veterinary Surgery is (at last) implementing an 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 next page.
Class Exercise 3 – At the Vet: Sample Solution

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 reported. 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.
Sample Exam Questions

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 one example 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 (ie one conflict across 2 requirements)

(10 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

Review the catalogue entry for requirement 7 below, examining the contents of each of the ten headings. For each heading, say whether or not the content is acceptable for sign-off, and justify your answer in each case.

(10 marks)

Requirement 7

<table>
<thead>
<tr>
<th>ID:</th>
<th>Req007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>23/02/2014</td>
</tr>
<tr>
<td>Author:</td>
<td>Ann Allist</td>
</tr>
<tr>
<td>Priority:</td>
<td>M</td>
</tr>
<tr>
<td>Rationale:</td>
<td>To produce precise costs for each product to enable more accurate pricing</td>
</tr>
<tr>
<td>Source:</td>
<td>Managing Director</td>
</tr>
<tr>
<td>Owner:</td>
<td>Accountant</td>
</tr>
<tr>
<td>Description:</td>
<td>The system is to produce a weekly report on all jobs completed that week, detailing for each: Craftsperson, Time, Material Cost, Total Cost</td>
</tr>
<tr>
<td>NFRs</td>
<td>To be available by 8.30am each Monday</td>
</tr>
<tr>
<td>Related Requirements</td>
<td>1</td>
</tr>
</tbody>
</table>

END OF EXAM PAPER

See over the page for the sample answers and marking scheme.
Sample Exam Answers

Question 1 – total 10 marks

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

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

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

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

“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”.

- All are pure statements of what the system is to do.

Non-Functional – 1 mark each for two of the below with appropriate justification.

“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 with appropriate justification.

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

“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”.

- Both state how the requirement may be met, but there may be other options.

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

**Interview with the MD as the project sponsor** – 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’.

**Workshop with management team** 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.

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

Observation of the craftspeople to understand the usability requirements and the steps in a typical job (for costing).

**Prototyping** of the user interfaces with the craftspeople 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>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).</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Decline to classify first part until it is rewritten as a requirement not a solution. The second part (non-functional) either SHOULD or COULD.</td>
<td>A manual workaround is possible in the second part. Priority depends on that assigned to the first part.</td>
</tr>
<tr>
<td>3</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>
<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>
<tr>
<td>5</td>
<td>Either decline to classify, or COULD or WANT</td>
<td>As currently expressed it’s rather a jumbled mess of lots of “requirements” which need to be clarified and dealt with separately.</td>
</tr>
<tr>
<td>6</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 10 marks

Allow 1 mark for each correct answer as below:

<table>
<thead>
<tr>
<th>ID</th>
<th>Not Acceptable</th>
<th>Should include version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Not Acceptable</td>
<td>What is this date? Is it date captured? Date amended? Might be better to have version history.</td>
</tr>
<tr>
<td>Author</td>
<td>Acceptable</td>
<td>Name of the analyst who captured requirement</td>
</tr>
<tr>
<td>Priority</td>
<td>Not Acceptable</td>
<td>Not clearly tied to business objective</td>
</tr>
<tr>
<td>Source</td>
<td>Acceptable</td>
<td>As long as it is true.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ideally it should also contain the name of the source in case there are multiple individuals performing the same role, or the role has been taken over since capturing the requirement…</td>
</tr>
<tr>
<td>Owner</td>
<td>Acceptable</td>
<td>Provided this person has the authority to sign it off.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ideally it should also contain the name of the source in case there are multiple individuals performing the same role, or the role has been taken over since capturing the requirement…</td>
</tr>
<tr>
<td>Description</td>
<td>Acceptable</td>
<td>A statement of what is required</td>
</tr>
<tr>
<td>Rationale</td>
<td>Acceptable</td>
<td>Justifies the need for this requirement to be met</td>
</tr>
<tr>
<td>NFR</td>
<td>Acceptable</td>
<td>Availability constraint</td>
</tr>
<tr>
<td>Related</td>
<td>Not Acceptable</td>
<td>Does this mean Requirement 1, or one other requirement? Either way it is not right</td>
</tr>
</tbody>
</table>
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)
Case Study Exercise 1 – Stakeholders and Elicitation Techniques

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

Identify five (5) stakeholders (or groups of stakeholders) you think you would need to access for information and suggest suitable techniques for eliciting and exploring their requirements.

