

Victorian Certificate of Education  
2016

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

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## COMPUTING: SOFTWARE DEVELOPMENT

## Written examination

Thursday 10 November 2016

Reading time: 11.45 am to 12.00 noon (15 minutes)

Writing time: 12.00 noon to 2.00 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       | 4                   | 4                                  | 20              |
| C       | 13                  | 13                                 | 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 21 pages.
- Detachable insert containing a case study for Section C in the centrefold.
- Answer sheet for multiple-choice questions.

**Instructions**

- Detach the insert from the centre of this book 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.
- You may keep the detached insert.

**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**

Which specific data type would be the most appropriate to represent a street number (for example, '5A')?

- A. string
- B. numeric
- C. Boolean
- D. decimal

**Question 2**

In the process of sorting an array of eight integers using the quick sort algorithm, the first partitioning with the array appears as follows.

|    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|
| 12 | 15 | 11 | 17 | 19 | 22 | 21 | 20 |
|----|----|----|----|----|----|----|----|

Which one of the following statements is correct?

- A. Neither 17 nor 19 was the pivot.
- B. The pivot was either 17 or 19.
- C. The pivot was 17, but was not 19.
- D. The pivot was not 17, but it could have been 19.

*Use the following information to answer Questions 3 and 4.*

The following algorithm has been written.

```

Begin
    Input score
    If score > 75 Then
        If score >= 85 Then
            grade = "A"
        Else
            grade = "B"
        EndIf
    Else
        grade = "C"
    EndIf
    output grade
End

```

**Question 3**

The algorithm needs to be tested for logic errors.

Which of the following sets of test data would provide the best test for the algorithm?

- A. 0, 75, 80, 84, 100
- B. 75, 76, 84, 85
- C. 70, 75, 76, 80
- D. 0, 74, 84, 85

**Question 4**

The algorithm contains

- A. procedures and functions.
- B. procedures and instructions.
- C. control structures and functions.
- D. selection statements and instructions.

**Question 5**

| Locker Requests                                    |                      |
|----------------------------------------------------|----------------------|
| First Name                                         | Surname              |
| <input type="text"/>                               | <input type="text"/> |
| Full-time Student                                  | Student ID           |
| Yes <input type="radio"/> No <input type="radio"/> | <input type="text"/> |

Which data structure would be best to store the data being collected from the form above?

- A. four one-dimensional arrays
- B. a single array
- C. a record
- D. a list

**Question 6**

When a student upgrades their operating system to a new version of the operating system, the updating software creates a new folder called 'OperatingSystem.old' and copies some of the computer's files to that folder.

This is an example of

- A. archiving the computer's files.
- B. backing up the computer's files.
- C. cleaning up the computer's files.
- D. creating extra space for the computer's files.

**Question 7**

The following array is sorted in ascending order.

Starting point: 13, 6, 64, 25, 12, 22, 11, 17

After the **third** pass: 6, 11, 12, 25, 64, 22, 13, 17

What type of algorithm is used to sort the array?

- A. quick sort
- B. bubble sort
- C. binary search
- D. selection sort

**Question 8**

If software is purchased over the internet, copies of that software can be sold provided that

- A. the software is open source.
- B. the software licence allows for this action.
- C. slight changes are made to the software before selling it.
- D. it explicitly states that the software is copyright protected.

*Use the following information to answer Questions 9 and 10.*

Consider the following piece of pseudocode.

```
Begin
    Total  $\leftarrow$  0
    For i = 0 to len(nums)
        If nums[i]  $\geq$  10 then
            Total  $\leftarrow$  Total + nums[i]
        EndIf
    EndFor
    Display "the value of Total is" Total
End
```

**Question 9**

The purpose of the pseudocode is to

- A. find the sum of all numbers in an array that are higher than 10.
- B. search for numbers in an array that are equal to or higher than 10.
- C. find the sum of all numbers in an array that are equal to or lower than 10.
- D. find the sum of all numbers in an array that are equal to or higher than 10.

