

STUDENT NUMBER           Letter

# INFORMATION TECHNOLOGY: SOFTWARE DEVELOPMENT

## Written examination

Friday 13 November 2015

Reading time: 3.00 pm to 3.15 pm (15 minutes)

Writing time: 3.15 pm to 5.15 pm (2 hours)

## QUESTION AND ANSWER BOOK

### Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	5	5	20
C	15	15	60
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

#### Materials supplied

- Question and answer book of 23 pages with a detachable insert containing a case study for Section C in the centrefold.
- Answer sheet for multiple-choice questions.

#### Instructions

- Remove the insert containing the case study during reading time.
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

#### At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.**

**SECTION A – Multiple-choice questions****Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

**Question 1**

Sue has just completed outlining the scope of a software development project.

At which stage of the problem-solving methodology does this occur?

- A. design
- B. analysis
- C. evaluation
- D. development

**Question 2**

A systems analyst wants to collect unbiased data about an existing system.

The best way to collect this data is by completing

- A. a site visit.
- B. mail-out surveys.
- C. telephone interviews.
- D. face-to-face interviews.

Use the following information to answer Questions 3–5.

The pseudocode below alters the values of the three variables A, B and C.

```
Begin  
  A ← 3  
  B ← 5  
  While A < 2 * B  
    C ← A * A  
    A ← A + 1  
    B ← B – 1  
  EndWhile  
  Print C  
End
```

### Question 3

What is the output from the pseudocode above?

- A. 4
- B. 9
- C. 16
- D. 25

### Question 4

How many times is the **While** loop executed?

- A. 1
- B. 2
- C. 3
- D. 4

### Question 5

In the pseudocode above, the lines  $C \leftarrow A * A$  and  $A \leftarrow A + 1$  are examples of which control structure?

- A. repetition
- B. selection
- C. sequence
- D. iteration

### Question 6

Which types of documentation would a programmer find most useful when needing to understand the logic of program code?

- A. CASE tools and storyboard
- B. internal documentation and storyboard
- C. external documentation and pseudocode
- D. pseudocode and internal documentation

**Question 7**

A binary search is performed on the following list of 15 names:

Anne, Ben, Charles, David, Dianna, Erica, James, Joanna, Joshua, Mary, Murray, Nuwan, Olivia, Piper, Soula.

How many names need to be compared to show that Francine is not on the list?

- A. 3
- B. 4
- C. 7
- D. 15

**Question 8**

What is the best tool to represent the role of people in a software development project?

- A. context diagram
- B. use case diagram
- C. data flow diagram
- D. data structure diagram

**Question 9**

When using files, fields and records, what is a record?

- A. a collection of related data
- B. a set of instructions saved into a table
- C. a collection of data saved into a table
- D. a collection of data all of the same type

**Question 10**

A company is developing a staff survey to help evaluate its new software solution.

What would be a good survey question to help evaluate the efficiency of this solution?

- A. Is the solution always accurate?
- B. Is the solution always faster to use?
- C. Are the online instructions always clear?
- D. Is the solution producing what is expected?

**Question 11**

Which one of the following would be the best description of a Trojan?

- A. It hides itself in an application and infects one or more systems after the application is executed.
- B. It is self-replicating and, therefore, needs no user intervention to allow the system to be infiltrated.
- C. It sends messages to a computer with an IP address, indicating that the message is coming from a trusted host.
- D. It collects personal information from the user without appropriately obtaining prior consent from the user and transmits this data.

**Question 12**

Molly is designing an electronic key card system to unlock the doors to rooms in a hotel.

Which one of the following validation techniques could be used to allow only numbers between 1 and 50 to be entered into the data entry field for the room number?

- A. check digit
- B. room check
- C. range check
- D. length check

**Question 13**

'This layer transmits data bit by bit over different media.'

Which layer of the Open Systems Interconnections (OSI) model does the statement above best describe?

- A. the physical layer
- B. the network layer
- C. the data link layer
- D. the transport layer

**Question 14**

Which one of the following best describes a wired network when compared with a wireless network?

