



Rewarding Learning

ADVANCED  
General Certificate of Education

Centre Number

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Candidate Number

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# Software Systems Development

Unit A2 1:

Systems Approaches and Database Concepts

**MV18**

[ADV11]

**Assessment**

**Time**

Assessment Level of Control    Tick the relevant box (✓)

Controlled Conditions	
Other	

2 hours, plus your additional time allowance.

## Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

This paper is accompanied by a Pre-release Case Study.

You must **not** use your own annotated copy of this Case Study.

Write your answers in the spaces provided in this question paper.

Answer **all ten** questions.

## Information for Candidates

The total mark for this paper is 100.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in **questions 3, 5 and 6(b)**.

**1** Following early discussions with Shepherd’s Veterinary, Frank Adams, the senior analyst with Solutions Computer Consultancy (SCC) has indicated to his team that there are major concerns surrounding both the appointments system for farm visits and the billing procedures currently in place for these visits.

**(a)** Outline an example of how each of these issues might affect the business. [1 mark for each]

Appointments: \_\_\_\_\_

\_\_\_\_\_

Billing: \_\_\_\_\_

\_\_\_\_\_

**(b)** Explain the two most appropriate techniques the team might use to determine the extent of the concerns noted. You must indicate why each of these techniques is suitable and how they might be applied at Shepherd’s Veterinary. [3 marks for each]

Technique 1: \_\_\_\_\_

\_\_\_\_\_

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Technique 2: \_\_\_\_\_

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- 2** Frank always involves new trainee analysts in the development process and insists on testing their knowledge whenever possible. He has asked the trainees to complete the following paragraphs using the word list provided. Words and phrases may be used more than once.  
[8 marks]

**beginning**

**evaluation**

**first**

**objectives**

**scope**

**budget**

**execution**

**initiation**

**plan**

**schedule**

**closure**

**Feasibility Study**

**last**

**project**

**stakeholders**

**controls**

**feedback**

**manages**

**resources**

**time**

**deliverables**

**final**

**monitors**

**risks**

**Terms of Reference**

At SCC, the development of any new system is carefully planned using the project life cycle phases of initiation, planning, \_\_\_\_\_ and \_\_\_\_\_. In the initiation phase, one of the outcomes is a \_\_\_\_\_ which is an agreement and possibly a legal contract between SCC and Shepherd's Veterinary. This document will define the vision, \_\_\_\_\_, scope and \_\_\_\_\_ of the new project.

In all projects, \_\_\_\_\_, scope and \_\_\_\_\_ are essential considerations. The project manager \_\_\_\_\_ and \_\_\_\_\_ the project and is responsible for ensuring that a detailed \_\_\_\_\_ is produced. This must contain a schedule to ensure the project is delivered on time, as well as the estimated \_\_\_\_\_ and all \_\_\_\_\_ necessary.

In the \_\_\_\_\_ phase, the project manager will identify any problems and take corrective action to deal with them.

In the \_\_\_\_\_ phase of the project, the project manager will inform all \_\_\_\_\_ and conduct an \_\_\_\_\_ of the project.



- 4 Emily, the lead developer, tells the trainees that she is considering the use of database technology using Hierarchical, Network or Relational models in the development. In order to test some basic knowledge, she asks them to complete the table below by inserting **true** or **false** opposite each statement.

Complete the table below. [5 marks]

<b>Statement</b>	<b>true/false</b>
Use of a database demands more storage space than the use of conventional files.	
In a network model, multiple parents are possible for each child.	
In a relational model, each column in a table corresponds to a field that has a unique name holding multiple data types.	
Many to many relationships in a relational database are decomposed using a link table.	
The hierarchical model is the only model that requires knowledge of the physical storage of records in a file or memory.	