**Question 10**

When converting the pseudocode into a program, it would be useful to include in the programming code the

- A. design specifications.
- B. constraints of the code.
- C. internal documentation.
- D. external documentation.

*Use the following information to answer Questions 11 and 12.*

A photographer is viewing high-quality photographs on a computer. The photographs are stored as JPEG files on a central fileserver and have an average size of 2 MB each.

**Question 11**

How long will it take the photographer to download one photograph to a computer that has a wireless connection running at 10 megabits per second?

- A. 0.8 s
- B. 1.0 s
- C. 1.2 s
- D. 1.6 s

**Question 12**

The photographer is considering using a wired network.

The advantages of a wired network compared to a wireless network are that it is

- A. faster and more secure.
- B. faster and more portable.
- C. more secure and portable.
- D. easier to set up and cheaper.

**Question 13**

A standalone application is being written for handheld devices. This application will store all its data on the device and does not need an internet connection.

Which type of application architecture would be best to use?

- A. mobile
- B. rich client
- C. thin client
- D. peer-to-peer

**Question 14**

XML stands for extensible mark-up language.

Which one of the following is **true**?

- A. An XML data file is designed to only display data on a web page.
- B. An XML data file will work as expected if some data is modified.
- C. An XML data file will never work as expected if some data is modified.
- D. An XML data file is interchangeable with an HTML file because they are both mark-up languages.

**Question 15**

Inta is writing a new application for a small bicycle company so its staff can use their mobile phones to access the stock information stored on the company's fileserver. In the company, there is a manager and four people who sell the bicycles. They all use different brands of mobile phones.

To help her with writing the software requirements specifications (SRS), Inta should

- A. interview all those who will use the new application.
- B. send out a survey to the manager and one other staff member.
- C. observe one of those who will use the new application at work.
- D. survey some of the people who have bought bicycles from the company.

**Question 16**

Just as Toni was returning to her car in the shopping centre car park, she witnessed another car reverse into her car and drive off. She quickly took a photograph of the car with her mobile phone, capturing the registration number.

Toni contacted her insurance company to lodge a claim. She supplied the registration number, but was told she also needed the driver's name and home address in order to make a successful claim. This information is only held by VicRoads, the Victorian government agency responsible for issuing drivers' licences. She contacted VicRoads, but was told she could not have this information.

In accordance with which Act is the privacy of Victorian driver's licence holders' information protected?

- A. *Privacy Act 1988*
- B. *Health Records Act 2001*
- C. *Privacy and Data Protection Act 2014*
- D. *Charter of Human Rights and Responsibilities Act 2006*

**Question 17**

Which one of the following correctly identifies features of type checking?

- A. checks if only letters are entered into a field and if the text is spelt correctly
- B. checks if data entered already exists in the database and if the data is reasonable
- C. checks if a number is entered into a numeric field and if the number is within a set range
- D. checks if numbers are entered into a numeric field and if letters are entered into a text field

**Question 18**

A data flow diagram can be used as a tool when designing software.

Data flow diagrams must always show

- A. the decisions that are made when sub-modules are called.
- B. the sequence of tasks involved in completing a project.
- C. where data originates and where it is stored.
- D. the specific data flows between processes.

**Question 19**

Some of the variables in a program are to be given new names.

Which documentation must also be modified?

- A. software requirements definitions
- B. milestones and dependencies
- C. data dictionary definitions
- D. functional requirements

**Question 20**

A local shopping centre is considering providing free wi-fi for its customers.

Which one of the following would be a non-functional requirement for its new system?

- A. The system must have a failure rate of less than 3%.
- B. The system must be easy for customers to connect to.
- C. The system must be able to cope with 500 simultaneous users.
- D. The system must have a speed of at least 5 megabits per second.

