VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2012

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

INFORMATION TECHNOLOGY: SOFTWARE DEVELOPMENT

Written examination

Friday 16 November 2012

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	16	16	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 white out liquid/tape.

Materials supplied
- Question and answer book of 22 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

When investigating an existing information problem, a use case diagram is developed.

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

A. design

B. analysis

C. evaluation

D. development

Question 2

Bill is writing a new software application for a small real estate company. Four real estate agents from the company all want an application on their mobile phones that allows them to access the data files back at the office while they are out. Each agent has a different model/make of phone.

To obtain information to help Bill write the software requirements specification (SRS), the most appropriate action for him to take is to

A. interview all four real estate agents.

B. observe one real estate agent at work.

C. survey at least four clients to find out what they would like.

D. interview at least four clients to find out what they would like.

Question 3

Software known as a Trojan

A. may look like useful software.

B. is an antivirus software application.

C. always replicates itself across a network.

D. always removes files without you knowing.

Question 4

A code of ethics for software developers is a set of moral principles and guidelines that assists when

A. a logic error is found within a program code.

B. a runtime error is found within a program code.

C. an issue occurs with management over pay and conditions.

D. an issue occurs with management over what a program will do.

Question 5

Compared to a cabled local area network, a wireless local area network is generally

A. easier to set up, cheaper and more secure.

B. easier to set up, cheaper but not as secure.

C. harder to set up, more secure and cheaper.

D. harder to set up, more secure but will not work over long distances.

Question 6

One of the functions of the physical layer of the Open Systems Interconnections (OSI) model is to

A. route data to a remote computer.

B. establish a connection to a communications medium.

C. establish a connection to a remote application program.

D. translate data into a form that is acceptable to the application layer.

Question 7

```
Input size
TooBig ← False
If size > 50 Then
        TooBig ← True
Endif
```

The algorithm above is tested with a number of inputs.

Which set of inputs will **always** cause variable TooBig to become True?

A. 47, 48, 49

B. 49, 51, 53

C. 50, 54, 56

D. 51, 52, 53

Question 8

Which of the following is a key activity in the design stage of the problem-solving methodology?

A. collect data

B. produce training material

C. develop evaluation criteria

D. determine how well the evaluation criteria have been met

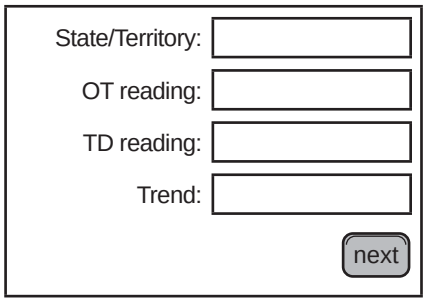
Use the following information to answer Questions 9–12.

Lindsay is writing a program that requires the entry of the following data.

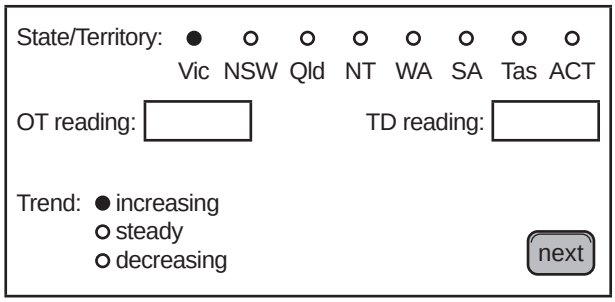
State/Territory	OT reading	TD reading	Trend
Victoria	96.7	–12	steady
Victoria	13.1	6.5	increasing
NSW	81.3	–4.1	increasing

Lindsay is considering two options for user input to the program.

Option A – all text boxes



Option B – radio buttons and text boxes



The program that Lindsay writes contains the following segment of code.

```
*** comment: the OT reading can only be a positive number up to 100 ***
If  (OTreading > 0) and (OTreading <=100) Then
      ProcessOTreading
Else
      DisplayMessage 'OT reading not positive up to 100. Please correct.'
Endif
```

Question 9

For a user who has a standard keyboard and mouse, input into the program will most likely be

A. more efficient and effective with Option A.

B. more efficient and effective with Option B.

C. more effective with Option B, but less efficient.

D. more efficient with Option B, but less effective.

Question 10

The first line of the code segment is an example of

A. an SRS.

B. user documentation.

C. criteria for evaluation.

D. internal documentation.

Question 11

What is the program control structure shown in the last five lines of the code segment?

