Pearson Edexcel

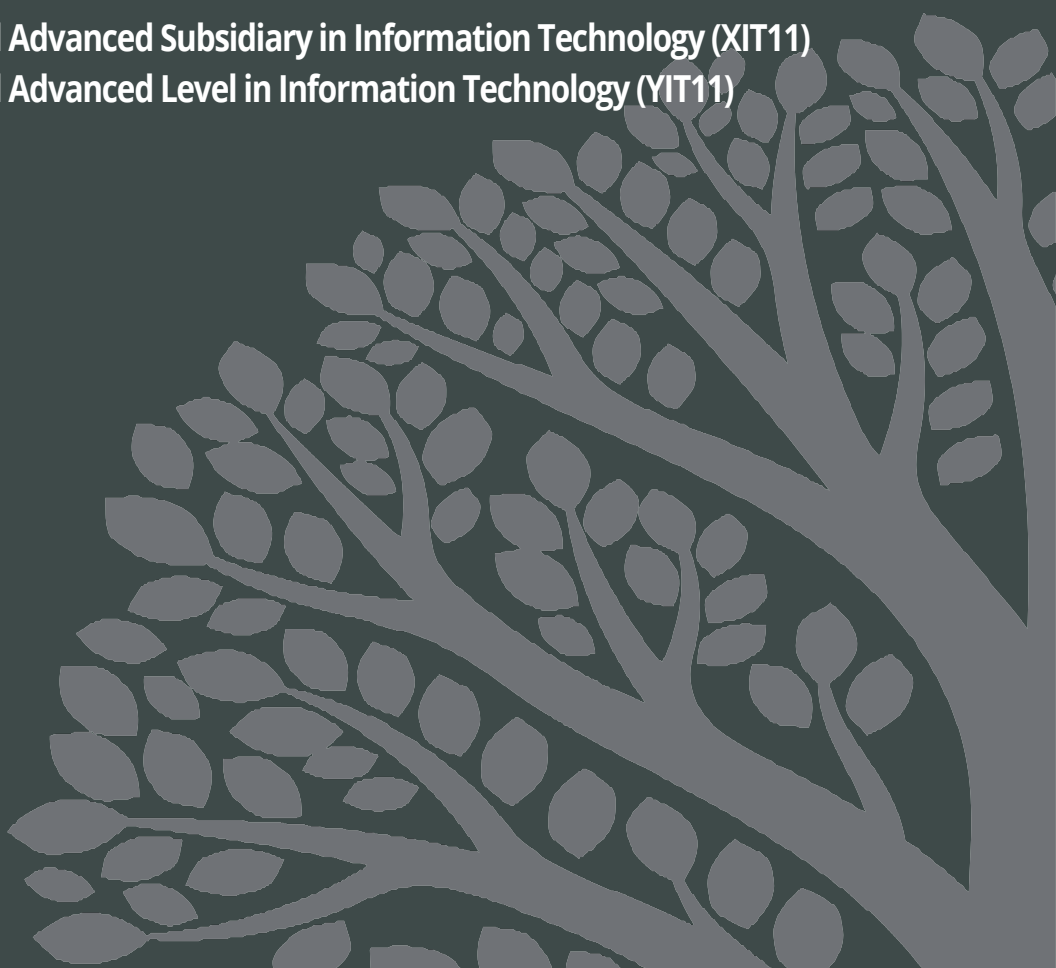
INTERNATIONAL ADVANCED LEVEL

INFORMATION TECHNOLOGY

Exemplars with examiner commentaries Unit 3

Pre-first assessment materials

Pearson Edexcel International Advanced Subsidiary in Information Technology (XIT11)
Pearson Edexcel International Advanced Level in Information Technology (YIT11)



Contents

Introduction

1.1 About this booklet

This booklet has been produced to support teachers delivering the Pearson Edexcel International Advanced Level in Information Technology specification. The Unit 3 exemplar materials will enable teachers to guide their students in the knowledge and skills required to successfully complete this course. The booklet looks at questions 1 to 7, showing examples of likely candidate responses to questions and how examiners should apply the mark schemes to demonstrate how student responses should be marked. The first examination of this unit is in 2020.

1.2 How to use this booklet

Each example covered in this booklet contains:

- Question
- Mark scheme
- Exemplar responses for the selected question
- Example of the marker grading decision based on the mark scheme, accompanied by examiner commentary including the rationale for the decision and where relevant, guidance on how the answer can be improved to earn more marks.

The examples highlight the achievement of the assessment objectives at lower to higher levels of candidate responses.

Centres should use this content to support their internal assessment of students and incorporate examination skills into the delivery of the specification.

1.3 Further support

Centres may find it beneficial to review this document in conjunction with the other assessment and support materials available here on the Pearson Qualifications website.

Question 1 uses this context.
An insurance company sells buildings, contents, car, life, travel and pet insurance.

Q1(a)(i) The company makes extensive use of IT.

Give **two** reasons why input validation should be implemented on databases and IT systems.

Marks available 2

Mark scheme

Question number	Answer	Additional guidance	Mark
1(a)(i)	Award **one** mark each for any of the following up to a maximum of **two** marks. • To ensure data is fit to be processed/in the correct format (1). • To ensure input errors are identified (1). • To ensure that any information extracted is reliable (1). Accept any other appropriate response.	Do not award 'correct' in relation to the data itself.	**2**

Sample response 1 – Marks awarded: 2

1. To make sure that data is in the correct format
2. To identify input errors

Commentary
Candidate has achieved 2 marks for giving two reasons for having input validation. 'To identify input errors' is equivalent to 'ensure input errors are identified'.

Sample response 2 – Marks awarded: 0

1. To make sure the data is correct
2. To prevent mistakes

Commentary
The first answer could apply to verification, but not validation. Verification may not ensure that data is correct – but checks that the details on the form have been entered correctly. The second answer is too vague to get a mark.

Q1(a)(ii) Figure 1 shows part of an insurance application form.

Insurance Application

Buildings ☐ Contents ☐ Car ☐ Life ☐ Travel ☑ Pet ☐

Name*: Mr Kirk Martin
Address: 37 Tulip Road
Danville
23910-448

Email*: K.Martin@somewhere.com
Mobile*:

0	1	2	3	4	5	6	7	8	9	0

Start Date: 20/03/2017

Duration (3 to 12 months): 6

*Information must be provided

Figure 1

The data in Figure 1 will be input into a database.

Complete the table with an example of a validation rule for each type of validation. The first row of the table has been completed.