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

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

**Question 1** (3 marks)

A company stores the following data in a linear file for its payroll.

```
<company>
  <name>Fireplace Enterprises</name>
  <staffid="1001">
    <staffname>Sue Jenkins</staffname>
    <salary>120000</salary>
  </staffid>
  <staffid="1002">
    <staffname>Mark Adimos</staffname>
    <salary>120000</salary>
  </staffid>
</company>
```

Name three fields contained in this file.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**Question 2** (6 marks)

A government department has been issuing new employees with a sequential employee number for over 70 years. The sequential employee numbers are now at just under 100 000 and the department would like to know who has the smallest number and is still working for the department.

A file has been created of the EmployeeName and the EmployeeNumber sorted on EmployeeName. The plan is to write a simple program to search this file for the smallest number. The pseudocode has been started.

Fill in the missing lines below to find the employee with the smallest number and to print this employee's name and number.

**Begin**

LowestEmployeeName ← ""

LowestEmployeeNumber ← 100000

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**End**



**Question 3** (6 marks)

To find an item in an array, a binary search, in most cases, is quicker than a linear search. However, a binary search requires the array to be sorted.

- a.** Explain why an array must be sorted to find a record using a binary search and how the record is found.

4 marks

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- b.** A linear search, unlike a binary search, can find records in an unsorted array.

Explain why.

2 marks

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**Question 4** (5 marks)

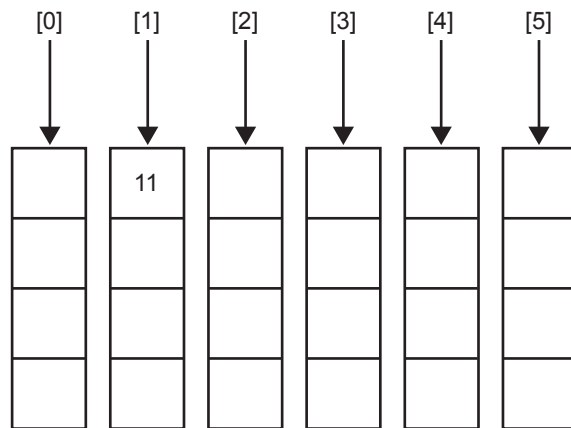
A hash function has been created to store a set of different integers in an array. The hash function creates a key value from the integer. The hash function takes the integer to be stored, divides the integer by 5 and uses the remainder as an index value. For example, if the first integer is 11, then 11 divided by 5 gives a remainder of 1. This becomes the hash key.

When a collision occurs because two integers hash to the same array location, the second integer is placed in the next available space under the hash key.

The numbers to be stored via the hash function are: 11, 17, 23, 8, 13. The number 11 has already been entered.

- a. Complete the diagram below.

4 marks



- b. Outline how a value is retrieved using a hash key.

1 mark

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## SECTION C – Case study

### Instructions for Section C

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

Use the case study provided in the insert to answer the questions in this section. Answers must apply to the case study.

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

Patel and Janette select a software development company to develop both the new Keep Fit application (app) for their patients' mobile devices as well as new communications software for their Soul & Body Health system to enable the Keep Fit app to communicate with their existing software.

#### Question 1 (5 marks)

Sue-Lee, the project manager, begins to plan the project. She decides to use two programming teams.

To write, test and debug the Keep Fit app for the mobile devices will take about 25 days. To write, test and debug the new Soul & Body Health communications software will take about 30 days. Then they will need to test that the Keep Fit app can communicate with the Soul & Body Health software. This should take about five days.

The next step would be to demonstrate the entire system to Janette and Patel, and to make modifications. This should take another five days. Then they would need to install the new software on the server at the clinic and test it using the app, which would take another five days.

That gives Sue-Lee a total of 70 days.

- a. Complete the Gantt chart below to show Sue-Lee how to complete the project in fewer than 70 days.

