



Rewarding Learning

**ADVANCED**  
General Certificate of Education  
2024

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

# Software Systems Development

Unit A2 1

Systems Approaches and  
Database Concepts



**[ADV11]**

\*ADV11\*

**THURSDAY 23 MAY, AFTERNOON**

## TIME

2 hours.

## INSTRUCTIONS TO CANDIDATES

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

**You must answer the questions in the spaces provided.**

**Do not write outside the boxed area on each page or on blank pages.**

Complete in black ink only. **Do not write with a gel pen.**

Answer **all eight** questions.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in questions **1(a)**, **2(b)**, **4** and **5(b)**.

14307



\*24ADV1101\*

- 1 (a) During the initiation phase of software development, a feasibility study may be commissioned, and a Terms of Reference document is usually established. Discuss how each of these components of the initiation phase contributes to the development of a new system at Total Cleaning Services (TCS), identifying the personnel likely to be involved.

**Quality of written communication will be assessed in this question.**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

[6]



(b) Catherine, the Systems Analyst, has explained to the various stakeholders that the initiation phase will set the foundation for the project at Total Cleaning Services (TCS) and establish its overall direction.

Identify two stakeholders needed to resolve the problems with the **Additional Hours Claim Form** (Document 3 – page 6 of the case study), explaining why their involvement is necessary.

Stakeholder 1: \_\_\_\_\_

Explanation:

---

---

---

---

---

Stakeholder 2: \_\_\_\_\_

Explanation:

---

---

---

---

---

[6]



2 Pat, the project manager, and her team have decided to adopt an agile methodology for the development of a new system at TCS, as an alternative to a traditional approach.

(a) Using the letters from the following list, complete the table below to show the key values of Agile Methodologies. The first match has been done for you.

- A Responding to change
- B Customer collaboration
- C Working software
- D Following a plan
- E Processes and tools
- F Contract negotiation
- G Comprehensive documentation
- H Individuals and interactions

Key Values of Agile		
H	over	E
	over	
	over	
	over	







[3]





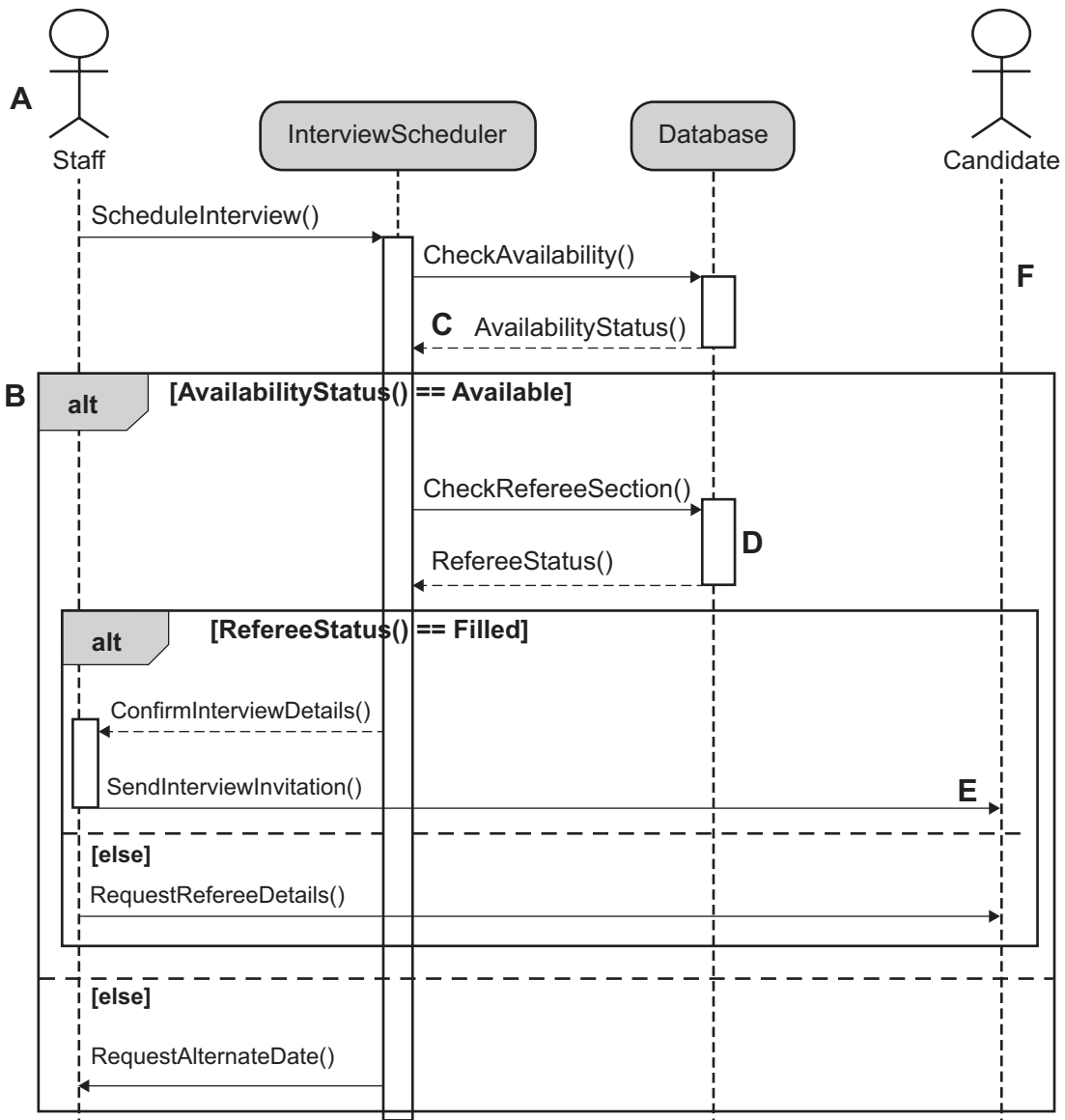
3 Catherine has used UML to create a sequence diagram which depicts part of the process of scheduling interviews for potential new employees.