A. repetition structure
B. sequence structure
C. recursion structure
D. selection structure

Question 12

The purpose of the code segment is to validate the user input into the variable **OTreading**.

To be thorough, what else should the code segment perform?

A. type check
B. limit check
C. range check
D. uniqueness check

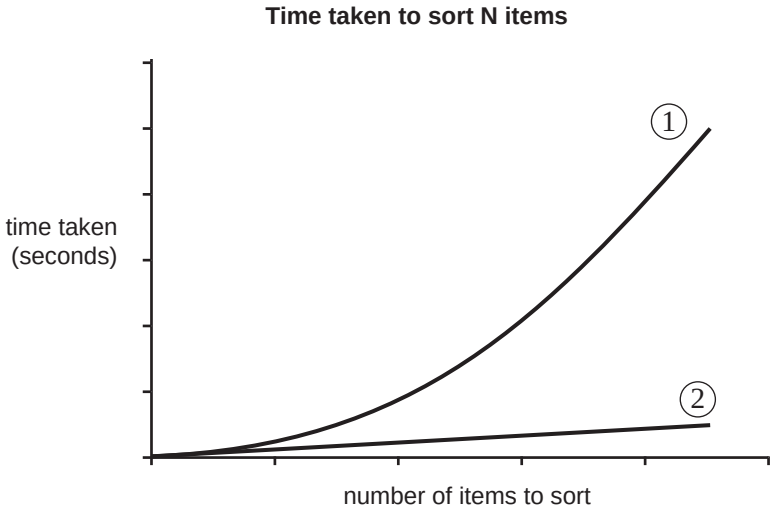
Question 13

One of the purposes of an SRS is to provide

A. the breakdown of a problem into its component parts.
B. the user with instructions for operating the new software.
C. information to other programmers about how a program works.
D. criteria for evaluating whether or not the solution requirements have been met.

Question 14

A procedure is required that can sort a list of randomly arranged items. This list can be of any given size. Two separate procedures are written, one using a quick sort algorithm and the other using a bubble sort algorithm. The performance of each procedure is compared by measuring the time it takes to sort an increasing number of list items. The results are shown below.



The graph line that most likely represents the performance of the **bubble sort** is

A. neither (1) nor (2) because a bubble sort cannot sort very large lists.

B. (2) because a bubble sort generally takes less time than a quick sort.

C. (1) because a bubble sort generally takes more time than a quick sort.

D. neither (1) nor (2) because the time taken for a bubble sort does not depend on the list size.

Question 15

Xian wants to design games for handheld personal computers and mobile phones.

What are the **most** important characteristics of mobile phones that Xian should consider?

A. screen size, weight and memory size

B. screen size, weight and operating system

C. screen resolution, processor speed and memory size

D. screen resolution, memory size and operating system

Question 16

The name, date of birth, membership number, address, suburb, postcode and phone number of one person is to be stored in memory.

Which one of the following would be the best data structure?

A. record

B. random file

C. sequential file

D. one-dimensional array

Question 17

Joanne, the owner of a small business that sells computer equipment, has asked a software developer to write a simple software solution that will allow her customers to buy items online. As her business is only small, she does not want to go to the expense of implementing secure storage or password protection.

The software developer advises strongly that secure storage and password protection must be included, but it will cost more. This advice creates a conflict.

Who are the major stakeholders affected by this conflict?

A. Joanne, her customers and the software developer

B. Joanne, her customers and her equipment suppliers

C. Joanne, her internet service provider and her equipment suppliers

D. Joanne's customers, her internet service provider and the software developer

Question 18

A company network crashed five times in January.