- A. easier to install, easier to add computers, less secure
- B. easier to install, harder to add computers, less secure
- C. harder to install, easier to add computers, more secure
- D. harder to install, harder to add computers, more secure

**Question 15**

Frederick is a professional photographer. At the end of each day, he copies all the files he has created that day onto a flash drive. At the end of each month, he copies all the files older than six months onto a DVD and stores the DVD in a fireproof safe. He then deletes these files (those over six months old) from his computer system.

This procedure is best described as

- A. backing up files each day and archiving files each month.
- B. archiving files each day and backing up files each month.
- C. archiving files each day and disposing of files each month.
- D. backing up files each day and disposing of files each month.

**Question 16**

When using stacks and queues, which is the correct statement?

- A. The last item in is the last item out for a stack.
- B. The first item in is the first item out for a stack.
- C. The last item in is the last item out for a queue.
- D. The first item in is the last item out for a queue.

**Question 17**

In addition to identifying, scheduling and monitoring tasks, what other key factors should be considered when managing a project?

- A. time, cost, programs
- B. time, resources, people
- C. people, procedures, cost
- D. people, programs, processes

**Question 18**

Which one of the following is a key action undertaken in the evaluation stage?

- A. validation of all variables used in the solution
- B. measuring the constraints that influence the solution
- C. designing measures to protect the security of the solution
- D. collecting data to measure the effectiveness of the solution

**Question 19**

When Julie is drawing data flow diagrams (DFD), she is always careful to follow the correct guidelines.

Which one of the following statements would she regard as correct?

- A. All data processes must manipulate data.
- B. The data stores are represented by large circles.
- C. Data flows must be labelled with the names of physical objects.
- D. Data flows can be shown as moving directly from an entity to a data store.

**Question 20**

Five family members each have a notebook computer and a mobile phone. The parents have decided to give each other and each child a tablet and an ebook reader.

The users furthest away from the wi-fi router, which is located at the front of the house, may experience

- A. decreased security.
- B. decreased bandwidth.
- C. decreased power usage.
- D. decreases in costs and services.

**SECTION B – Short-answer questions****Instructions for Section B**

Answer **all** questions in the spaces provided.

**Question 1** (5 marks)

Annalie asks a programmer, Sam, to help her code a program. She suggests that 50 per cent of code lines be internal documentation as that is her company's normal practice. Sam says that adding internal documentation is a waste of time and he can work much faster if he just leaves out all internal documentation.

- a.** Outline two reasons to support Annalie's suggestion of adding internal documentation. 2 marks

Reason 1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Reason 2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- b.** Describe **one** naming convention that you have used in programming. Explain how this convention makes programming better. Give an example to support your answer. 3 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Question 2** (4 marks)