(a) Complete the following table to identify the components of the sequence diagram opposite:

Component Symbol	Component Name
<b>A</b> 	
<b>B</b> 	Alternative Frame
<b>C</b> 	Return Message
<b>D</b> 	
<b>E</b> 	
<b>F</b> 	

[4]





Note: an alternative frame (alt) represents a choice between two or more message sequences and is equivalent to an "if-else"

[Turn over



**(b)** Describe the interactions in the sequence diagram that ensure there are no missing referees.

---

---

---

---

---

---

---

---

---

---

[3]

**(c)** Identify two other UML diagrams that could be used during development of the new systems at TCS. For each diagram you choose, specify the intended audience type.

UML Diagram 1: \_\_\_\_\_

Intended Audience Type: \_\_\_\_\_

UML Diagram 2: \_\_\_\_\_

Intended Audience Type: \_\_\_\_\_ [4]







**4** Pat has prioritised the requirement for developing an interview schedule in the development process but is now concerned that other issues with the current system should be addressed first.

Considering the constraints of the Iron Triangle, discuss the potential implications to other project requirements if the interview schedule requirement proves more complex to design and implement than initially anticipated.

In your answer, you should identify other requirements from the case study that might be affected, and how Pat might manage the project to ensure its success without compromising on quality.

**Quality of written communication will be assessed in this question.**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**[6]**

**[Turn over**



5 Catherine wants to ensure the new system will apply the correct overtime rate for staff and has begun the testing process.

(a) By referring to **Table 1 Overtime Rates** from page 5 of the case study, complete the partial Test Table below to ensure that relevant test data is entered which will produce the expected outcome.

Partial test table		
Test Data	Reason for Test Data	Expected Outcome
Day Worked: _____  Time Period: _____  Specialist Code:	To ensure that the base rate is applied.	Base rate applied.
Day Worked: _____  Time Period: _____  Specialist Code:	To ensure that the base rate +18% is applied.	Base rate applied +18% applied.

[6]





6 Catherine is considering the optimal database structure for the proposed software solution at TCS.

Complete the paragraphs below by selecting the correct words or phrases from the selection provided. Words and phrases may be used more than once.