Marks available 4

Mark scheme

Question number	Answer	Additional guidance	Mark
1(a)(ii)	Award **one** mark for each correctly completed cell in the table up to a maximum of **four** marks.	Accept either description words or implementation detail.	4

Validation type	Validation rule	
Length check	The mobile number must be 11 digits long/ len (mobile_number) = 11.	(1)
Range check	Duration must be a minimum of 3 to a maximum of 12/3 >= policy term <= 12.	(1)
Lookup check	Type of insurance: buildings, contents, car, life, travel, pet insurance.	(1)
Presence check	Name/email/mobile cannot be blank.	(1)

Sample response 1 – Marks awarded: 4

Type of validation	Validation rule
Type check	**Start date must be of type date.**
Length check	The mobile number must be 11 digits long.
Range check	Duration must be a minimum of 3 to a maximum of 12.
Lookup check	Type of insurance: choose from buildings, contents, car, life, travel, pet insurance.
Presence check	Name cannot be blank.

Commentary
The candidate has achieved 4 marks.
The rules are written descriptively rather than as they would have been in the database, but they are understandable.

Sample response 2 – Marks awarded: 3

Type of validation	Validation rule
Type check	**Start date must be of type date**
Length check	len (mobile_number) = 11
Range check	3 >= policy term <= 12
Lookup check	Check email address exists by getting return
Presence check	email <> null

Commentary
Answers 1, 2 and 4 in the table above, i.e. 'len (mobile_number) = 11', '3 >= policy term <= 12' and 'email <> null' are written as they might be in a database and are worth 3 marks.
Answer 3, i.e. 'Check email address exists by getting return' attempts to describe how an email could be checked, but this is not validation.

Q1(b) The insurance company plans to use a customer relationship management (CRM) system to interact with its customers.

Explain how it could use a CRM system to improve its business.

Marks available 6

Mark scheme

Question number	Indicative content	Mark
1(b)	Candidates are not required to have working knowledge of the insurance industry but should apply their knowledge of CRM systems to the information provided in the scenario. • Manage communication with customers to improve customer service (returning calls after complaints). • Upsell insurance products (all customers with car policies could be target marketed for a travel insurance promotion). • Customer retention (all customers whose household policies were up for renewal next month could be sent an offer of a price reduction, a free month, or a gift). • Identify overall sentiment about their customer service department (after each call with a customer service representative, the customer could be sent an email survey. The responses could be analysed to identify new customer services or ways to improve existing ones). • Identify buying trends (e.g. those over the age of 65 and living alone may be more likely to purchase pet insurance). • Synchronise marketing events (to ensure customers are not sent too much marketing material).	6

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a response that lacks development.
Level 2	3-4	• Demonstrates knowledge and understanding which is mostly relevant but may include some inaccuracies. • Applies understanding to make some coherent connections and a partially developed response.
Level 3	5-6	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a fully developed response.

Sample response 1 – Marks awarded: 6

There are several ways in which the company can use a CRM system. These include:

- improving customer service
- exploiting trends and buying patterns
- marketing and communications.

Improving customer service. The company could improve its contacts systems, making the procedures for complaints, policy changes, and claims more streamlined and efficient. They could also make the system more responsive to customer needs by increasing the number of ways of interacting, such as using social media and on-line chat.

Exploiting trends and buying patterns. The company could analyse its customer communications to identify 'hot topics' with a view to increasing sales in the area of insurance. For example, if they find there is an increased demand for travel insurance at certain times of the year, they could do more promotion of suitable products.

Marketing and communications. This might involve using the customer database to make sales calls based on past purchases and customer demographics, e.g. customers with buildings and contents insurance probably own the building and may be interested in having cover for mortgage payments if they become ill.

Marketing and communications could also cover the way in which customers can be reached. Different types of customer are likely to prefer email, text messages, or paper-based communication. Using a customer's preferred method will make them be more likely to engage with the company.

Commentary
This answer meets the descriptor for a Level 3 answer.
The candidate has written a balanced account that shows a good understanding of the use of CRM.
They have covered multiple uses and have given numerous examples of what those uses might involve.
There is nothing that would be regarded out of place for a CRM and the candidate has set out the work in a coherent manner.

Sample response 2 – Marks awarded: 2

Customer Relations Management CRM is about how the company deals with its customers.

A good CRM system will help with customer retention and keep people coming back to the company every year to get their insurance.

A poor system will not do this and may even lose customers because they get frustrated with how they are treated by the company.

The company will be more profitable with a CRM system and will be able to sell more insurance.

Commentary

This answer meets the descriptor for a Level 1 answer.
The account is superficial and unbalanced and demonstrates limited knowledge and understanding. Some of the answer is a restatement of the question and the candidate only gives one use of a CRM system with little expansion.

Question 2 uses this context.
A car manufacturer has factories in several different countries.

Q2(a) The head office is in London. The factory in Colombo sends sensitive data to the head office using asymmetric (public key) encryption.

Describe the process of asymmetric encryption for data sent from Colombo to London.

Marks available 4

Mark scheme

Question number	Answer	Mark
2(a)	Award **one** mark for each linked descriptive point up to a maximum of **four** marks. The Colombo factory encrypts the data (before sending to London) (1) using the public key (1). The London office will decrypt the data it receives (1) using the private key (1).	4

Sample response 1 – Marks awarded: 4

The Colombo factory encrypts the data using the public key. The London office will decrypt the data using the private key.

Commentary
The answer describes both the encryption and decryption processes of asymmetric encryption.

Sample response 2 – Marks awarded: 1

Asymmetric encryption uses public and private keys, which are exchanged between the sender and receiver. Both are needed at each end of the communication.

Commentary
The candidate gets one mark for understanding the need for public and private keys. The information about both being needed at each end is incorrect and may be a confusion with symmetric key encryption and is not worth any marks.

Q2(b)(i) The factory in Colombo has been operating since 2010 and collects a terabyte of new data each month. This data is stored on several networked servers.

The factory is currently using 92% of its local file storage capacity.

For legal reasons, some of the data cannot be permanently destroyed.

Explain the impact of archiving the data.

Marks available 2

Mark scheme

Question number	Answer	Mark
2(b)(i)	Award **one** mark for identifying the impact and **one** mark for justification/expansion up to a maximum of **two** marks. • There will be greater free space on live storage (1) because the historical data has been moved to a different storage medium (1). • There will be delays accessing the historical/archived data (1) because it will have been moved to a slower storage medium (1). • The archiving requires additional storage media (1), which will incur financial costs/occupy physical space (1).	2

Sample response 1 – Marks awarded: 2

There will be more space available on the file servers because the archived data has been moved to a different storage medium.

Commentary
The candidate has given a sensible impact, more server space and a connected reason for it.

Sample response 2 – Marks awarded: 1

The archives will be in a different place so they'll be slower to read.

Commentary
The candidate gains one mark for access to the archives being slower, but the extension, put before the effect in this case, does not explain why the archives will be slow.

Q2(b)(ii) The factory needs a disaster recovery plan for its IT systems.

Describe **one** way in which the factory could prepare for a disaster that destroys the hardware and software IT systems in its main building.