To discover the cause of these crashes, the most helpful action the system administrator could take is to

A. run a firewall update.

B. check all the error logs.

C. run the antivirus software.

D. complete an audit of all software on the network.

Question 19

When planning software projects, it is necessary to identify, schedule and then monitor

A. resources, people, time and tasks.

B. resources, people and documentation.

C. tasks, time, people and documentation.

D. tasks, resources, documentation and systems.

Question 20

An online sales company has decided to develop a mobile phone application that will allow its customers to access the sales website at all times.

From a customer's point of view, which of the constraints listed below should the company consider **most** important when designing its solution?

A. speed of processing

B. cost of development

C. security of transactions

D. capacity of the web server

END OF SECTION A
TURN OVER

SECTION B – Short answer questions

Instructions for Section B

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

Question 1

'Worms' and 'spyware' are both terms used to describe specific types of malware.

a. What feature must malware contain to be called a worm?

1 mark

b. What feature must malware contain to be called spyware?

1 mark

c. Explain how a single malware program can be called both a worm and spyware.

2 marks

Question 2

Minama has just begun working for a software developer. He is given the pseudocode for a program and asked to write the program code.

a. At what stage of the problem-solving methodology does program coding take place?

1 mark

Minama is unsure about what naming convention he should follow.

b. **i.** Identify **two** features of a naming convention for solution elements of a program that Minama could use.

ii. Explain how this naming convention helps **both** the development and the maintenance of the software solution.

2 + 2 = 4 marks

Question 3

In a computer science lesson, Dr Little claims that, at times, it can be more cost effective to produce code quickly and not be concerned about the quality of the program and code.

State when this may be the case. Explain your answer.

2 marks

Question 4

The algorithm below contains five lines, three of which are **not** shown. **Length** and **Width** are variables. Write the next three lines of the algorithm that is needed to swap the contents of Length and Width. You may introduce other variables as needed.

Length ← 5

Width ← 7

3 marks

Question 5

A procedure starts. It sets Variable A to 1 and Variable B to 2. A loop is started. Variable A is doubled and Variable B has 1 added to it. The loop continues until Variable A is bigger than or equal to Variable B. The procedure then stops.

Write this as pseudocode.

6 marks

END OF SECTION B

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.

Having obtained agreement about the overall system, Ilma carries out a full analysis. She will document this in a software requirements specification (SRS) and give it to the team to make sure they agree with her analysis.

Question 1

The data collection section of AQADAS has a number of non-functional and functional requirements.

a. Identify the most important non-functional requirement.

_____

1 mark

b. Identify **two** important functional requirements.

_____

_____

2 marks

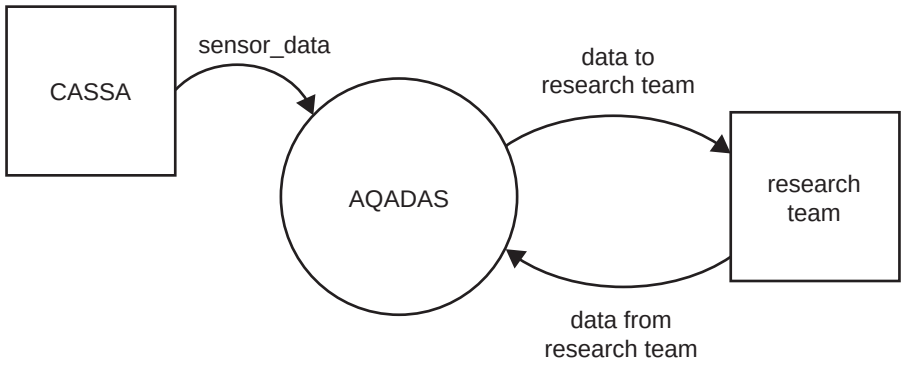
c. Identify one important functional requirement that a mobile phone alone cannot provide.

_____

1 mark

Question 2

Ilma begins to draw a context diagram (below) so that it is clear where AQADAS will get its data from and to whom it will provide information. Based on the case study, including the data flow diagram (DFD; Diagram 3), complete the diagram for Ilma.



3 marks

Question 3

Ilma thinks that her non-computer-science colleagues might not understand technical diagrams, so she decides to include a use case diagram in her SRS. Most of the diagram is drawn below.