6 SCC has decided to develop an enquiry system for vet appointments. This will provide the following functionality:

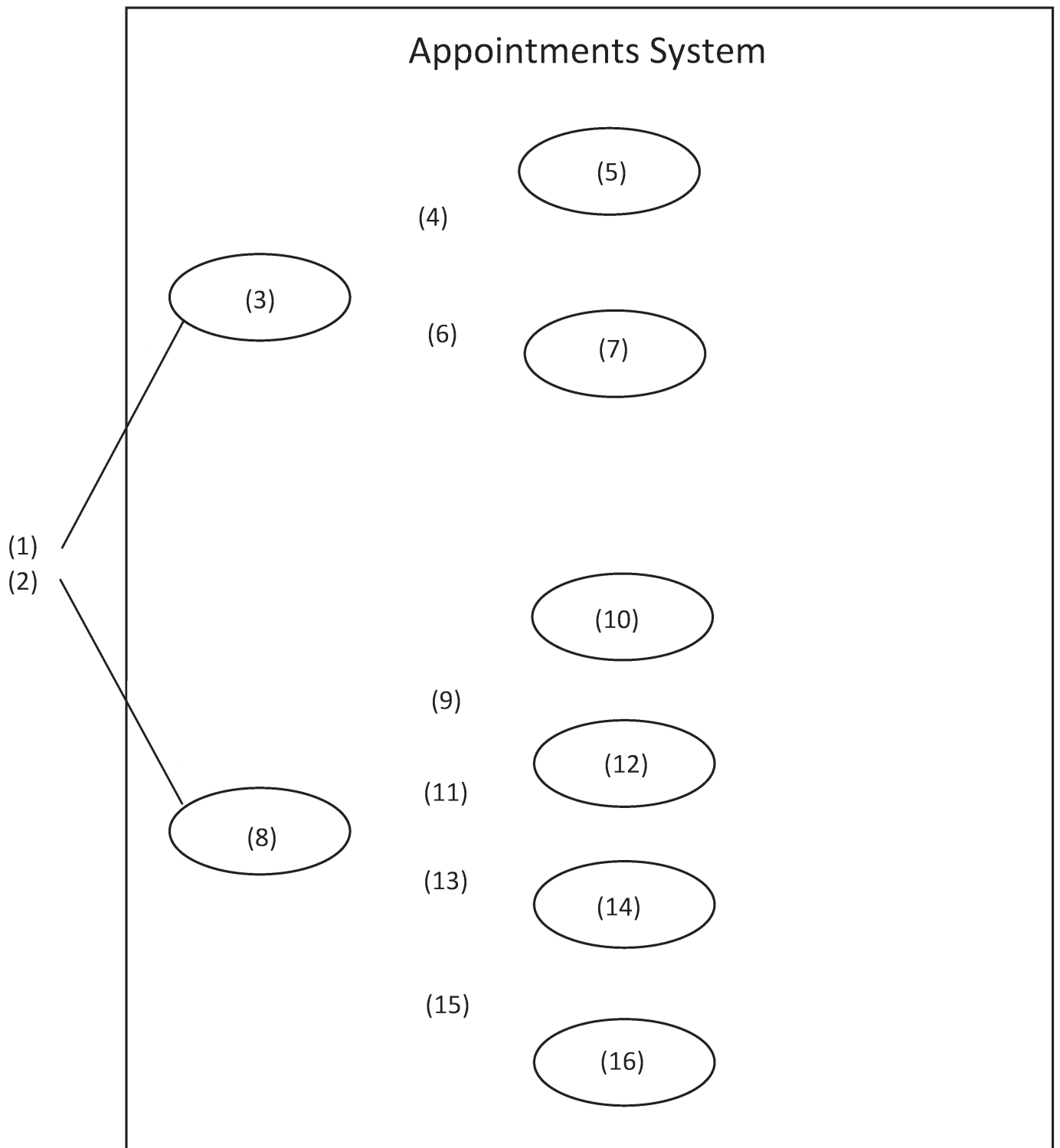
- A vet must be able to log on to the system using login credentials. These must be verified and an error message displayed if incorrect. It is assumed that being logged on is a prerequisite for any other functionality;
- A vet can view today's appointments and have the option to view future and historical appointments;
- Viewing today's appointments will automatically display the travel time and provide the option to view animal records.

(a) Frank has asked the trainees to complete the Use Case diagram opposite identifying the missing items.