Marks available 2

Mark scheme

Question number	Answer	Additional guidance	Mark
2(b)(ii)	Award **one** mark for each linked descriptive point up to a maximum of **two** marks. • A warm/parallel system/site, with appropriate hardware already installed and ready, could be maintained (1), which could be brought online with restored data (1). • A hot/mirrored system/site, with appropriate hardware already installed and ready, could be maintained (1) which could be brought online immediately (1). • A planned fund could be established for hardware/software to be purchased (1) so that a replica of the system can be created quickly (1).	Do not accept responses indicating only backing up of data.	**2**

Sample response 1 – Marks awarded: 2

A hot site, with a copy of the hardware and software installed and ready to be used. The site would be maintained and could be brought online immediately.

Commentary
The candidate has correctly identified that a hot site could be used and how it could function.

Sample response 2 – Marks awarded: 1

A hot site with everything running on it would copy all the actions of the main site and would take over in an emergency.

Commentary
The candidate has confused a hot site with a mirror site. The answer is still worth one mark from the description of what the site would do.

Question 3 uses this context.
A city is using the latest technologies to ensure a safer working environment for its employees and reduce the amount of pollution caused by motorists looking for car parking spaces.

Q3(a) The city has an extensive training programme for its emergency response teams.
The city is considering using virtual reality in its training programme.

Discuss the advantages and disadvantages of using virtual reality in the training programme.

Marks available 6

Mark scheme

Question number	Indicative content	Mark
3(a)	Advantages in context: • could save lives caused by accidents • could save time by having practised exact procedures • could save harm to the environment by understanding how to handle chemical spills • system could be reused to train additional teams of emergency responders • emergency personnel could be better trained by experiencing unique situations challenging to reproduce in real life. Disadvantages in context: • might be expensive if the procedure was a one-off, not to be repeated • would be expensive/costly to buy the best/high-end virtual reality hands-free kit • would not simulate the full experience of being in a dangerous situation because of smells or touch • the emergency response personnel could experience bad side-effects such as dizziness or nausea during the training.	6

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a superficial and unbalanced discussion.
Level 2	3-4	• Demonstrates knowledge and understanding which is mostly relevant but may include some inaccuracies. • Applies understanding to make some coherent connections, leading to a discussion that shows some development, but may be unbalanced.
Level 3	5-6	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a balanced and fully developed discussion.

Sample response 1 – Marks awarded: 6

Advantages:

Using virtual reality would let the team practise for events that would be dangerous in real life, such as chemical spills or situations involving large crowds. It also reduces the environmental impact of training such as use of fire or chemicals.

It also allows the event to be stage managed more easily in that it can be stopped and restarted at any point. This would be difficult if not impossible in real life.

Once an event has been set up, it can be reused many times with different teams. This can save money and allow more people to experience an event that might otherwise only happen once.

Disadvantages:

Setting a virtual reality system up will be expensive. The money may be saved by being able to reuse it several times but there is still a large initial investment.

Although virtual reality is constantly improving, it still doesn't give the full 'real life' experience in most situations. Smells, tastes, and to some extent touch, are very limited.

Finally, virtual reality has its own environmental impact in the production, use and disposal of IT equipment.

Commentary

This answer meets the descriptor for a Level 3 answer.

The candidate correctly identifies several advantages and disadvantages, putting them in context. The candidate gives alternative aspects of costs and environmental impact. The answer is balanced and fully developed.

Sample response 2 – Marks awarded: 2

Virtual reality lets the city run its training programme for less money than it would cost if the emergency response teams had to use the real thing.

It will also save the environment; pollution won't be created by the training as it's all done inside a computer.

Virtual reality lets people do things that they couldn't do for real, such as look inside a burning building. This is much safer for the team.

Commentary

This answer meets the descriptor for a Level 1 answer.

The candidate shows some limited understanding, e.g. environmental impact safety and costs but does not develop them.

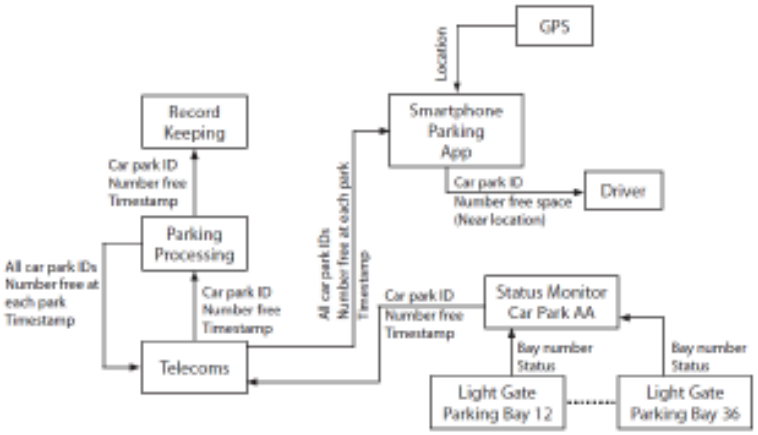
Q3(b) The city has several multi-storey car parks. Each car park has many parking bays. Drivers, with smartphones, planning trips to the city are alerted to the location of car parks with free bays from an app. This information is relayed in real time and continuously updated. As the driver approaches the car park, the location of all the free bays in the area is relayed. When a driver takes a bay, it becomes occupied. When a driver leaves a bay, it becomes free. This information is monitored and processed at city central. The city tracks all the information about parking activities.

Draw an information flow diagram to show how this parking management system could be implemented using the Internet of Things.