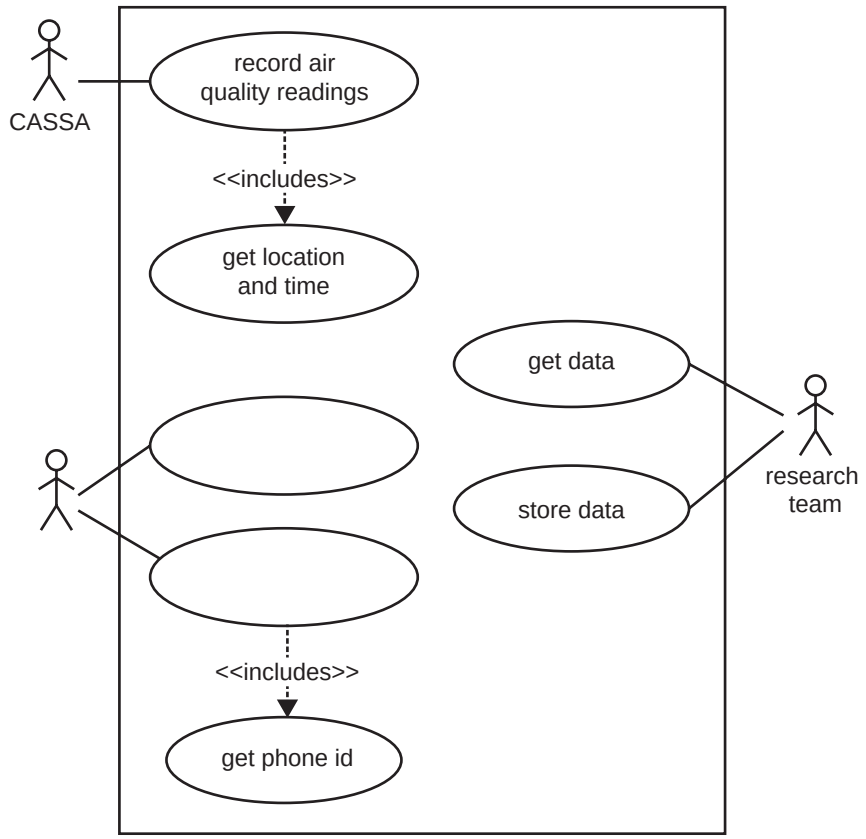
Based on the case study, complete the diagram by

a. labelling the un-named actor in the diagram

1 mark

b. identifying the actions that this actor needs to carry out and appropriately labelling the empty use cases.

2 marks



Question 4

From the DFD in the case study, list the processes that have to be included in the software solution for the mobile phones.

1 mark

Question 5

After reading through Ilma's SRS, Anton suggests that it might be a good idea to implement the system as a virtual private network (VPN).

a. Briefly describe a VPN.

2 marks

b. Do you agree or disagree with Anton's recommendation? Justify your answer.

2 marks

Question 6

Ilma is about to begin the design and development of the software when Dr Fischer receives an email from the university's legal department, reminding him that there are some legal obligations that must be complied with by the software developer.

Discuss two concerns that Ilma needs to investigate to make sure she meets her legal obligations and describe what she can do to deal with these concerns.

concern 1

concern 2

4 marks

Question 7

The application software on the mobile phone will cause an air quality measurement to be taken every five minutes. As shown in the DFD, the air quality data will be stored in the data store **accumulated_air_quality_data**. Since only 24 hours of data is needed, after each measurement is taken any air quality measurement that is more than 24 hours old will be deleted.

What type of data structure is most suited to storing data in this way? Justify your selection, making reference to other data structures.

data structure _____

justification _____

_____

_____

_____

3 marks

Question 8

Maria is given the task of designing the user interface to be used on the mobile phones. The SRS has the following specifications.