Complete the missing symbols/names/connections.  
[8 marks]

- |           |            |
|-----------|------------|
| (1) _____ | (9) _____  |
| (2) _____ | (10) _____ |
| (3) _____ | (11) _____ |
| (4) _____ | (12) _____ |
| (5) _____ | (13) _____ |
| (6) _____ | (14) _____ |
| (7) _____ | (15) _____ |
| (8) _____ | (16) _____ |

# Use Case diagram for the Appointments System





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**(Questions continue overleaf)**

7 Normalisation is an important part of database design.

(a) State the three steps of the normalisation process.  
[3 marks]

1NF

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2NF

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3NF

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(b) **Multiple** and **Nested** repeating group types are often identified during the normalisation process.

With reference to the sample invoice given in the case study, identify the repeating group and indicate its group type.

Invoice repeating group [2 marks]

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Group type [1 mark]

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8 One of the priorities of the new computerised system is to streamline the process of recording details of farm visits. Emily is working on an entity relationship (ER) model for appointments and payments.

(a) Name the two main components of an ER diagram.  
[2 marks]

Component 1 \_\_\_\_\_

Component 2 \_\_\_\_\_

(b) Describe **three** benefits of using ER models when developing relational databases. [3 marks]

Benefit 1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Benefit 2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Benefit 3 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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**(Questions continue overleaf)**

9 **Figure 1** below shows a partial database design for animal appointments for use with the following requirements.

**Figure 1 Partial Database Design for Animal Appointments**

<b>Animal</b>	<b>Client</b>	<b>Breed</b>
AnimalID AnimalName AnimalDOB ClientID BreedID	ClientID ClientForename ClientSurname ClientAddress1 ClientAddress2 ClientAddress3 ClientPostcode ClientTelNo	BreedID BreedDesc
<b>Appointment</b>	<b>Vet</b>	<b>AppAnimal</b>
AppID AppDate AppTime ClientID VetID FarmVisitYN Duration NoOfAnimals	VetID VetForename VetSurname	AppID AnimalID

- (a) For the **ANIMAL** table, name and describe the constraint that **must** be applied to each of the following fields. [3 marks]

Field	Constraint / Description	
AnimalID		
BreedID		
AnimalDOB		





**10** Emily asks the trainees to consider the tests required to determine which vets are available to cover a two hour appointment at 3:00 pm on Wednesday 3rd June.

Complete the partial Test Table, opposite, to ensure that a selection list only includes available vets when new appointments are being made. [10 marks]

Use the partial database given in **Figure 1**, Question **9** and assume the following:

No appointments exist for June 3rd 2020

Last AppID used            1045

VetIDs:                      10 Peter Shepherd  
                                    11 Robert Hardy,  
                                    12 Jean Higgins and  
                                    13 Thomas Bryce.

IDs may be created for clients and animals.

## Test Table (partial)

Test data	Reason for test data	Expected outcome
<b>Appointment details:</b> <b>AppDate 3/06/2020</b> <b>AppTime 14:30</b> <b>Duration 1.5 hrs</b> <b>VetID 12</b> <b>ClientID 0051</b> <b>NoOfAnimals 2</b> <b>FarmVisitYN N</b> <b>(animal IDs D156, D157)</b>	<b>Insert valid appointment details for VetID 12 ending between 3:00 pm and 5:00 pm</b>	<b>Appointment 1046 details added to Appointment table</b> <b>Animals added to AppAnimal table with AppID (Vet 12 will not be available)</b>
	<b>Insert valid appointment details for VetID 11 starting between 3:00 pm and 5:00 pm</b>	
<b>Appointment details:</b> <b>AppDate 3/06/2020</b> <b>AppTime 13:00</b> <b>Duration 2 hrs</b> <b>VetID 13</b> <b>ClientID 0066</b> <b>NoOfAnimals 3</b> <b>FarmVisitYN Y</b> <b>(animal IDs R804, R905, R906)</b>		
<b>Appointment details:</b> <b>AppDate 3/06/2020</b> <b>AppTime 15:00</b> <b>Duration 2 hrs</b>	<b>Check that only free vets are available for selection from grid</b>	

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**This is the end of the question paper**

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For Examiner's use only			
Question	Marks available	Marks	Remark
1	8		
2	8		
3	8		
4	5		
5	8		
6	14		
7	14		
8	5		
9	20		
10	10		
<b>Total</b>	<b>100</b>		

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# Software Systems Development

Unit A2 1

Systems Approaches and Database Concepts

Case Study

**MV18**

**[ADV11]**

**Assessment**

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Assessment Level of Control    Tick the relevant box (✓)

Controlled Conditions	
Other	

## Assessment Case Study

### Instructions to Candidates:

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

You should use **this** clean copy of the pre-release material in the examination and not your own annotated copy.