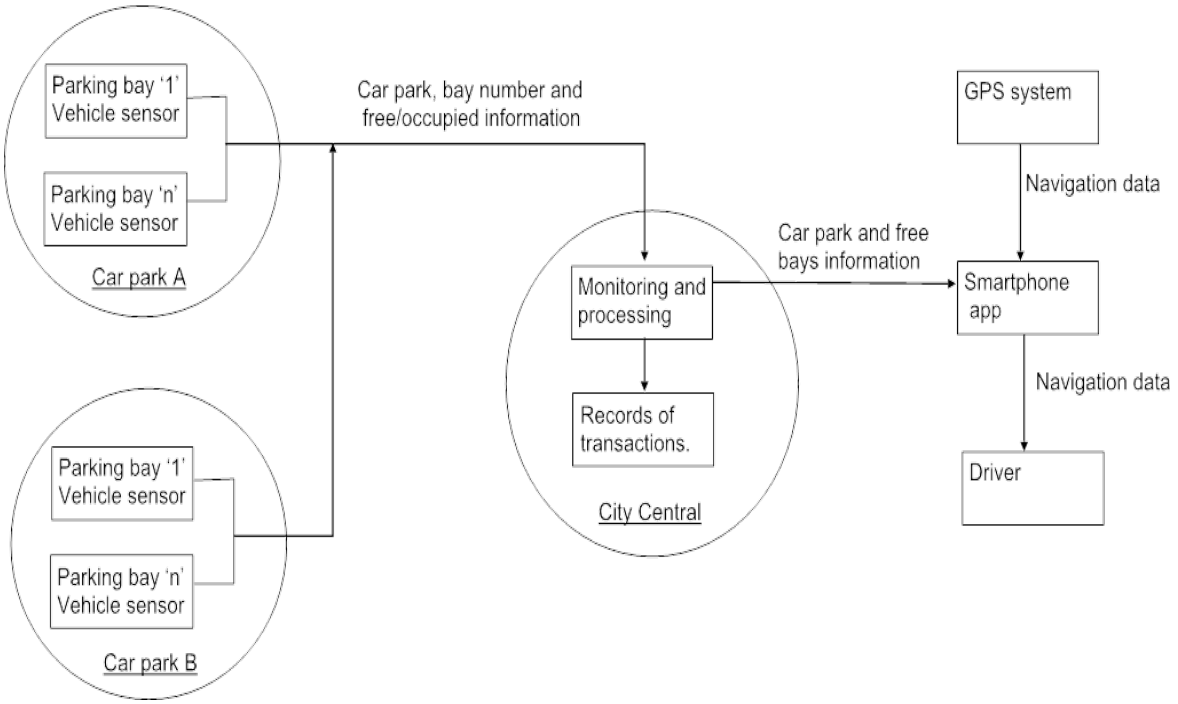
Assume the driver is using the app in a safe, legal way.

Marks available 12

Mark scheme

Question number	Answer	Mark
3(b)	Award **one** mark for each correctly drawn part of the information flow diagram up to a maximum of **twelve** marks. • identification of a smartphone app • identification of GPS • input to smartphone input of GPS location • identification of driver • parking information (car park, free spaces) sent to driver • multiple bays in a car park • light/pressure sensor collecting bay status • aggregator/monitor collecting status of all bays in a single car park • car park monitor sends information to city central • car park monitor sends car park ID and number of free spaces • telecoms sends parking information to parking processing • parking processing sends parking information to record keeping • parking processing sends accumulated information back to telecoms • telecoms sends accumulated data to smartphone app • fully functional solution that could work. Marks can also be awarded for any additional functionality, such as payments, indicated on the diagram.  	12

Sample response 1 - Marks awarded: 9



Commentary

The candidate has created a diagram that meets most of the requirements of the question.

There are marks for:

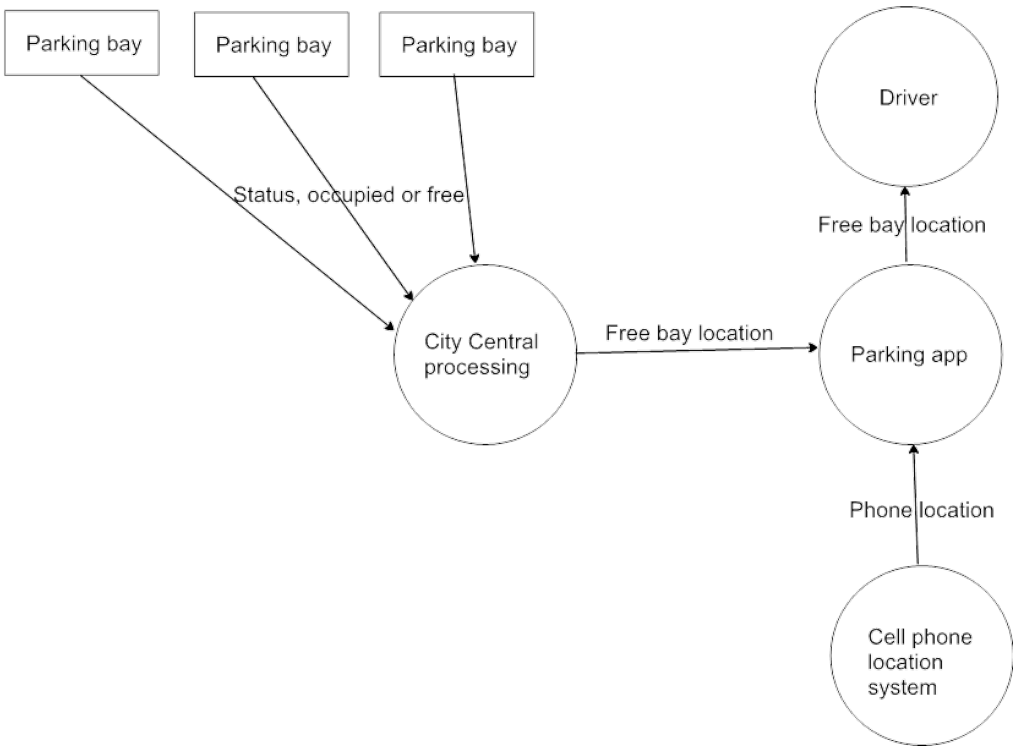
- the smartphone app, MP1
- GPS, MP2
- GPS sending location (navigation) data to the app, MP3
- the driver, MP4
- multiple bays in a car park, MP6. The second car park does not get a mark but having one bay in each of two car parks would have been sufficient for MP6
- sensor for bay status, MP7. The MS states light/pressure sensor but vehicle sensor is acceptable
- car park monitor sends data to city central, MP9. This mark is given even though the car park aggregator is missing as the data flow is shown
- MP13 and MP14 are awarded as one mark. The intermediate telecoms step is missing but appropriate data is sent from city central to the smartphone app
- MP14, a functional solution that could work, is given. There is some data missing and no car park aggregators, but each bay could in theory report individually to city central.

The candidate has produced an incomplete but workable solution but has missed some important points:

- MP5, parking information sent to driver, is not given as navigation data is not specific enough.
- MP8, aggregator/monitor for each car park is not present. Joining the data flow into a single line is not sufficient to indicate an aggregator.

- MP10, car park ID and free spaces sent to city central is not awarded as the diagram seems to show each bay reporting rather than each car park. The system is dealing with car parks rather than individual bays at this stage in the process.
- MP11, telecoms, is not awarded as the method of transmission is not shown in the diagram.
- MP12, record keeping, is not given as there is no data identified moving from 'monitoring and processing' to 'record of transactions'.

Sample response 2 – Marks awarded: 5



Commentary

The candidate has produced a simple diagram which nevertheless identifies several of the required components.

There are marks for:

- the app, MP1
- a location system, in this case cell phone location rather than GPS, MP3
- the driver, MP4
- bay location sent to driver, MP5
- multiple bays in a car park, MP6.

Information flow direction is indicated but the answer lacks detail about what information is being passed.

There is no record of the parking transaction and the way in which the parking bays measure occupancy and indicate status is unclear.