> When an asthmatic enters data about the symptoms of an asthma episode, the system must obtain the following.
>
> Date and time of episode – user will accept system time and date or change them if they are logging it after the event
>
> Symptom data:
>
> - wheezing or whistling – none, mild, medium, severe
> - cough – none, mild, medium, severe
> - shortness of breath – none, mild, medium, severe
> - tightness in chest – none, mild, medium, severe
> - Has the asthmatic participated in physical activity? Yes/No
> - Does the asthmatic currently have a cold/illness? Yes/No

Maria has been advised that some asthmatics will enter this data during or immediately after an asthma episode, so the user interface needs to ensure that the data is captured efficiently and limit the chance of errors. The sketches marked Design 1 and Design 2 in the case study insert show two designs that Maria has created for this interface.

a. Identify one important technical consideration that has affected the two designs of the user interface.

_____

1 mark

b. For both Design 1 and Design 2, explain one advantage of each that makes that design the more efficient and/or effective method of data entry for the asthmatics.

advantage of Design 1 _____

advantage of Design 2 _____

2 marks

c. Of the two interface designs provided, select and justify the better option for the AQADAS system.

2 marks

While Maria is designing the user interface for the mobile phone, Ilma starts to work out how to store the data in the university's file server. There will be a large amount of air quality and symptom data sent to the university by asthmatics. The researchers will also need to store personal data about the asthmatics. Ilma decides to put the data in two separate files: **SymptomAirQualFile** and **AsthmaticsFile**. To link the two files, each asthmatic will be given a code number.

Question 9

It is decided to have the asthmatics fill out a standard form so that the large amount of personal data can be entered efficiently. This data will then be entered using Optical Character Recognition (OCR). Unfortunately, this can produce a number of errors and, where possible, Ilma wants the software to validate the data before it is stored in AsthmaticsFile.

The table below shows some of the data that will need to be stored. From the following list of data types, select the **most appropriate** data type and give one reason for your choice. An example has been provided.

Data types: integer, floating point number, Boolean, character, string

Data	Use	Data type	Reason
surname	*to store the surname of the asthmatic*	*string*	*a simple list of characters is required*
postcode	to store the postcode of the asthmatic		
gender	the gender of the asthmatic stored as M or F		
adult	Is the asthmatic over 18? True or false?		
mobile	to store the mobile number of the asthmatic in the form +61(0)499999999		

4 marks

Question 10

To check that the postcode for the asthmatic is valid, the function below is written. To be a valid Victorian postcode for a residential address, it must be a number from 3000 to 3999. The function is called after validating that the postcode has been entered and is a number.

```
Function CheckPostcode(postcode)
Begin
    ValidPostcode ← true
    If postcode<3000 or postcode>3999 Then
        ValidPostcode ← false
    Endif
    Return ValidPostcode
End
```

a. Complete the table below by giving **four** values of a postcode that would test the function and give a reason for selecting each. These values together should give a broad test of the function.

Postcode value	Reason

4 marks

b. Not all numbers between 3000 and 3999 are used as postcodes in Victoria. Ilma decides to include a function that checks whether the entered number matches a postcode that is used in Victoria.

How is this type of validation best described?

_____

1 mark

Question 11

Dr Fischer has decided that he wants an equal number of males and females involved in this study. Ilma writes the following short procedure to calculate the number of male and female asthmatics already entered.

```
Begin
    NumAsthmatics ← 0
    NumMales ← 0
    Repeat
        Read AsthmaticsGender from AsthmaticsFile
        If AsthmaticsGender = 'M' Then
            NumMales ← NumMales + 1
        Endif
        NumFemales ← NumAsthmatics – NumMales
        NumAsthmatics ← NumAsthmatics + 1
    Until End of File
    Display NumAsthmatics, NumMales, NumFemales
End
```

a. To check the algorithm, the values F, M, F have been entered into AsthmaticsFile.

Use this test data to complete the table below, showing the actual output of the algorithm.

Working space

	NumAsthmatics	**NumMales**	**NumFemales**
Values displayed at the end of the procedure			

1 mark

b. Unfortunately, when Ilma runs the procedure the results show that it is not working properly.

What is it about the values displayed at the end of the procedure that show that the procedure is not working properly?

1 mark

c. Explain how this error could be corrected. As part of your explanation, write in full the pseudocode statement(s) to which you are referring. Do not use line numbers.