<b>attributes</b>	<b>entities</b>	<b>indexing</b>	<b>parent-child</b>	<b>schema</b>
<b>C#</b>	<b>entity</b>	<b>management</b>	<b>primary key</b>	<b>sibling</b>
<b>cardinality</b>	<b>entity-relationship</b>	<b>network</b>	<b>query</b>	<b>SQL</b>
<b>child</b>	<b>foreign key</b>	<b>normalisation</b>	<b>relational</b>	<b>tables</b>
<b>children</b>	<b>hierarchical</b>	<b>parents</b>	<b>relationships</b>	<b>transaction</b>

Databases come in various types, but the three most common ones are the \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ models. The \_\_\_\_\_ model is widely used today due to its flexibility and efficiency. It organises data into \_\_\_\_\_ and relationships are established using \_\_\_\_\_ and \_\_\_\_\_ concepts. In contrast, the \_\_\_\_\_ model organises data in a \_\_\_\_\_ structure, much like a family tree. The \_\_\_\_\_ model is similar, but it allows a \_\_\_\_\_ to have multiple \_\_\_\_\_, creating a more complex set of relationships.



A critical part of modern database design is the \_\_\_\_\_ model.

This method of database design involves identifying \_\_\_\_\_ and their \_\_\_\_\_, as well as the \_\_\_\_\_ between them.

The \_\_\_\_\_ of a relationship, that is, the number of instances of an \_\_\_\_\_ that can be associated with instances of another, is a crucial aspect of this model.

It is important to note that all these operations and manipulations are made possible by a database \_\_\_\_\_ system which uses languages like \_\_\_\_\_ for data manipulation and definition.

[10]



7 Jean and Henry record client overtime submissions in tabular format on their laptop. A sample of the monthly overtime submissions is displayed on the next page.

Catherine will examine this data and attempt to normalise it.

(a) Explain the importance of normalising data when developing database systems.

---

---

---

---

---

---

---

[3]

(b) Identify the key focus for the following stages of normalisation:

(i) 1NF

---

---

[1]

(ii) 2NF

---

---

[1]

(iii) 3NF

---

---

[1]





**BLANK PAGE**

**DO NOT WRITE ON THIS PAGE**

**(Question 7 continues overleaf)**

**[Turn over**

14307



\*24ADV1115\*

Partial record of overtime hours for employees:

OTMonthID	StaffID	FName	SName	EmploymentType	ContractHours	FormReceived	OTDate	StartTime	EndTime	DayType	SpecialistID
Mar24	2001	Warren	Patterson	Full-time	40	30-03-2024	01-03-2024	18:00	22:00	Weekday	S1
											S2
Mar24	2002	James	McArdle	Part-time	20	26-03-2024	02-03-2024	07:00	08:00	Saturday	
											S2
											S3
Apr24	2001	Warren	Patterson	Full-time	40	25-04-2024	04-03-2024	18:00	22:00	Weekday	S1
---	---	---	---	---	---	---	---	---	---	---	---





Catherine has identified three repeating groups from the overtime hours table.

(c) Transform the data from the table into 1NF.

**1NF**

**OTMONTH\_STAFF** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**OTMONTH\_STAFF\_DATE** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**OTMONTH\_STAFF\_DATE\_SPECIALIST** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]

[Turn over



Transform the data from the table into 2NF.

**2NF** (unchanged tables should be labelled as *table name (unchanged)*)

---

---

---

---

---

---

---

---

---

---

---

---

[3]

Transform the data from the table into 3NF.

**3NF** (unchanged tables should be labelled as *table name (unchanged)*)

---

---

---

---

---

---

---

---

---

---

---

---

[1]





**BLANK PAGE**

**DO NOT WRITE ON THIS PAGE**

**(Questions continue overleaf)**

14307

**[Turn over**



\*24ADV1119\*

- 8 Louise, the database developer, is working on a database structure (**Fig. 1**, below) to help automate the matching process between clients and staff.