Question 4 uses this context:
A local youth group is creating a gaming room for playing a popular multi-user adventure game.
The room will have a server and 12 client workstations. There is a fixed budget.

An experienced project manager is in charge of the overall project. She has decided that an agile approach will be used.

There are four tasks which need to be completed in six weeks:
1. designing the room layout
2. calculating electrical and network cabling costs
3. installing network cabling
4. installing benches for server and client workstations.

A team is assigned to each task.
Three elements of an agile approach are incremental release, detailed planning and verbal communication.

Q4(a) Explain how an agile approach could be used when carrying out the four tasks.

Marks available 16

Mark scheme

Question number	Indicative content	Mark
4(a)	**For each characteristic** Incremental release • The design team could create a design as quickly as possible. • They could then have the users of the room give feedback on the design. • They could then amend the design and show it to the users again. • This process could iterate several times until the design is correct and/or the timeframe is exhausted. Detailed planning by each team • The team calculating the cabling costs could plan two sprints. • They could deliver the costs for the electrical cabling in the first sprint and the costs for the network cabling in the second sprint. • The team could further break down the calculation task into subtasks such as measuring up, calling vendors, and making spreadsheets. Verbal communications • Face-to-face communications is the preferred method in agile developments. • Each day or two, the entire team will meet for a very short time (scrum), perhaps only 10 minutes, to discuss what has been accomplished and what is left to do. • These meeting may take place in larger groups of several teams and could include the users of the games room (stakeholders) as well. • The two teams installing the cabling and the benches could meet to avoid working in the same part of the room at the same time.	6

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a response that lacks development.
Level 2	3-4	• Demonstrates knowledge and understanding which is mostly relevant but may include some inaccuracies. • Applies understanding to make some coherent connections and a partially developed response.

Level	Mark	Descriptor
Level 3	5-6	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a fully developed response.

Sample response 1 – Marks awarded: 6

Designing layout:
Incremental release. The team would make an initial design, get feedback from users, then update the design. This could be repeated until the design is accepted.
Detailed planning. The team would get costs for each component, breaking it down into, e.g. getting vendor quotes, measuring dimensions of locations where items are planned to go.
Verbal communication. The team would have daily, face-to-face meetings to discuss progress.

Network cabling:
Incremental release and verbal communication would be similar to that in designing the layout, except it would be the cable layout.
Detailed planning would involve measuring cable runs and costing the different cable types.
Installing cabling.
Incremental release is probably not used for this task.
Verbal communication would be team meetings, plus liaison with the team doing the non-cable installation.
Detailed planning would involve working out the sequence for running the different cables so that it is more efficient.

Installing benches:
This would be similar to the installing cable team, except that the planning would involve working out the best sequence for installing the benches.

Commentary
This answer meets the descriptor for a Level 3 answer.
The candidate has looked at each of the teams and each of the agile elements, giving appropriate ideas for each team.

Sample response 2 – Marks awarded: 3

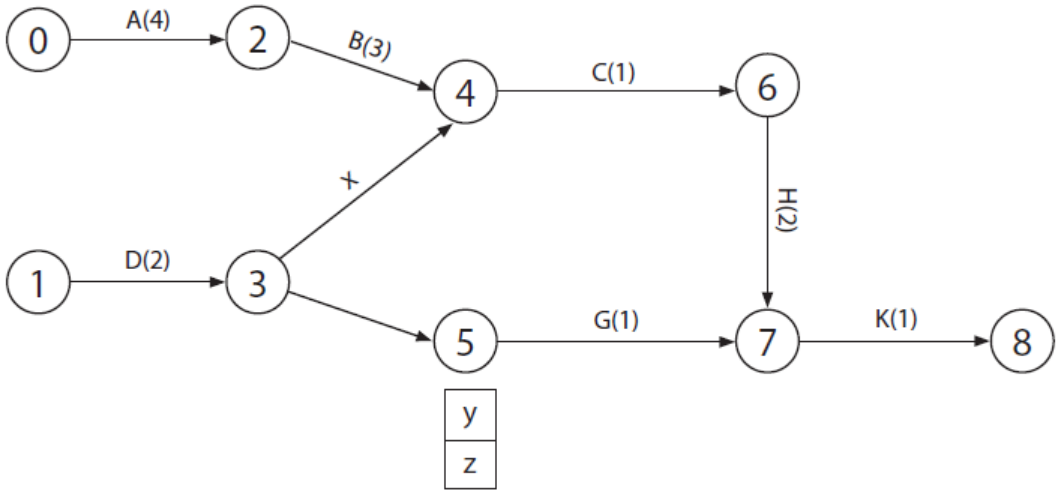
The teams would need to work together, so verbal communication would be needed so that everyone knows what the other teams are doing. This would help with the detailed planning. The incremental release element will also involve verbal communication in the form of feedback.

Detailed planning is needed for working out the sequence in which things are purchased and installed by the different teams. Incremental release is about the teams developing prototype solutions and then getting feedback so that they can amend what they are doing.

Commentary
This answer meets some of the descriptor for a Level 2 answer, with some coherent connections between the elements.
The candidate only gives limited use of the agile elements therefore achieving lower band 2 rather than higher.

Q4(b) The installation of the server, the twelve client workstations and all the software is planned using precedence tables and a project network diagram. The critical path needs to be identified.
Here is the precedence table for this part of the project.

Activity	Description	Duration	Predecessor
A	Set up clients	4	-
B	Test clients	3	A
C	Connect to network	1	B, E
D	Set up server	2	-
E	Test server	1	D
F	Install game on server	1	D
G	Configure game on server	1	F
H	Test all communications	2	C
K	Clients test game	1	H, G



Q4(b)(i) Give the values for x, y and z.

X .....
Y .....
Z .....

Marks available 3

Mark scheme

Question number	Answer	Additional guidance	Mark
4(b)(i)	Award **one** mark for each correct value up to a maximum of **three** marks. • x = E(1) • y = 3 • z = 9.	E must include duration.	3

Sample response 1 – Marks awarded: 3

1. x = E(1)
2. y = 3
3. z = 9

Commentary
The candidate has correctly identified X, Y and Z and achieved 3 marks.
X must be E or F as these are shown as following D. The time for both is 1. F cannot be correct as it is followed by G, while E is followed by C.
Y is the minimum time required to reach step 5 and is the sum of E + F. Z is the maximum time that could be taken to reach step 5 and is the sum of times to reach step 7, 4+3+1+2 minus the time from step 7 to step 7, 1.