4 marks

| Task                                                                  | Days |    |    |    |    |    |    |    |    |    |
|-----------------------------------------------------------------------|------|----|----|----|----|----|----|----|----|----|
|                                                                       | 5    | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| Write, test and debug the app for the mobile devices.                 |      |    |    |    |    |    |    |    |    |    |
| Write, test and debug the Soul & Body Health software.                |      |    |    |    |    |    |    |    |    |    |
| Test that the app communicates with the Soul & Body Health software.  |      |    |    |    |    |    |    |    |    |    |
| Demonstrate the entire system to Janette and Patel, and make changes. |      |    |    |    |    |    |    |    |    |    |
| Install the new software on the Soul & Body Health system.            |      |    |    |    |    |    |    |    |    |    |

- b. Name **one** milestone for the project.

1 mark

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**Question 2** (2 marks)

Sue-Lee begins to plan the software requirements specifications (SRS). She understands that she will need to follow the goals and objectives of Soul & Body Health.

Apart from financial considerations, state one organisational goal and one system objective.

Organisational goal \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

System objective \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

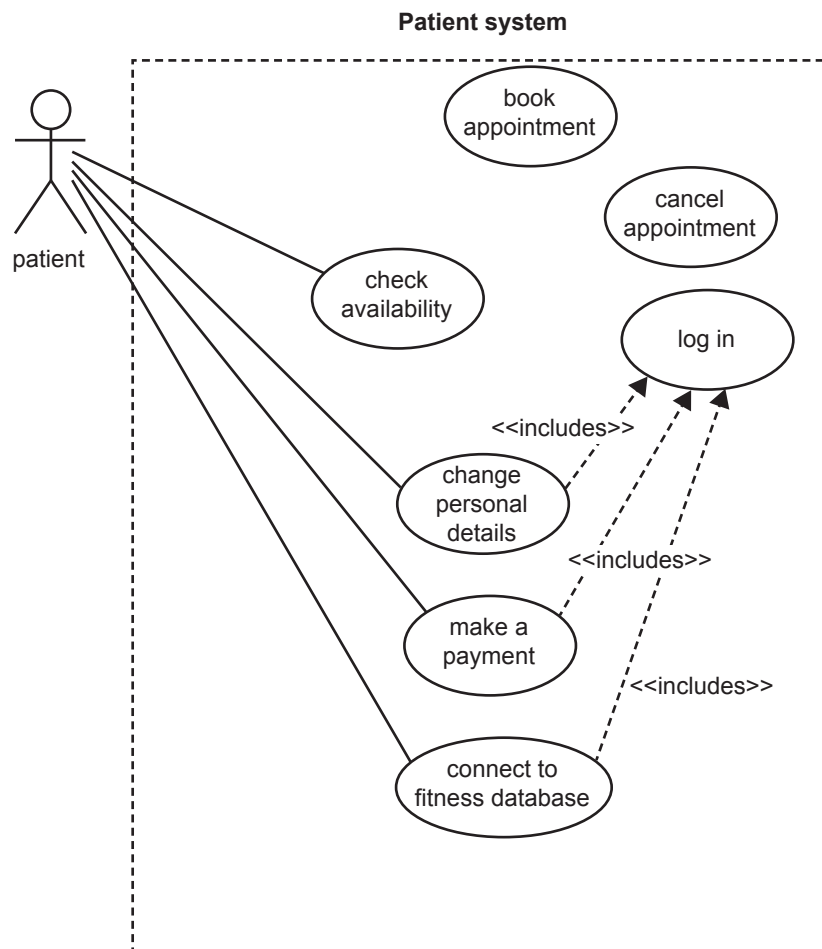
\_\_\_\_\_

**Question 3** (3 marks)

Sue-Lee now begins to prepare a use case diagram for the Keep Fit app. A patient should be able to log in and:

- check the availability of appointments
- make an appointment
- cancel an appointment
- pay any fees that are due
- change personal data
- download their own Keep Fit data.

Complete the use case diagram below by indicating all of the requirements.