STAFF		SPECIALITY		TOWN	
Field	Data Type	Field	Data Type	Field	Data Type
StaffID	int	SpecialID	int	TownID	int
StaffTitle	varchar(5)	SpecialDesc	varchar(20)	TownName	varchar(20)
StaffFName	varchar(20)	SpHourlyRate	decimal(4,2)		
StaffSName	varchar(20)				
StaffPcode	varchar(12)				
StaffTownID	int				
StaffTel	varchar(11)				
StaffEmail	varchar(20)				

STAFF_SPECIALITY		STAFF_CLIENT_MATCH	
Field	Data Type	Field	Data Type
StaffID	int	StaffID	int
SpecialID	int	ClientID	int

STAFF_AVAILABILITY	
Field	Data Type
StaffID	int
SlotID	int

**Fig. 1: Partial** database structure for matching process

- (a) Declan Downey (StaffID: 3) is available in the morning (SlotID: 1) and afternoon (SlotID: 2).

Write the SQL script that will add these records to the database.

---



---



---



---



---



---

[4]



**(b)** After taking a course, one of Declan's specialities has changed from Basic Sanitisation and Deep Cleaning (SpecialID: 2) to Hazardous Tasks Cleaning (SpecialID: 3).

Write the SQL script that will reflect this change in the database.

---

---

---

---

---

---

---

---

[4]

**(c)** A new field, StartDate, needs to be added to the STAFF table. The field's value should be the current date, by default.

**(i)** Write the SQL script that will reflect this change in the database.

---

---

---

---

---

---

---

---

[4]

**(ii)** What will be the StartDate value for existing staff such as Declan, after this change has been made?

---

[1]

[Turn over



(d) A list of experienced cleaners is needed who specialise in antique and artwork cleaning. The client requesting the service understands that this is a niche service and will consider cleaners from any town. The client will accept any time slot except Sunday.

**Note:**

- Assume that SpecialID for Antique and Artwork Cleaning has been added as ID 4
- SlotID for Sunday is 5
- A cleaner is classified as experienced if they have been employed for 5 years or more
- Assume StartDate has been added to the Staff table and values have been added for existing staff

Write the SQL script that will create a list that satisfies the requirements above. The list should include the number of suitable cleaners available per town.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---





---

---

---

[12]

---

**THIS IS THE END OF THE QUESTION PAPER**

---

14307



\*24ADV1123\*

**DO NOT WRITE ON THIS PAGE**

<b>For Examiner's use only</b>	
<b>Question Number</b>	<b>Marks</b>
1	
2	
3	
4	
5	
6	
7	
8	

<b>Total Marks</b>	
--------------------	--

**Examiner Number**

Permission to reproduce all copyright material has been applied for.  
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified.

ADV11/4  
295713







*Rewarding Learning*

**ADVANCED**

**General Certificate of Education**

**2024**

---

# **Software Systems Development**

Unit A2 1

Systems Approaches and Database Concepts

Case Study

**[ADV11]**

**THURSDAY 23 MAY, AFTERNOON**

---

## **Examination Copy**

### **Instructions to Candidates:**

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

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

## **TOTAL CLEANING SERVICES**

Total Cleaning Services (TCS) is a developing company that continues to expand and diversify. The company is owned by Jean and Henry Johnson who have personal experience of the management of hotel housekeeping and maintenance services in the business sector. This experience has helped them form the foundations of their business.

Jean and Henry identified two goals. The first, which is now well established, was to create an agency service that would provide full-time or part-time cleaners and housekeeping staff for individual private clients and local businesses. The second, longer term goal, is to establish a maintenance service to be developed in a similar manner. Their hope is that this will ultimately lead to a full facilities management service. They have a very clear business vision.

TCS has already recruited 35 skilled staff whose details have been added to an employee register. They have also created a client register (currently holding 112 clients) to record requests and maintain client details. TCS must be able to provide the right match between employee and client.

Many clients require help at short notice due to unforeseen circumstances and Jean and Henry see this as an important aspect of TCS. They want to present their clients with fully-trained professional employees who will maintain the highest possible standards in their work. They intend to expand these services to include contracts with larger scale clients, including hospitals and schools.

TCS recruits staff depending on demand and possible future need. Following an application and interview process, successful applicants are invited to join the company. Details are taken from their application form (see Document 1) and recorded in the staff register. These include contact details, availability and any specialist certification and experience.