Sample response 2 – Marks awarded: 1

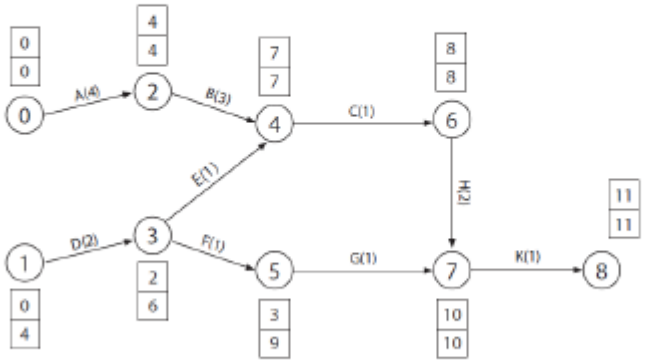
1. x = E
2. y = 2
3. z = 9

Commentary
The candidate has correctly identified X and Z but has not included the duration for X.
The value of Y is too low as the candidate has not allowed for activity F between steps 3 and 5.

Q4(b)(ii) State the nodes in the critical path.

Marks available 1

Mark scheme

Question number	Answer	Mark
4(b)(ii)	Award **one** mark for: A, B, C, H, K 	1

Sample response 1 - Marks awarded: 1

A, B, C, H, K

Commentary
The candidate has identified the correct path.
These activities form a single chain which must be completed. Activities D,E,F and G must also be completed but the time required for these is always less than the time required to reach the same point via the critical path. These activities can therefore be completed before they are needed by activities that rely on them.

Q5 uses this context.
A family-run cheese business is looking to modernise.

Q5(a) It is introducing new delivery vans to cover a wider geographical area.

By using digital devices and software, the vans and drivers can be in constant communication.

The project manager uses SMART criteria to write project objectives.

This is one of the project's objectives:

'Deliver 90% of the cheese within one hour of the delivery window over a period of one month, using a maximum of eight vehicles and drivers.'

Complete the table to show how this objective fits the SMART criteria.

One row has been completed for you.

Marks available 4

Mark scheme

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>5(a)</td><td>Award one mark for each correctly completed cell in the table up to a maximum of four marks.
<table>
<tr><th>Criteria</th><th>How the objective meets the criteria</th></tr>
<tr><td>S</td><td>The objective is specific, clearly defined and precise. It is clearly applicable to the delivery of cheese (1).</td></tr>
<tr><td>M</td><td>Delivery times can be easily monitored so are measurable (1).</td></tr>
<tr><td>A</td><td>Provided that cheeses, vehicles, and drivers are available, the objective is achievable (1).</td></tr>
<tr><td>R</td><td>Reliable delivery is relevant in maintaining good customer relationships (1).</td></tr>
<tr><td>T</td><td>Time-bound to one month (1).</td></tr>
</table>
</td><td>4</td></tr>
</table>

Objective: Deliver 90% of the cheese within one hour of the delivery window over a period of one month, using a maximum of eight vehicles and drivers.	
Criteria	How the objective meets the criteria
S	**The objective is specific and well defined. It is clearly applicable to the delivery of cheese.**
M	
A	
R	
T	

Sample response 1 – Marks awarded: 4

Objective: Deliver 90% of the cheese within one hour of the delivery window over a period of one month, using a maximum of eight vehicles and drivers.	
Criteria	How the objective meets the criteria
S	**The objective is specific and well defined. It is clearly applicable to the delivery of cheese.**
M	Delivery windows must be met, the times of delivery and percentage meeting them can be measured.
A	The objective can be achieved if the eight vehicles are available and working.
R	The objective is relevant in that delivering to schedule will improve efficiency and keep customers happy.
T	The objective is time-bound to one month and there is a one-hour delivery window.

Commentary
This candidate has correctly identified criteria that are related to the delivery of cheese.

Sample response 2 – Marks awarded: 0

Criteria	How the objective meets the criteria
S	**The objective is specific and well defined.** **It is clearly applicable to the delivery of cheese.**
M	The number of vehicles used can be measured.
A	The objective is achievable because drivers can be in constant communication.
R	Meeting the targets is relevant to modernising the business.
T	The target is timely because the cheese has to be delivered on time.

Commentary
The candidate has correctly identified criteria types but has not made appropriate links from the objective to the criteria.
Much of the answer is a restatement of the stem, with an attempt to fit things into the criteria.
These answers should be compared to those in sample response 1.

Q5(b) As part of the expansion, the business has commissioned new control software for its four cheese-making facilities. The new software was installed overnight on August 10th at all four locations. During the morning of August 11th, all of the milking and processing machines exhibited unrecoverable errors. The entire day's milk and cheese production, at all four locations, was ruined.

Discuss the appropriateness of alternative software changeover methods for the cheese business.

Marks available 6

Mark scheme

Question number	Indicative content	Mark
5(b)	• A direct changeover is where the whole new system is installed into all the business at one time and the old system is removed. • A direct changeover of the control software caused the whole day's production to be lost. • A pilot changeover is where the new system is put into operation at a single location and tested to see if it works. • A pilot changeover would mean that only one cheese-making location would have failed on August 11th. • A phased changeover is where only part of the new system is installed at a time. • A phased changeover could work in the cheese factory if the cheese-making process was changed on one day, in one location, and the milking process changed on another day. • A parallel changeover is where both the old and the new systems run at the same time. • A parallel changeover would not work because the hardware cannot be controlled by two different software programs at the same time.	6

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–4	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a response that lacks development. • Demonstrates limited awareness of competing arguments. Conclusion, if present, is generic or unsupported.
Level 2	5-8	• Demonstrates knowledge and understanding, which is mostly relevant and may include some inaccuracies. • Applies understanding to make some coherent connections and a partially developed response. • Demonstrates some awareness of competing arguments, but this may be unbalanced, and partially supports conclusion with evidence.

Level	Mark	Descriptor
Level 3	9-12	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a fully developed response. • Demonstrates an awareness of competing arguments and supports conclusion with evidence.

Sample response 1 – Marks awarded: 6

There are four possible changeover types, direct, phased, pilot and parallel.

A direct changeover is where the whole new system is installed into all the business at one time and the old system is removed. This is the type used in the given scenario.
Although it has the advantage of being fast and cheap compared to other methods, it carries a greater risk of disaster, as happens in this case.

A phased changeover is where only part of the new system is installed at a time.
This could work in the cheese factory if the cheese-making process was changed on one day, in one location, and the milking process changed on another day.
It has the advantage that only a part of the system will be affected if there is a problem with the changeover, which means it should be easier to recover if something goes wrong as the error will be in the changed part.
The disadvantage is that the whole process would take a lot of time, since each part would have to be changed in succession.

Pilot changeover is where the new system is put into operation at a single location and tested to see if it works.
This would have the advantage that only one cheese-making location would be at risk.
Problems could be fixed and the revised changeover would be applied once the first cheese-making station was working reliably.
The disadvantage is that the pilot must be completed before the rest of the system is changed, and this takes extra time.

A parallel changeover is where both the old and the new systems run at the same time.
This would be impossible to implement as cheese cannot be made using two processes at the same time.