## Shepherd's Veterinary

Peter Shepherd is the owner of a well-established veterinary practice situated on a farm location in the Newtown area. The practice caters mostly for large animals. Peter is a highly regarded member of the local community and has cared for the animals on local farms for many years. He is an enthusiastic environmentalist.

Peter has a busy practice and is assisted by three other full time vets, Jean Higgins, Thomas Bryce and Robert Hardy. Peter is old fashioned in his approach to the running of the practice. When he was working by himself, he simply responded to calls from animal owners as they arose. He accepted payment for his services as and when it was given. He did not give a great deal of attention to his billing system until his accountant forced him to be more rigorous in his approach because he was losing money. Peter did not have any real structure or routine in the way in which he conducted his work. Basically, he was much more interested in being a vet than in making money. However, over the years he gradually introduced a bit more organisation into the running of the practice and tried to establish a proper billing system, set times for routine calls as well as vaccination schedules and other similar routines.

The practice has increased dramatically in size and diversity and while there are now four full-time vets working at capacity, they are extremely stretched and intend to expand the team further. There are plans for two more vets and a practice manager. They now offer a pet service to the public and cater for all types of domestic pets. The practice also provides health care for JD Dog Care, run by Peter's son and daughter-in-law. The team already has a wide range of experience and expertise and is highly effective.

Many ideas for the development of the practice have been discussed by the team at their weekly meetings. However, expansion of provision as well as the necessity to provide an efficient service for such a large practice, along with cover for sickness and holidays, is always problematic. This is not helped by the fact that the administrative aspect of the practice requires a considerable overhaul.

Some years ago Peter employed a secretary, Rose Bryce, to assist him in the day-to-day running of the practice. At the time he saw this role as answering the phone, writing appointments in the diary and sending out invoices. In reality the requirements of the job were significantly greater than this and as the work expanded and more vets were employed, an additional administrative member of staff, Stephen Jackson, was also employed.

Peter invested in a computer system in 2010. At that time there were just Peter and Robert in the practice and very basic consultation regarding their administrative needs took place. Because Peter had limited knowledge of the possibilities of a suitable computer system, there were many oversights in the final installation. The system was extended to provide a small network of computers and printing facilities for Rose, Stephen and the vets. This system is insufficiently developed and does not have adequate software or capacity to facilitate the services that the practice now delivers. The database is poorly structured and the appointment booking system is error prone and does not access either the client database or the staff rota. Queries and reports are not readily accessible. Client details are repeatedly entered. The hardware is virtually obsolete and speed is an issue. There is no web site and consequently no opportunity for on-line bookings. There is no way of interacting with clients.

Any of the vets should be able to log on to the system at any time and check their schedule for the day/week. They should also be able to view animal records. If the system has not been properly updated then information can be incorrect. Increasingly vets are going to Rose or Stephen to check if they have anything written down in their notebooks/diaries regarding appointments.

Scheduling a correct amount of time for appointments to include travel between locations and doing the work required is always difficult and can only be estimated based on previous experience.

Rose and Stephen have resorted to maintaining a backup manual system. In order to avoid delays on the telephone, they frequently jot down appointment requests and other queries in notebooks/diaries and try to remember to enter them on to the system when they are not so busy. This has resulted in serious mistakes and farmers are very unhappy when a vet does not attend at an agreed time to conduct whatever service is required.

Because the system is so slow and unstructured, simple queries regarding appointments, bills or availability of services cannot always be addressed immediately and clients are told that there will be a follow-up phone call. This is highly unsatisfactory. Sometimes these queries are overlooked or the client is not available to answer the phone when a return call is made.