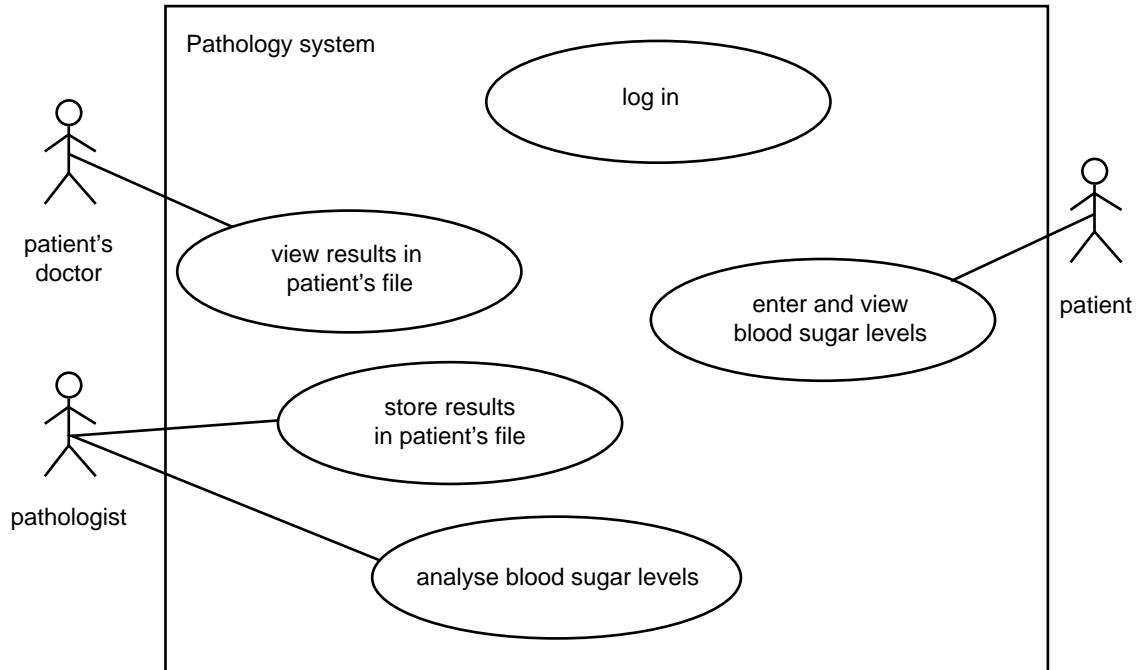
A pathology company provides patients with a device to monitor their blood sugar levels on a daily basis. After taking a reading, patients enter their blood sugar level readings into a website.

Software on the pathology company's information system will then allow:

- a pathologist to log in, analyse the data and store the results in the patient's file
- the patient to log in and check their blood sugar levels
- the patient's doctor to log in and view results.

A use case diagram is drawn to help understand the system.

Indicate all the links to represent this system correctly on the incomplete diagram below.





**Question 3** (5 marks)

Sue has written a program to record the results of History tests. She has decided to use a two-dimensional array to hold the results of four tests so that each row corresponds to a student. The programming language that she is using does not allow her to mix data types. She has decided to set up a one-dimensional array sorted by students' names, Names[ ], to store the students' names. Each position in Names[ ] corresponds to the position of the student's results in the two-dimensional array, called Results[ ][ ]. In this case, the index values start with 1.

Array: Names[ ]

Amy
Ben
Charlie
Harriett
Olivia
Sophie

Array: Results[ ][ ]

23	30	25	26
19	20	14	20
27	29	28	26
25	29	27	25
29	24	28	30
27	30	22	27

- a. The total mark for each test is 30. No half-marks are awarded.

What was Olivia's test score for the third test?

1 mark

---

- b. The lowest test score is 14.

What are the index values for i and j in Results [i, j] for this test score?

1 mark

---

- c. To find the total of the four test scores of a student, would Sue write a procedure to find the sum of each column or the sum of each row?

1 mark

---

- d. State **two** reasons why Sue has used a two-dimensional array instead of four one-dimensional arrays to store the test scores.

2 marks

---



---



---



---

**Question 4** (2 marks)

Teachers and students use the same computer network in a school. Teachers are concerned that tests and personal information kept on their computers may be accessed by students.

Describe a test that could be carried out to see if students can access this information.

---

---

---

---

---

**Question 5** (4 marks)

Explain how error logs can be used to measure the reliability and maintainability of a network.

Reliability \_\_\_\_\_

---

---

---

---

Maintainability \_\_\_\_\_

---

---

---

---

**SECTION C – Case study****Instructions for Section C**

Answer **all** questions in the spaces provided. Remove the case study insert and read **all** the information provided before you answer these questions. Answers must apply to the case study.

**Question 1** (2 marks)

The council has appointed the company Marvellous Management Systems (MMS) to produce the voting software. The council has provided the information in the case study insert and has asked MMS for the software requirements specifications (SRS) document as soon as possible.

Explain the purpose of the SRS document.

---



---



---



---



---

**Question 2** (4 marks)

Sally, as the manager of the voting software for MMS, is beginning to write the SRS document.

Provide two important non-functional requirements relevant to this voting software for Sally's SRS and explain why each is relevant to the software.