Commentary
This answer meets the descriptor for a Level 3 answer.
The candidate has considered advantages and disadvantages for three methods of changeover and explained why the fourth method could not be used.

Sample response 2 – Marks awarded: 2

The different types are direct, phased, pilot, and parallel.
The direct method is unsuitable as it didn't work in the cheese factory and all production was lost.
Pilot would be better than direct because it only puts one bit of the factory at risk rather than all of it.
Phased could work as well as it is a bit like pilot except that only one part of the system is replaced rather than one cheese making station.
Parallel would mean running both systems together. This would be difficult as it would mean having one cheese making station doing two things at the same time.

Commentary
This answer meets the descriptor for a Level 1 answer.
The candidate shows limited understanding and has only looked at limited aspects of each type of changeover. The discussion is not developed.

Question 6 uses this context.
A water company has millions of residential and commercial customers. All customers have smart meters that track water consumption every 60 seconds. The smart meter transmits the consumption information back to the water company once a day.
The performance of the water pumps is monitored constantly. The information collected includes the volume of water pumped every minute, the power consumption and the intensity of the vibrations caused by each pump.
Information from automated testing facilities is constantly monitored to ensure the highest levels of water quality.
The water company recognises that it is dealing with Big Data.

Q6 Evaluate the advantages and disadvantages for the water company of collecting and using big data.

Marks available 12

Mark scheme

Question number	Indicative content	Mark
6	(A) = advantage, (D) = disadvantage Volume • (D) The water company will need to consider the merits of different available storage methods (local, cloud). • (D) It will need to develop policies for monitoring and archiving the large volumes of data. • (A) The large volume of data will support confidence in the analysis results (statistical significance). • (A) The large volume of historical data will provide a good foundation for business decisions (where to put new pumping stations). Veracity • (A) If the quality of the water drops on one of the pumps then action can be taken immediately to shut down the pump to ensure no ill effect on the consumer. • (D) Errors in employee records could lead to the water company failing to comply with legislation, such as taxation and reporting. • (D) The water company will have to consider methods for ensuring that data is reliable and trustworthy. • (A) Being able to trust the data could allow the water company to identify faults in the system confidently. Velocity • (D) The water company will have to consider if it has the processing capacity (machines, software) available to handle the speed at which the data arrives. • (D) Data arriving very quickly may mean having to purchase/procure/construct new machines/software/processes that are capable of working more quickly. • (A) By having data arrive quickly, the water company can respond immediately to system faults (redirect water, shut down pumps).	12

Question number	Indicative content	Mark
6 *Cont.*	Variety • (D) Readings from sensors will need to be processed in a different way to the readings from the smart meters. • (D) The customer data will need to be processed in a different way to the employee data. • (A) The different varieties of data could be shared with other organisations (achieve common goals, monetary gain). Analysis • (A) The collected data could be analysed to derive insights (customer fraud, seasonal patterns in usage, patterns in pump breakdowns). • (A) The collected data could be analysed to provide a more customised service (water quality tests/pump efficiencies could be reported to consumers based on local area). Security • (D) By placing a smart meter in their customers' homes, the water company needs to consider the security of the device. • (D) The smart meter must be secured to a level which protects the device from being accessed by an unauthorised person.	

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–4	Basic, independent points are made showing elements of knowledge and understanding of key facts/concepts/principles/ issues of information technology. The discussion will contain basic information with little linkage between points made.
Level 2	5-8	Demonstrates adequate knowledge and understanding of key facts/concepts/principles/issues of information technology. The discussion shows some linkages and lines of reasoning with some structure.

Level	Mark	Descriptor
Level 3	9-12	Demonstrates comprehensive knowledge and understanding by selecting relevant knowledge and understanding of key facts/concepts/principles/issues of information technology to support the discussion being presented. The discussion shows a well-developed, sustained line of reasoning which is clear, coherent and logically structured.

Advantages:

Having a big volume of data available for analysis should make the results of that analysis more accurate, increasing the probability that decisions made will be best for the business. Historical data will also build over time, giving improved ability to decide on e.g. new or replacement infrastructure.

Collecting water quality data at small intervals will give the company confidence in its ability to deliver high quality water to customers and will allow rapid response if there is a problem. e.g. if readings at one pumping station go out of the acceptable range the station can be shut down quickly so that other stations can take on the load without affecting quality.

The large amount of data collected also has an economic value to the company. It can be shared with or sold to other organisations or companies. Individual readings are worth very little but aggregated data which shows trends, usage patterns etc. can be worth a lot of money.

Disadvantages:

The large volume of data can be a problem as it must be stored and analysed. The storage required will increase rapidly over time and the processing power needed to conduct any analysis will go up as well. This all costs money.

The data will need to kept secure, and anonymised if it is sold on. This also has a cost. The company will need to conduct a cost benefit analysis to see if the benefits of having the data are worth the costs of collecting, storing and analysing it.

The company will also have to comply with GDPR or its equivalent in other countries.

The data collection process will require the smart meters and other sensors to be reliable. There will be costs for this, and additional costs in monitoring and replacing items. The meters themselves will also need to be made tamper proof, both physically and digitally.

The data transmission may also be a problem. If it uses cell phone technology it must be strongly encrypted and there will be a cost for the cell phone traffic. If send by wired connection cables will need to be laid or the water company would have to make arrangements with e.g. telephone or electricity companies that may already have cabling to each house.

In conclusion, the balance of advantage to disadvantage will probably come down to the costs of collecting, storing, securing and processing the data versus the savings that could be made in decision making, planning, avoiding infrastructure problems and of course the money that could be gained by selling the data.

Sample response 1 – Marks awarded: 12

Commentary
This answer meets the descriptor for a level 3 answer.
The candidate has considered advantages and disadvantages and given a coherent account several of these.
The conclusion does not come down on either side but explains that a cost benefit analysis would be needed.

Sample response 2 – Marks awarded: 3

Advantages to the water company:

1. They can get patterns and trends from the information to help with planning
2. They can sell the data on to other companies.
3. They will be able to identify pump faults and water quality problems quickly; this lets them give a better service.
4. They can save on staff costs as they won't need meter readers.

Disadvantages to the water company:

1. The company will have to pay for supply and maintenance of smart meters and other devices.
2. They will have to keep the data secure and they will need to pay for secure storage and encryption of the data.
3. There will be very large amounts of data, the company will need to pay for systems that can cope with it all.
4. Processing the data will need people to write specialised software.

Commentary
This answer meets some of the descriptor for a level 1 answer.
The candidate shows limited understanding and has formulated their answer as a list of facts. This is a set of basic, independent points showing elements of knowledge and understanding of key
facts.
The information given is correct but there is no attempt to link things together into a discussion. The answer contains basic information with no linkage between points made.
Some attempt at linkage would have raised the mark to the top of level 1.
A level 2 answer would need some of the facts to be enlarged into a discussion with linkage between them.