If Rose or Stephen is busy, the details taken from a client may be minimal and lead to wrong appointments, limited information regarding the issues involved, possible double bookings and the need to try and contact the client to clarify arrangements. This is time consuming for everyone and causes a great deal of frustration.

If Rose and Stephen are both taking calls and making notes because the system is inaccessible then there is a major capacity for error. They can only see double bookings they have made or unrealistic scheduling of appointments when they start to input the data to the computer system.

Extract from Rose's notebook on 10th March 2020



Hughes Wednesday afternoon 2ish  
sheep, (dip) 02890 777777

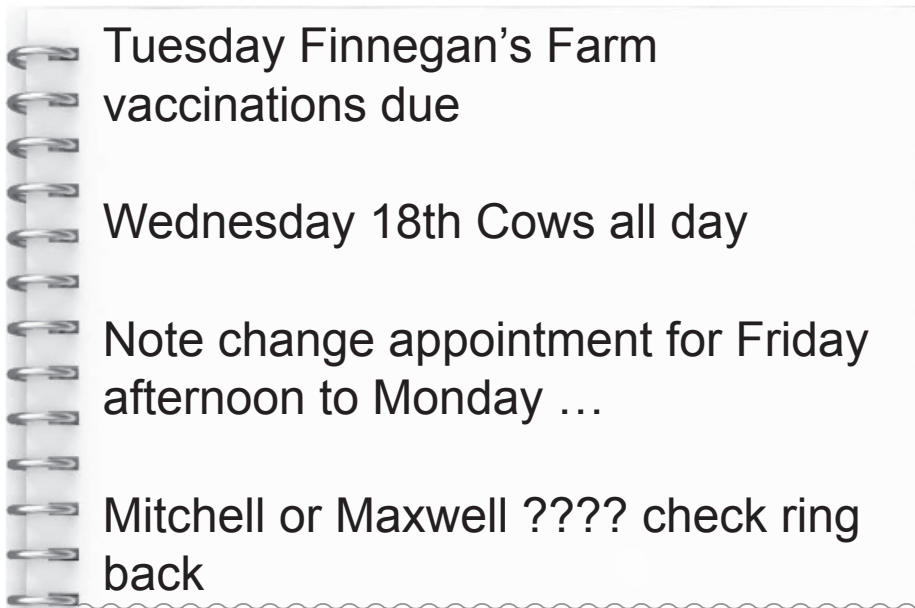
Bernard Farren Friday 27th 9.30  
could manage Thursday afternoon

Next Tuesday danny Brown calf  
(sore foot) 02890 555555

\*\*\*\*\*Check Wednesday appointment  
for Forbes 02890 222222 ring back  
urgent

cheques not cleared for Mitchells  
ring back

## Extract from Stephen's notebook on 10th March 2020



Client satisfaction is extremely important to Peter and he has become aware that people have complained about the difficulties they have encountered with appointments and payments. The invoicing system is hopelessly behind schedule and there are problems with issuing reminders and ensuring that payments are properly recorded.

When a vet completes a farm visit, details must be recorded on the system. These details include the nature of the visit, the treatment provided, the length of time taken and any medication or prescriptions issued. Initially vets tried to enter these details themselves following a visit. However, because the system is so slow and the time taken caused a huge problem, a document was designed for them to complete either at the farm or on return to the office. Details from the document are then entered onto the system by Stephen. This data entry should be done by close of business on the day after the visits, but this is rarely the case. The documents are also sometimes incomplete and this means that the content has to be validated with the vet concerned. These details are used to generate invoices.

Rose generally takes care of the accounts. Most clients have a running account because they require the services of the practice on an on-going basis. Rose uses the data entered onto the system about the appointments to create the invoices. Charges are based on the service provided, the medication used, any additional resources required and the time taken based on an hourly rate. Invoice production is very difficult as Rose must first check on any outstanding invoices, go through every record for each calendar month selecting information on each client and then calculate the bill. An additional problem for Rose is that clients might pay part of the sum owed for any given month and there is a 'carry over' impact. Rose has to be careful not to miss any of these incomplete payments and must note that VAT has already been calculated on the previous total. There are frequent disputes on the amounts involved and Rose is not always correct.