**Document 1**

**TOTAL CLEANING SERVICES (TCS)**

**Application Form**

**Full Time /Part Time (circle preference)**

Title: \_\_\_\_\_ Forename: \_\_\_\_\_ Surname: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Postcode: \_\_\_\_\_

Telephone No: \_\_\_\_\_

Email: \_\_\_\_\_

Current position: \_\_\_\_\_

Availability: **Morning / Afternoon / Evening / Saturday / Sunday (circle preference)**

Qualifications: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Experience: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Specialist Skills: \_\_\_\_\_

Referees: 1. Name: \_\_\_\_\_ 2. Name: \_\_\_\_\_

Address: \_\_\_\_\_ Address: \_\_\_\_\_

\_\_\_\_\_

Postcode: \_\_\_\_\_ Postcode: \_\_\_\_\_

Telephone No: \_\_\_\_\_ Telephone No: \_\_\_\_\_

Requests for cleaning services come from a variety of clients, both private and business. These requests are recorded in a client register. Details are gathered on a client request form (Document 2) which may be completed by the client or by Jean.

Details include client information, nature of the service requested, and the times required.

**Document 2**

**TOTAL CLEANING SERVICES (TCS)**  
**Client Request Form**  
**Private / Business Client (circle preference)**

Business Name: \_\_\_\_\_ Contact: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Postcode: \_\_\_\_\_

Telephone No: \_\_\_\_\_

Email: \_\_\_\_\_

One-off service / regular service (daily / weekly / monthly) **(circle preference)**

Preferred time slot: Morning / Afternoon / Evening / Saturday / Sunday **(circle preference)**

Specialist service: Yes / No **(circle preference)**

Number of hours: \_\_\_\_\_

Requests can come from private clients seeking one-off services, for example, a total house clean prior to or after a house move, or help following renovations. Private clients may also seek regular services, daily, weekly or monthly depending on circumstances.

Requests from businesses are generally for regular cleaning services at particular times, sometimes early in the morning, after business hours or at weekends. Sometimes, a business will seek an annual one-off deep clean, specialist cleaning following work-related incidents, reconstruction of an office layout or before a change of premises.

All clients can avail of specialist cleaning services which could involve using special equipment, wearing protective clothing and perhaps dealing with hazardous substances and other environmental issues. Staff conducting this type of cleaning must be fully trained and equipped with the correct resources to conduct the service required. These services could include carpet cleaning, complete sanitisation of an area, dealing with hazardous spillage or completely deep cleaning kitchens and appliances, domestic or commercial.

On completion, the contents of Documents 1 and 2 are copied into WORD documents. This is effectively just a random store of details with no real organisation. Many applicants omit sections of the form which are important, like 'previous experience' or 'Referees'. Some applicants do not supply correct contact details and this is a big issue.

Once the closing date for a round of applications has passed, candidates are invited for a short interview. Where possible any incomplete information is recorded at this point, although this is time consuming and causes delay. A similar process is conducted with clients completing a request form for services with the information again being copied into a WORD document. No dates are indicated on either document. TCS wants all these processes to be conducted entirely on-line.

All employees and all clients sign a contract.

As the registers increase in size the manual matching process has become less efficient and quite unreliable.

TCS matches clients with available staff, always seeking to achieve the best possible fit. This matching process has been managed in a reasonably efficient manner so far, largely because of the low numbers involved. However, it has always been acknowledged that a proper computer system would be necessary to facilitate a growing client base, allow on-line interaction, manipulate information and extract proper reports and statistics. It is clear to TCS that the need for a proper computer system is now a priority. Flaws in the 'matching' process are emerging. Delays are becoming inevitable because of demand and there is a real danger of business being lost. On several occasions there has also been a clear mis-match between client and employee and poor communication regarding scheduled services and client requirements.

Some clients have indicated that staff do not appear to conduct a specialist service adequately and on occasions they do not have the appropriate equipment.

Although TCS has now employed three full-time staff to assist with administration, it is difficult to manage everything and there is a chaotic approach. The administration of recruitment, record keeping, tracking staff schedules, managing maintenance and transport of equipment, financial aspects of salaries, overtime and billing is approaching crisis level.