Requirement 1 \_\_\_\_\_

Explanation \_\_\_\_\_

---



---

Requirement 2 \_\_\_\_\_

Explanation \_\_\_\_\_

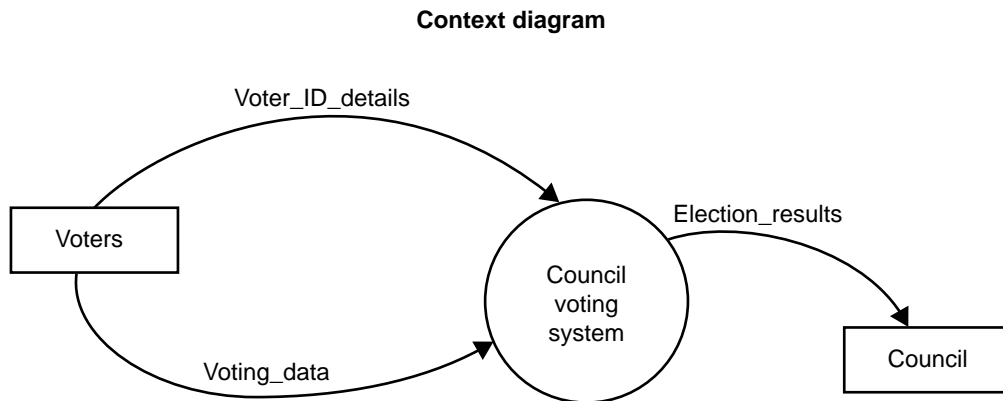
---



---

**Question 3** (6 marks)

Sally continues her analysis by drawing a context diagram and she has started a data flow diagram (DFD).



- a. List the entities involved.