**Question 4** (4 marks)

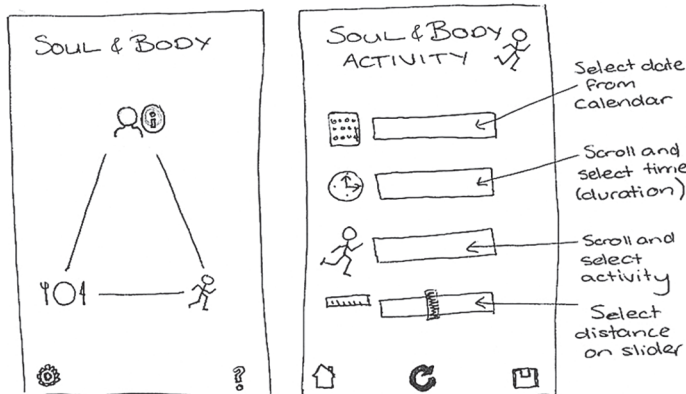
Patel and Janette have asked the developers to take a simple approach to the design of the Keep Fit app. They want error-handling features, simple navigation between the components of the solution, and a clean and clear interface that allows for easy data entry regardless of the device. They also want it to be interesting to look at.

Sue-Lee has developed two design ideas for the app. Each design idea includes a start screen and one of the data entry screens. The design ideas are shown below.

**Design idea A**

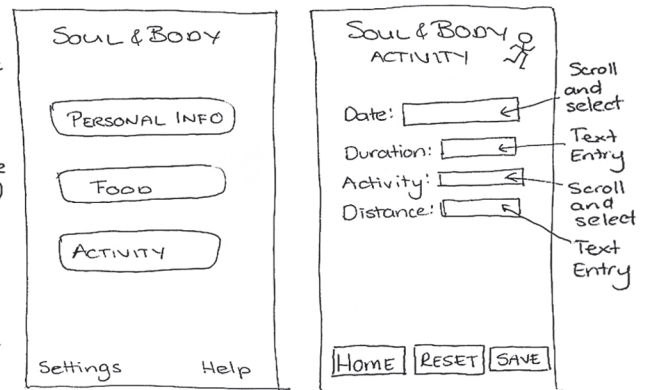
Main Screen

Activity Screen

**Design idea B**

Main Screen

Activity Screen



- a. Describe one feature of each design idea that contributes to its effectiveness.

2 marks

Feature of Design idea A \_\_\_\_\_

\_\_\_\_\_

Feature of Design idea B \_\_\_\_\_

\_\_\_\_\_

- b. Which design idea would you choose based on the stated requirements? Justify your choice.

2 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Question 5** (3 marks)

Sue-Lee also looks at the flow of data to and from the Keep Fit app and the Soul & Body Health system by starting to draw a context diagram.

Continue the context diagram below by naming the **three** entities and showing **one** data flow from each entity.

**Question 6** (4 marks)

The Keep Fit app will require access to the kilojoule content of a large selection of foods. Ethan, a member of the software development team, suggests that this data be stored on the mobile device where the app is installed. Sue-Lee feels that the data should be stored centrally at the Soul & Body Health head office and accessed over the internet.

a. State two advantages of Ethan's method.

2 marks

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

b. State two advantages of Sue-Lee's method.

2 marks

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

**Question 7 (9 marks)**

The system at the Soul & Body Health head office will need to store sensitive information.

- a. Identify **one** appropriate security measure that could protect this data and explain how the measure would protect the data.

3 marks

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- b. Describe **one** backup procedure that could be used to back up this data. Make reference to the technique used and the frequency of the backup procedure.

3 marks

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- c. It has been suggested that patients who have not visited Soul & Body Health for over five years should have their records archived.

Explain what is meant by archiving and provide **one** advantage of archiving records.