In addition to this, billing clients and managing the staff payroll are very labour intensive tasks and are not always completed in a timely and accurate manner. These activities were reasonably well managed when numbers were small but now delays are arising and even more worryingly, mistakes are being made.

Full-time and part-time staff are paid monthly on a fixed base rate that is reviewed annually. All staff may also take on overtime hours beyond their contracted hours. These hours are paid at different rates depending on whether it is daytime, evening or weekend work and also if any specialist skills are provided as clients should be billed accordingly. A code of S1 involves the use of equipment and applies to jobs such as carpet cleaning and commercial appliances. A code of S2 would be applied to sanitisation and deep cleaning. A code of S3 indicates any hazardous tasks. Specialist skills, S1, S2 and S3, are paid at a flat rate of £10, £20 and £30 respectively.

Table 1 below shows the various rates of pay.

**Table 1: Overtime Rates**

Day	Time Period			Specialist S1/S2/S3
	6.00am–9.00am	9.00am–5.30pm	5.30pm–10.00pm	
Weekday	Base rate + 10%	Base rate	Base rate + 10%	Time period rate + 5% + S1/S2/S3
Saturday	Base rate + 15%	Base rate + 10%	Base rate + 15%	Time period rate + 8% + S1/S2/S3
Sunday	Base rate + 15%	Base rate + 10%	Base rate + 15%	Time period rate + 8% + S1/S2/S3

All staff doing overtime must submit an 'Additional Hours Claim Form' at the end of each month for any additional hours worked. These hours should be paid in the middle of the following month, after they have been verified. A sample document 'Additional Hours Claim Form' (Document 3) is shown below.

**Document 3**

**TOTAL CLEANING SERVICES (TCS)  
ADDITIONAL HOURS CLAIM FORM**

Full-time / **Part-time** (circle contract type)

Contract hours: 18

Name: Sally McKenna

Date received: \_\_\_\_\_

Week beginning:		Client Name: <i>Smiths Smythes</i>					
Day	Date	Start:	End	Weekday	Saturday	Sunday	Totals
<i>Monday</i>	<i>5/02/24</i>	<i>6.30am</i>	<i>8.30am</i>	<i>√</i>			<i>2</i>
<i>Saturday</i>	<i>17/02/24</i>	<i>10.00am</i>	<i>11.45pm</i>			<i>√</i>	<i>1.5</i>
<i>Sunday</i>	<i>18/02/24</i>	<i>1.00pm</i>	<i>4.00pm</i>		<i>√ S2</i>		<i>3</i>
<i>Monday</i>	<i>19/02/24</i>	<i>7.00am</i>	<i>8.30pm</i>		<i>√</i>		<i>2.5</i>
<i>Saturday</i>	<i>17/02/24</i>	<i>9.30am</i>	<i>11.00am</i>	<i>√</i>			<i>1.5</i>
<i>Sunday</i>	<i>18/02/22</i>	<i>1.00pm</i>	<i>3.00pm</i>		<i>√ S2</i>		<i>2</i>

Overall hours claimed: 12

Signed: Sally McKenna Date: 29th February 2024

The form has become an administrative nightmare. A separate form must be completed for each client. Employees sometimes get the client's name or dates and times wrong or total their additional hours incorrectly. There is no way of identifying employees or clients with the same name. The form is tedious and difficult to complete. Employees frequently submit the form too late for payment in the middle of the month and this leads to a lot of annoyance and subsequent complaints. If the form takes too long to be checked, payment is also delayed.

Billing clients also takes up a great deal of time, and multiple checks are required.

Although both Henry and Jean recognise the importance of good IT facilities to assist their operation, they have no real understanding of what might be required. They have already acquired lap-tops and some software and have recorded information relating to applicants and the job requests. However, they do not have the IT resources necessary to run the business effectively.

**Henry and Jean have discussed the problems with their staff and their accountant and have made contact with the computer consultancy Software Solutions. Henry and Jean recognise the urgent need to investigate proper computer solutions for the business. The consultancy will review the entire organisation and make recommendations for the implementation of a new computer system.**

Permission to reproduce all copyright material has been applied for.  
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA  
will be happy to rectify any omissions of acknowledgement in future if notified.