2 marks

Question 12

It will be necessary from time to time to update personal information for some of the asthmatics. It is thought that this will need to be done no more than three times a month for the life of the project. The code used to uniquely identify each asthmatic will be a simple number starting at 0001 and increasing to 1500. There are two possible ways that the AsthmaticsFile can be organised, either as serial access or as random access.

Ilma decides to use a random access file and use the asthmatics code to retrieve the record.

Using **two** advantages that random access has over serial access in this situation, explain why she has made this decision.

4 marks

Question 13

The records in AsthmaticsFile will be kept in asthmatics code order (from lowest to highest). It will be necessary to find individual records by using the asthmatic's name. Anton suggests using a simple linear search, where you start at the first record and read each record until you find the one you want. Maria says that for 1500 records this will be too slow and argues that they should use a binary search.

Which method is the more appropriate to use in this case and why?

2 marks

Question 14

Before Ilma can announce that the mobile phone software solution is ready to be used, she needs to go through the process of acceptance testing.

a. Who else should be involved in the acceptance testing?

1 mark

b. The table below shows three criteria that should be tested.
Outline a technique for obtaining information about each.

Criteria	Technique
Are the requirements in the SRS for the mobile phone being met?	
Is the output from the mobile phone in the correct format?	
Is the mobile phone software solution easy to use?	

3 marks

Question 15

Anton is preparing user documentation that will be provided to the 1500 asthmatics in the asthma study. He has proposed the development of a printed user manual that outlines how to use the software, the mobile phone and the sensor that is provided to the asthmatics. However, Maria has suggested that an electronic guide that is stored on the mobile phone would be a better approach.

a. Outline two advantages of a printed manual over an electronic guide.

advantage 1 _____

_____

_____

advantage 2 _____

_____

_____

2 marks

b. Outline two advantages of an electronic guide over a printed manual.

advantage 1 _____

_____

_____

advantage 2 _____

_____

_____

2 marks

c. Ilma has looked at both of these options and is not happy with either of them.

Suggest another way to present the user documentation that would suit this situation **and** explain the benefits to users.

_____

_____

_____

_____

_____

2 marks

Question 16

Asthmatics in the study will be mailed their pack one month prior to the commencement of the research. The pack contains their mobile phone (with the software solution pre-installed), the sensor and user documentation. The research team has insisted that all users of the system be provided with appropriate training in the use of the software module and the use and care of the sensor. The team also wants the asthmatics to undertake a short quiz at the end of the training to ensure that they have developed the necessary skills and knowledge to use the software and equipment. All of the training must be completed within four weeks of the asthmatics receiving their packs. As the 1500 asthmatics are located across all of Victoria, this will be a very difficult task to organise.

Outline the most suitable training strategy that will allow all 1500 asthmatics to undertake the necessary training and meet the requirements set out by the research team. Justify your strategy.

4 marks

END OF QUESTION AND ANSWER BOOK

CASE STUDY INSERT FOR SECTION C

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

Case study

The air quality and asthma study

The government has funded Bigton University to carry out a major study into the effects of air pollution on asthma sufferers in Victoria. They would like to find out

- how much effect common air pollutants have on asthmatics
- the geographical distribution of asthma attacks in relation to the time when they occur and the pollutants involved.

Dr John Fischer has been put in charge of the research. He has a team of postgraduate students who will acquire data about air pollution and asthma, and store it in one place so that they can analyse it.

To achieve the goals of the study, the team will recruit up to 1500 volunteer asthmatics from as many parts of Victoria as possible and collect data from them during a one-year period.

The data collection system must obtain data about symptoms from the asthmatics as well as obtain measurements of air quality, location and time for up to 24 hours before an asthma episode. The data must also be acquired by a method that is portable.

One of the team members suggests that they could give each asthmatic a 'smart' mobile phone. The asthmatic could enter data about their asthma episode and the phone could provide the location and time data.