3 marks

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**Question 8** (5 marks)

The new software for Soul & Body Health's system will be receiving sensitive information from the new Keep Fit app from all of the patients. Sue-Lee is investigating how the mobile devices could send this information as securely as possible. To do this, she is exploring the use of protocols.

- a. Apart from the patient's name, list **two** different pieces of sensitive information that the new software will need to keep secure. 2 marks

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- b. Identify a suitable protocol for securing this sensitive information and explain how the protocol achieves this. 3 marks

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**Question 9 (5 marks)**

A commercial software company has contacted Patel with a proposal about some newly developed software that is suitable for Soul & Body Health's system. The software would search the data and provide extra information about the patients, which could help Soul & Body Health improve its business.

a. What is this process called?

1 mark

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b. The software company is willing to load its software onto Soul & Body Health's system so it can provide information automatically. Patel is concerned about how this new software will affect the rest of Soul & Body Health's system.

Discuss two technical issues Patel should investigate before making a decision regarding the offer.

4 marks

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

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

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**Question 10 (3 marks)**

Patel has questions about the use of patient information. He is concerned about who owns the patient information stored on Soul & Body Health's system and what his legal obligations are concerning this information.

Outline three actions that Patel should take to ensure that he meets Soul & Body Health's legal obligations before purchasing the software.

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

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

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

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**Question 11** (4 marks)

Soul & Body Health's new software will be able to connect to the national healthcare system so that patient healthcare numbers can be verified.

Sue-Lee would like to be able to check that the data that will be used by Soul & Body Health's new software has integrity.

List two characteristics of data that has integrity and explain one method Sue-Lee could use to check the integrity of the data. (A healthcare number contains 10 digits, as shown on the card above.)

Characteristic 1 \_\_\_\_\_

Characteristic 2 \_\_\_\_\_

Explanation \_\_\_\_\_

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**Question 12** (8 marks)

The Keep Fit app will record all exercise that a patient does and calculate the energy used. It will give the patient a choice of exercise style and then ask questions such as distance travelled and how much time the exercise took.

One exercise that can be selected is running. The app takes into account the patient's weight and any other special factors in a disability index that a physiotherapist can set.

The patient's average speed can be calculated by dividing the distance covered by the time taken. The algorithm to do this is complicated and will work properly only for speeds greater than 1 km/h and less than 30 km/h. This is considered a satisfactory range.

- a. It is necessary to make sure that the speed is within these limits.

What is this input testing called?

1 mark

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- b. Sue-Lee has written the following pseudocode to check that the speed meets this range.

```

Begin
ValidSpeed ← False
    If Speed >= 1 And Speed <= 30 Then
        ValidSpeed ← True
    EndIf
End

```

Complete the following test data table to fully test this pseudocode.

4 marks

| Test no. | Test data | Expected results  | Actual results    |
|----------|-----------|-------------------|-------------------|
| 1        | 20        | ValidSpeed = True | ValidSpeed = True |
| 2        |           |                   |                   |
| 3        |           |                   |                   |
| 4        |           |                   |                   |
| 5        |           |                   |                   |

- c. What is the invalid response produced by the pseudocode given in **part b.**?

1 mark

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- d. Rewrite the pseudocode given in **part b.** so that it works correctly.

2 marks

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**Question 13** (5 marks)

At the end of each day, the federal government requires a summary of who has been treated under its health plans and what treatment they received.

Sue-Lee was originally going to send this data in a simple file organised on the basis of when data was created. Now she has found out that an XML file is required.

- a. In terms of the structure of the file, what advantages does an XML file have over a simple file? 2 marks

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- b. The federal government requires the transmission of this file via a virtual private network (VPN).

Explain **one** advantage of using a VPN over another form of transmission.

3 marks

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**Insert for Section C – Case study**

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Patel and Janette started a small, suburban physiotherapy clinic. They both have a professional interest in a holistic approach<sup>1</sup> to health and wellbeing.