In each case justify your choice of stakeholder and elicitation technique.

(10 marks)

A sample answer can be found on the next page
# Case Study Exercise 1 – Sample Solution

<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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Explore the need for interface with payroll system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigate how he feels out of his depth and why the system should be limited to orders and invoices.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ascertain what data is used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.
Case Study Exercise 2 – Functional and Non-Functional Requirements

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).

2.1 Summarise the Business Objectives relevant to the First Step project. (2 marks)

2.2 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 next page
Case Study Exercise 2 – Sample Solution

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?
Case Study Exercise 3 – Prioritising Requirements

Use *MoSCoW* to prioritise the requirements in the set, following on from your analysis in Exercise 2. Justify your decisions briefly.

Notes:

1. FR and NFRs should be assessed individually for prioritisation.
2. Wherever there is ‘solution’ language used, make an assessment of the requirement ‘hidden’ there, and prioritise that. In practice of course this would have to be taken up and confirmed with the stakeholders concerned as soon as possible.

(20 marks)

A sample answer can be found on the next page
Case Study Exercise 3 – Sample Solution

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.

1 mark for each valid justified prioritisation.

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 Should</td>
</tr>
<tr>
<td>3</td>
<td>This one must be prioritised against the NFR components</td>
<td>Access for Office Staff Access for Customers</td>
<td>Must Should</td>
<td>Important control MD wants customers to help themselves, but perhaps not essential in the first release.</td>
<td></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></td>
</tr>
<tr>
<td>FR</td>
<td>Priority</td>
<td>Comment</td>
<td>NFR</td>
<td>Priority</td>
<td>Comment</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------</td>
<td>----------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>7</td>
<td>Overall a Must</td>
<td>Minimum required in view of the business objectives</td>
<td>Office Staff</td>
<td>Must</td>
<td>Important Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not vital via the system in the first release</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Could</td>
<td>Not essential to the business objectives but probably nice to have</td>
<td>Production Manager access</td>
<td>Could</td>
<td>Not clear why access to this report needs to be especially restricted.</td>
</tr>
<tr>
<td>9</td>
<td>Want</td>
<td>Unclear what this means and why it is required and it appears to be out of scope</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Want</td>
<td>Not clear what is required</td>
<td></td>
<td></td>
<td></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.
Case Study Exercise 4 – Use Case Diagram

Examining the requirements 1 – 8 only, draw a use case diagram to summarise the functionality required and the primary 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 next page.
Case Study Exercise 4 – Sample Solution

1 mark for each valid use case and actor. ½ mark for each valid include relationship.

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
   Shown as Time to Produce Report
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.
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.

A sample answer can be found on the next page

(10 marks)
Case Study Exercise 5 – Sample Solution

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.

2 marks for each valid justified answer. *If the answer is correct but not justified then you only earn ½ mark.*
Case Study Exercise 6 – Use Case Description

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. (13 marks)

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. (3 marks)

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

A sample answer can be found on the next page.
Case Study Exercise 6 – Sample Solution

Use Case: ‘Record Order’ - Happy Day Scenario

1. User selects “Record Order” use case
2. System requests customer ID
3. User enters ID (A1)
4. System displays customer details
5. System displays standard flavours (A2)
6. User selects flavour from list
7. System displays tub size options and quantity selection (A3)
8. User selects tub size and quantity
9. System confirms availability, calculates cost and requests confirmation
10. User confirms order
11. System displays delivery date options
12. User selects delivery date
13. 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.
Revised 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:

![Class Diagram](image-url)
Goatilicious

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