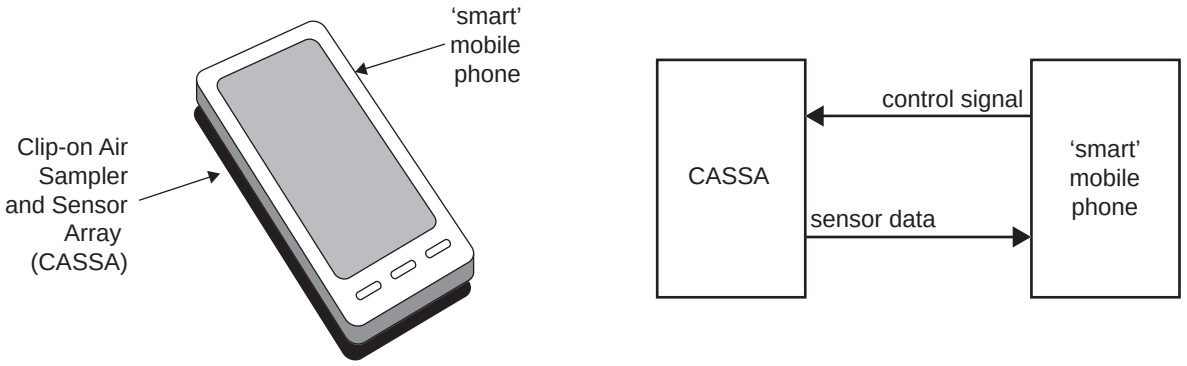
Dr Fischer asks the university's engineering department to design a cheap device that can measure levels of four common air pollutants, so that the data collection system can measure air quality. He would also like this device to be attached to a mobile phone.

The Clip-on Air Sampler and Sensor Array

In response to Dr Fischer's request, the engineering department has designed and built a small device that can be clipped onto the back of a mobile phone.

The Clip-on Air Sampler and Sensor Array (CASSA) contains four sensors, one for each air pollutant of interest. In order for the CASSA to work properly, users must wear the phone and the device on a belt rather than having it in their pocket or handbag. The CASSA is a simple device that communicates with the mobile phone via a mini USB cable. It is capable of taking one set of measurements every five minutes.

Diagram 1 – CASSA



The Air Quality and Asthma Data Acquisition System (AQADAS)

Now that the team has the hardware to capture all the data that it needs for the study, it can start work on creating a system that will collect and store all this data. One of the team members, Ilma, is studying computer programming. She agrees to design the Air Quality and Asthma Data Acquisition System (AQADAS) and write whatever software is needed. Two other students, Anton and Maria, offer to help her.

Ilma starts her analysis by leading a discussion about how data collection in AQADAS could work. The three students think that the simplest approach would be

- either during the asthma episode or soon after an episode, the asthmatic enters details about their symptoms into the mobile phone
- after completing the entry, the asthmatic sends all the data acquired by the mobile phone to a central file server at the university, as shown in Diagram 2.

As the discussion proceeds, Ilma draws a data flow diagram (DFD). The three students agree that the DFD shown in Diagram 3 represents what they need for the data collection section of the system. They also agree to work out the details of the main data store later. Ilma draws a single data store to represent all the data that would be stored in the system. Similarly she draws a single process to show the research team's own data processing requirements.