Extract from sample document completed by Robert Hardy  
5th March 2020

<b>Farm Visit Record</b>		
<b>Farm:</b> Hillcrest Farm <b>Owner:</b> William Lyttle	<b>Date:</b> 10/3/20	<b>Start:</b> 10 am <b>End:</b> 12.15 pm <b>Duration (rounded):</b> 2.5 hrs
<b>Service</b>	<b>Medication</b>	<b>Units used</b>
Animals checked		
Second round vaccination administered	G125 S144	20 20
Black fly dosing	Brown's lotion	20
Red Eye dosing	Brown's lotion	20
<b>Issues:</b> None		
<b>Notes:</b> Animal Tag (ID) details attached (20) Follow up required in two weeks Schedule further appointment Farm Manager has noted that no invoices have been supplied since January		
<b>Vet:</b>		Robert Hardy

Sample Invoice

**Shepherd's Veterinary**

**Invoice**

**Shepherd's Veterinary**

**Coast Road**

**Newtown**

**02899444444**

**shepherds@animal.com**

**ClientID: 0025**

**William Lyttle**

**Hillcrest Farm**

**Church Road**

**Newtown**

**Appointment date: 10/3/2020**

**Farm Visit**

**Y**

**Invoice No: 397746R**

**Invoice Date: 3rd April 2020**

**Duration: 2.5 hrs**

**No of Animals: 20**

Service ID	Service	Medication	Qty	Medication Unit Price	Amount
Vac2	Second round vaccination	G125	20	5.00	£100.00
		S144	20	3.00	£60.00
DS22	Black fly dosing	BL2	20	1.50	£30.00
DS17	Red Eye dosing	BL2	5	1.50	£7.50
				Call out fee	£20.00
				Assessment Fee (Rate × Duration)	£150.00
				Sub-total	£367.50
				Vat (20%)	£73.50
				<b>Total</b>	<b>£441.00</b>

Shepherd's Veterinary liaises directly with JD Dog Care. Any dog attending the Dog Care centre must have a full health check. Unless owners can provide proof of this, an appointment is made with Shepherd's Veterinary pet facility. All dogs attending an appointment will have a full health check, vaccination top-ups if required and an electronic chip if necessary. All details are recorded for each dog on attendance and any medication dispensed is noted.

Initially, it was felt that the dog owners would prefer to be billed for veterinary services through JD Dog Care. This meant that the vet facility had to notify JD Dog Care of all details relating to check-ups and treatments. Shepherd's Veterinary then billed JD Dog Care on a monthly basis. JD Dog Care billed their clients using whatever method the client preferred.

After two months, it was realised that this was totally unsatisfactory. Information was not communicated effectively and payments from JD Dog Care to Shepherd's Veterinary were sometimes incorrect, late and difficult to track. Many payments were lost as a result. In addition, translating the vet bill and mapping it to the client bill was causing an enormous amount of unnecessary work.

Shepherd's Veterinary now bills clients coming from JD Dog Care in the same way as routine customers. There is still an issue over the transfer of records for each dog from the vet to JD Dog Care.

The team has a very dynamic approach to current developments and recognises that the practice must address many new initiatives in order to remain popular with local farmers. Robert, who along with Peter is a senior partner, wants to introduce Health Plans and Infection Monitoring for animals

in their care. Robert also understands the importance of the administrative issues that will be involved in establishing these schemes. The team understands that this development will provide a very secure financial income. They also recognise that a new computer system is essential for this aspect of the business.

In addition, the new developments already in place with JD Dog Care and the public also provide the possibility of establishing similar Health Care Plans.

It is clear to everyone that a complete overhaul of the system is necessary in order to maintain the organisation.

**Peter and his partners at Shepherd's Veterinary have decided that it is now essential to have a totally reliable computer system that will resolve the administrative issues they are facing. They have approached Solutions Computer Consultancy (SCC) to review their entire operation and implement a fully functional computer system.**

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