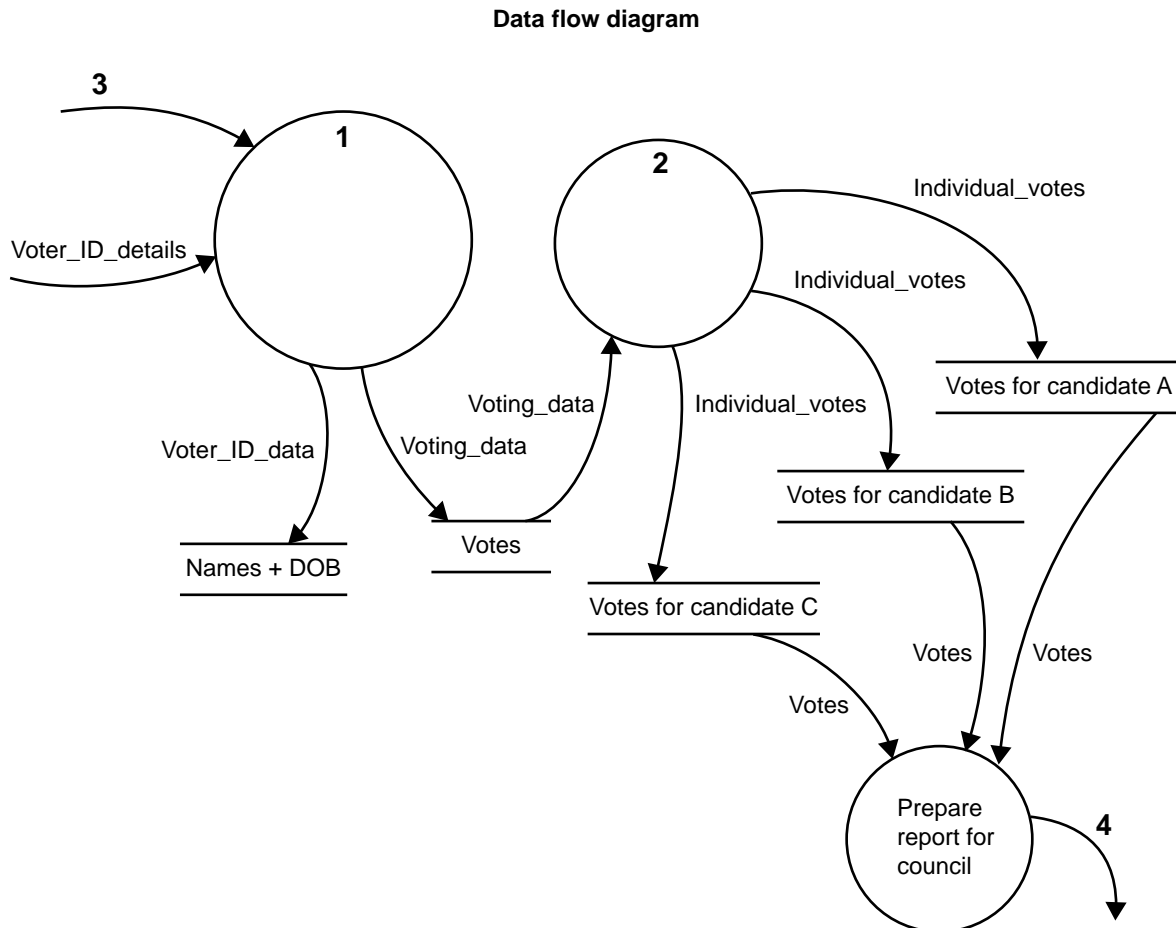
2 marks

---

- b. There are three processes:
- Process A – Allocate votes to candidates
  - Process B – Prepare reports for each candidate
  - Process C – Check voter eligibility and record votes

From these processes, select the correct two for the circles labelled 1 and 2 in the DFD below. Write your answers in the circles.

2 marks



- c. Using the context diagram, the DFD and correct labelling conventions, choose labels for the data flows numbered 3 and 4.

2 marks

3. \_\_\_\_\_

4. \_\_\_\_\_

**Question 4** (6 marks)

The council wants to offer mobile voting to voters aged 80 and above or those who may be unable to get to the polling booth due to a diagnosed medical condition. To obtain an estimate of how many voters will require mobile voting, Sally has decided to use the council's electronic roll of eligible voters. She will create a file containing each voter's name, address, age and information on whether they have a diagnosed medical condition. The following algorithm is suggested, with Age being the age of the person in years and Medical indicating if they have a diagnosed medical condition.

**Begin**NumberEligible  $\leftarrow$  0**While Not** End of File    **Read** Age, Medical    **If** Age  $\geq$  80 **Then**        NumberEligible  $\leftarrow$  NumberEligible + 1    **EndIf**    **If** Medical = True **Then**        NumberEligible  $\leftarrow$  NumberEligible + 1    **EndIf**    **Display** NumberEligible**EndWhile****End**

- a. To check this algorithm before coding, the data in the table below was created.

Complete the table by filling in both expected and actual values after each record is read and the loop is executed.

3 marks

Record number	Age	Medical	Expected value of NumberEligible	Actual value of NumberEligible
1	81	False	1	1
2	75	True		
3	75	False		
4	85	True		

**b.** Outline the major error in this algorithm.

1 mark

---

---

---

---

**c.** Write new lines of code to correct this error.

2 marks

---

---

---

---

---

---

---

---

---

---

**Question 5** (4 marks)

Sally has started a data dictionary of all the variables that will be used in the voting software.

For each variable in the table below, state the most appropriate data type and a description of what it is used for. An example has been provided.

Variable name	Type	Description
Name	<i>string</i>	<i>stores the names of all those eligible to vote</i>
NumberEligible		
Medical		

**Question 6** (2 marks)

Choose the best data structure from the list below for the data in the voters' electoral roll:

- one-dimensional array
- file
- record

Description	Data structure
storage of <b>all</b> of <b>one</b> voter's details	
storage of all voters' surnames in RAM	



**Question 7** (4 marks)

A member of Sally's team has suggested using a virtual private network (VPN) for sending the voting data back to the council.

Explain **two** advantages for the council of using a VPN rather than the internet using HTTP or HTTPS.