Question 7 uses this context.

A bicycle hire company operates a rental scheme in a city. Cyclists must register to use the rental scheme. Bicycles are placed in lockable racks around the city. Cyclists use a phone app or website to book a bicycle at a particular location. They are sent a text message with the lock code to release the bicycle. A member can book more than one bicycle on any day. The bicycles are inspected and serviced once a week to maintain safety of the riders.

Q7 Design the tables for a relational database for this system.
The solution should be in third normal form.
Use single line, parenthetical notation. Do not draw a diagram.

Marks available 10

Mark scheme

Question number	Answer	Additional guidance	Mark
7	Award a maximum of **ten** marks for presenting a viable solution. • Two tables identified by suitable names (1) for a maximum of (2). • Primary keys identified for two tables (1) for a maximum of (2). • Foreign keys identified (1) for a maximum of (3). • Additional fields provided in correct tables (1). • A functional solution demonstrating efficiency in terms of reducing data redundancy and reducing unnecessary storage requirements (1). • Use of notation across all tables (1). CYCLIST_TABLE (cyclistID, cyclistLastName, cyclistFirstName, ...) BICYCLES_TABLE (bicycleID, bicycleLockCode, bicycleLocation, bicycleMaker, ...) SERVICE_TABLE (serviceID, bicycleID*, serviceDate, servicePerson, ...) BOOKING_TABLE (bookingID, cyclistID*, bicycleID*, bookingDate, bookingPrice, ...)	A solution using more tables and keys may be correct, but the maximum marks awardable are based on the simplest solution. Compound keys are awardable, if used correctly. Functionality needs to consider removing duplicated data across tables and removing unnecessary fields.	**10**

Sample response 1 – Marks awarded: 10

CYCLIST_TABLE (cyclistID, lastName, firstName, mobile, address1, postcode)

BICYCLES_TABLE (bicycleID, lockCode, location, bikeMake, dateOfPurchase, hireCost)

SERVICE_TABLE (serviceID, bicycleID*, serviceDate, comments, safeToUse?)

BOOKING_TABLE (bookingID, cyclistID*, bicycleID*, bookingDate, bookingTime)

Commentary

The candidate has identified 4 tables, all of which have suitable names. The maximum of 2 marks awarded (marking point 1).

Each of the 4 tables has a suitable primary key identified. The name of each is relevant to the table contents. The maximum of 2 marks awarded (marking point 2).
The service table includes a suitable foreign key. A bicycle can have many services though a particular service can apply to only one bicycle. This is a 1:M relationship between the bicycles and service tables. Therefore, including the bicycleID in the service table is appropriate. The booking table includes two foreign keys. cyclistID is suitable as a cyclist can make more than one booking but a particular booking can only belong to one cyclist. This is a 1:M relationship between the cyclist and booking table. bicycleID is also appropriate as it is bicycle that is booked, a bicycle can be booked more than once but a particular booking can only be for one bicycle. This is a 1:M relationship between the bicycle and booking table. The maximum of 3 marks awarded (marking point 3).

Each of the tables includes additional fields that are suitable for the purpose of the table. 1 mark awarded (marking point 4).

The solution is functional. Data is atomic and there is no redundant data therefore no unnecessary storage. 1 mark awarded (marking point 5).

The candidate has produced a set of tables, written in the correct format, that result in a functional solution.

This includes correct naming of tables, identification of keys, normalisation. Standard notation has been used throughout. Table name followed by attributes. Primary keys are underlined, foreign keys are shown with asterisks. 1 mark awarded (marking point 6).

Sample response 2 – Marks awarded: 6

bike (bikeID, location)

rider (riderID, name, bikeID*, textNumber)

service (bikeID*, serviceDate, passed?)

Commentary

There are three tables with suitable names. It is clear to see the purpose of each table from the name. Maximum of 2 marks can be awarded (marking point 1).
Each of the three tables includes a suitable primary key. The candidate has chosen to use a composite key in the service table. The combination of both fields would ensure the key was unique for every instance. Maximum of 2 marks awarded (marking point 2).
Two foreign keys have been identified. bikeID is shown in the rider table. Whilst it is correct that there is a relationship between the bike and the rider the candidate has not realised that this would be a M:M relationship i.e. a rider can book many bikes and a bike can have many different riders. They have not picked up on the need for a booking table to solve this problem. No mark was awarded for this foreign key. bikeID is also used as a foreign key in the service table. This is correct. A bike can have many services, but a particular service can only be for one bike. This is a 1:M relationship between the bike and service tables. 1 mark awarded (marking point 3).
The candidate has included additional fields in each of the tables. However, the candidate has not included at least one important field that could be found in the scenario i.e. 'lock code, how could the rider release the bike without knowing the code? The candidate is not being penalised again for including bikeID in the rider table here. 0 marks awarded (marking point 4).
The solution is not functional and could not be implemented i.e. the rider table could not implement the bikeID as a foreign key unless the rider table did not have a primary key. This would then lead to the name and text number having to be repeated each time a rider hired a bike. The name should also have been atomised i.e. first and last name. The solution is inefficient in terms of reducing data redundancy and reducing unnecessary storage requirements. 0 marks awarded (marking point 5).
The candidate has produced a set of tables, written in the correct format. The tables are semi-functional but do not form a complete solution. The tables are not fully normalised. The candidate has not implement the bikeID as a foreign key unless the rider table did not have a primary key. This would then lead to the name and text number having to be repeated each time a rider hired a bike. The name should also have been atomised i.e. first and last name. The solution is inefficient in terms of reducing data redundancy and reducing unnecessary storage requirements. 0 marks awarded (marking point 5).
as not implement the bikeID as a foreign key unless the rider table did not have a primary key. This would then lead to the name and text number having to be repeated each time a rider hired a bike. The name should also have been atomised i.e. first and

last name. The solution is inefficient in terms of reducing data redundancy and reducing unnecessary storage requirements. 0 marks awarded (marking point 5).
The candidate has produced a set of tables, written in the correct format. The tables are semi-functional but do not form a complete solution. The tables are not fully normalised. The candidate hs used standard notation across all tables. Table name followed by attributes. Primary/composite keys underlined, foreign keys identified with asterisks. 1 mark awarded (marking point 6).

FOR INFORMATION ABOUT EDEXCEL, BTEC OR LCCI
QUALIFICATIONS VISIT QUALIFICATIONS.PEARSON.COM

EDEXCEL IS A REGISTERED TRADEMARK OF PEARSON EDUCATION LIMITED PEARSON

EDUCATION LIMITED. REGISTERED IN ENGLAND AND WALES NO. 872828
REGISTERED OFFICE: 80 STRAND, LONDON WC2R 0RL
VAT REG NO GB 278 537121

GETTY IMAGES: ALEX BELMONLINSKY

Pearson
Edexcel