Business has been steady, so Patel and Janette decided to expand the number of clinics and have established four clinics around the state. They have called their business 'Soul & Body Health'.

One of the clinics has become their head office and it contains their fileserver and the commercial medical software required to keep patient records, both medical and financial.

There is also a connection to the national healthcare system so that rebates<sup>2</sup> may be claimed from the government. The commercial medical software also allows Soul & Body Health to upload other data files to the healthcare system.

The other three clinics use virtual private network (VPN) connections to the head office.

Patel and Janette feel that they can improve patient care by introducing preventive medicine techniques. So they have decided to provide extra services to their patients by incorporating a fitness application (app) called Keep Fit.

The purpose of the app is twofold:

1. To allow patients to make appointments and pay fees online to the head office
2. To provide an online recording service to help patients record their dietary intake as well as their daily exercise regime

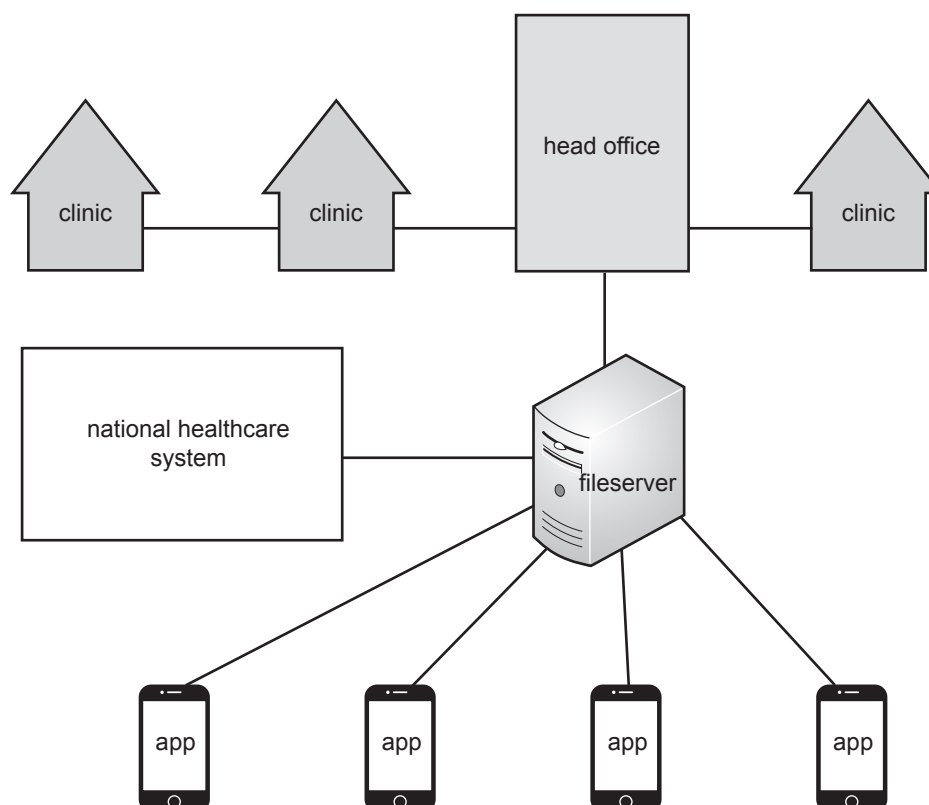
Patel and Janette believe that patients will benefit from detailed knowledge of their eating and exercising habits. The data will be held locally on each patient's mobile device and then uploaded to the Soul & Body Health server each night or when it is convenient.

Patel and Janette feel that, in addition to having detailed knowledge of their eating and exercising habits, patients will benefit from a more holistic approach by also maintaining an accurate record of their diet and exercise plan.

<sup>1</sup>**holistic approach** – an approach concerned with the whole person (physical, mental and emotional)

<sup>2</sup>**rebate** – return of part of an amount paid or due for a service

#### Overview of Soul & Body Health's information system and its conventions



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