---

---

---

---

---

---

---

---

---

---

**Question 8** (3 marks)

The voting software will need to be accessible to all eligible voters. This includes voters with special needs, such as visual impairments, reading disabilities and physical disabilities.

Outline how these special needs will influence the design of the voting software.

Visual impairments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Reading disabilities \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Physical disabilities \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Question 9** (6 marks)

Voters may need to update their details on the electronic electoral roll. Sally needs to be sure that all data entered into this file is reasonable.

a. What is this technique called?

1 mark

---

b. Surnames must contain alphabetic characters and may also contain an apostrophe ('), hyphens and spaces. The field 'Surnames' cannot be blank and no upper limit on length is set. Surnames must start with an upper-case letter.

In the table below, create five test data that could be used to check the processing of names. The test data should test a wide variety of conditions. An example has been provided.

5 marks

Test no.	Test data	Expected output
1	<i>Smith</i>	<i>Valid Name</i>
2		
3		
4		
5		
6		

**Question 10** (2 marks)

MMS has made a recommendation to the council to mail to each voter a printed copy of a simple quick start guide to assist them with the use of the online voting software. The council had assumed that all user documentation would be built into the software and this would help them to reduce printing costs.

Explain **one** disadvantage (other than cost) of providing voters with a simple printed quick start guide instead of in-built user documentation in this situation.

---



---



---



---

**Question 11** (2 marks)

In order for the election process to run smoothly, election officials will need to be trained to use the new voting software. The council will need to employ at least 60 officials to supervise voting at the polling booths. Many of these officials will be employed only for Election Day and could have other employment on other days.

Describe a low-cost training strategy that the council could use to ensure that all of its election officials employed on Election Day are able to perform their duties.

---

---

---

---

---

---

---

---

---

---

**Question 12** (4 marks)

The data collected from the file servers at the polling booths and through mobile voting is irreplaceable. The data must be retained and must be collected even if the internet connection is lost between the polling booth file servers or the mobile devices and the main server at the council’s office.

Describe a method to do this for data

- on the polling booth file server

---

---

---

---

---

- on the mobile devices.

---

---

---

---

---

**Question 13** (3 marks)

If this voting software is successful, it is hoped that the software will be sold and used in other larger elections. As such, it may need to allow for electoral rolls of approximately 10 million voters. Each voter's record is approximately 150 bytes.

- a.** Calculate the file size, in gigabytes, of an electoral roll with 10 million users and explain if the file can be stored on a mobile device with 32 GB of storage. 2 marks

Size of file \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- b.** If the mobile device has 512 megabytes of RAM, what effect is using this file likely to have on processing? 1 mark

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Question 14** (6 marks)

Sally is concerned that during the two-week period prior to Election Day, the newly installed voting software may create conflicts for other council services, such as the council’s website and IT department.

- a. State **two** conflicts that may occur. 2 marks

---

---

---

- b. For **one** of the conflicts stated above, identify the stakeholders and outline why the conflict exists. 2 marks

---

---

---

---

- c. Suggest two techniques that could be used to minimise the conflict discussed in **part b.** 2 marks

1. \_\_\_\_\_

---

---

2. \_\_\_\_\_

---

---

**Question 15** (6 marks)

After Election Day, the council needs to prepare a list of those who have not voted. The voters' electoral roll contains a number of fields, including Surname, GivenName, StreetAddress, Suburb, Postcode and Voted. To do this, it is necessary to read each voter's details from the Electoral Roll file and display the fields Surname, GivenName, StreetAddress, Suburb and Postcode for those who are recorded as false in the Voted field. Each record is read until the EndOfFile is reached.

Write pseudocode for a procedure to perform this process.

---



---



---



---



---



---



---



---



---



---



---



---



---



---



---



---





**CASE STUDY INSERT FOR SECTION C**

Please remove from the centre of this book during reading time.

**THIS PAGE IS BLANK**

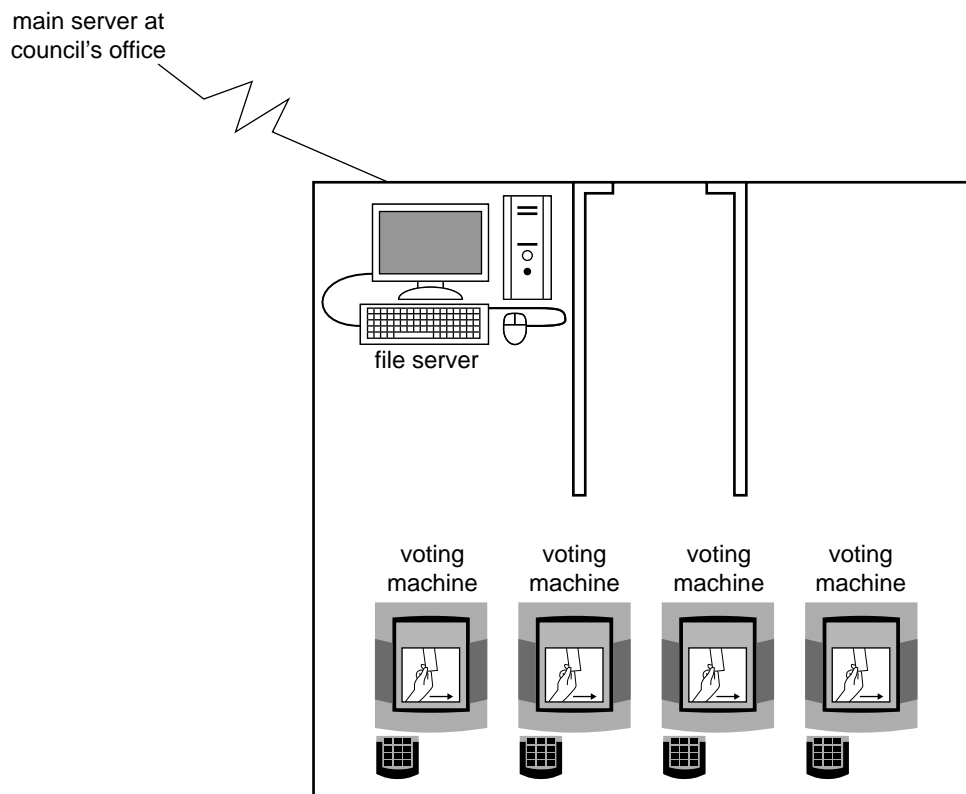
## Case study

A large regional city council is due to elect new council members. The city council covers an area of 20 000 square kilometres and has a population of 50 000. The council members are elected by council residents and property owners who are legally able to vote. The council maintains an electronic roll of all eligible voters (voters' electoral roll). This year, the council has decided to use electronic voting to collect and count the votes.

The current proposal is to use specially designed desktop computers (voting machines) connected to a server at each polling booth. Each of the servers will be linked to the main server at the council's office. When voters cast their votes, the data will be uploaded to the local file server at the polling booth. A file of voters who have voted will be created and a separate file containing the actual votes, stripped of any identification, will also be created. These files will then be transmitted to the local council records, where they will be stored on the main server as part of the council's computer system.

All voters who cannot attend on Election Day will be required to vote earlier at the council's office or request access to the mobile voting service, if they meet certain eligibility criteria. The mobile voting service will be available to voters who live within the council's boundaries and are at least 80 years of age or have a diagnosed medical condition that may prevent them from travelling to a polling booth. A mobile device will be brought to eligible voters so that they can cast their vote. The mobile device will be connected wirelessly to the main server at the council's office.

The proposed voting system will operate two weeks prior to, and on, Election Day. Voters who need to vote before Election Day will be required to come into the council's office during this period to cast their votes. The mobile service will be available only on application.



The electronic voting system is expected to have the following advantages:

- It substantially reduces invalid votes.
- It allows for election results to be known earlier.
- It eliminates the need to employ staff to count votes.
- It reduces postal voting.
- It is accessible to those with disabilities.
- It reduces the possibility of human manipulation of the results.

**END OF CASE STUDY INSERT FOR SECTION C**