Diagram 2 – overall network

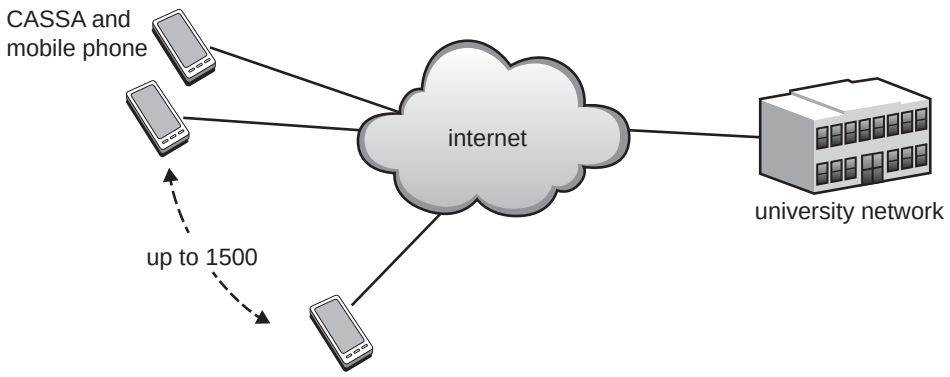
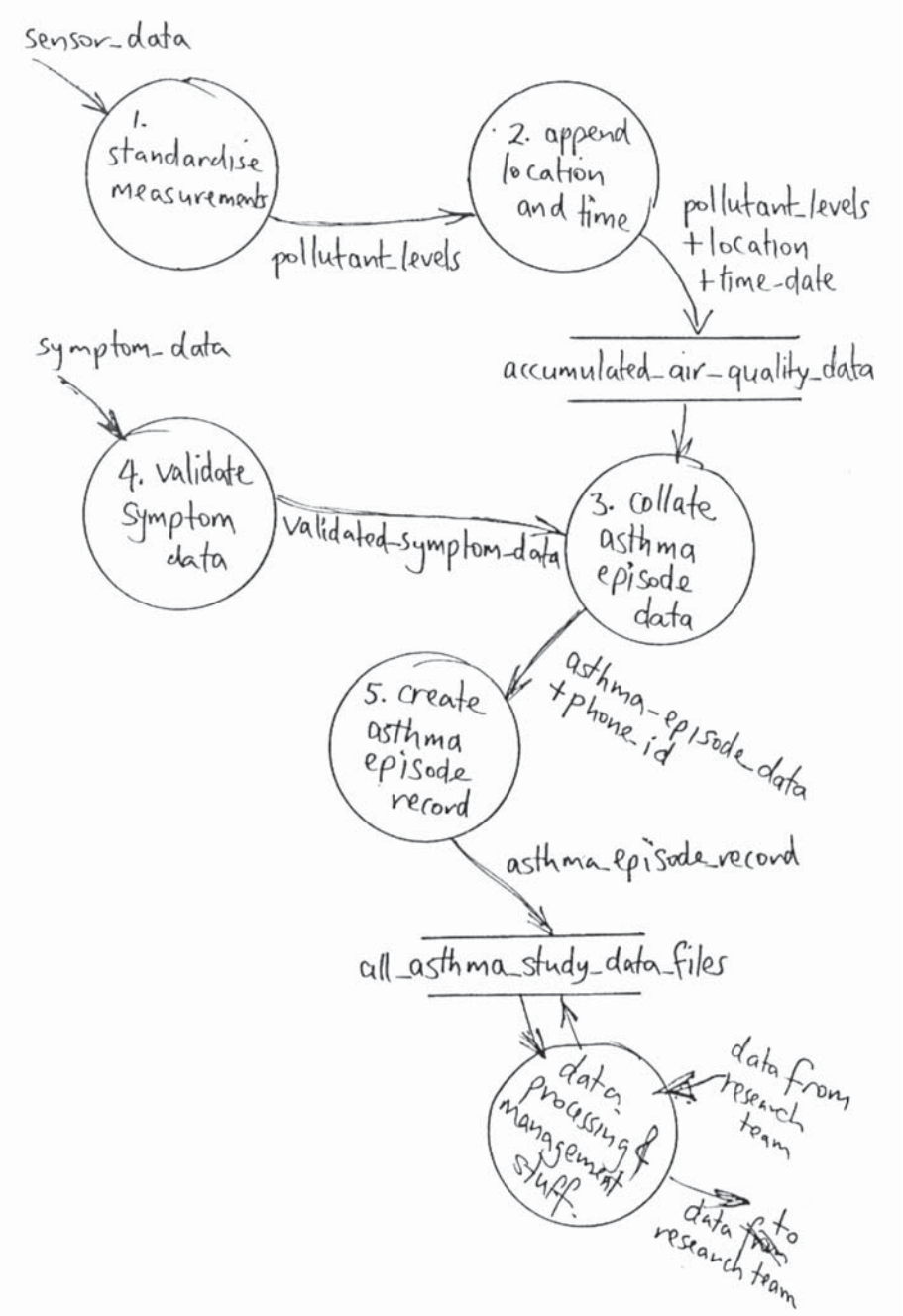


Diagram 3 – DFD



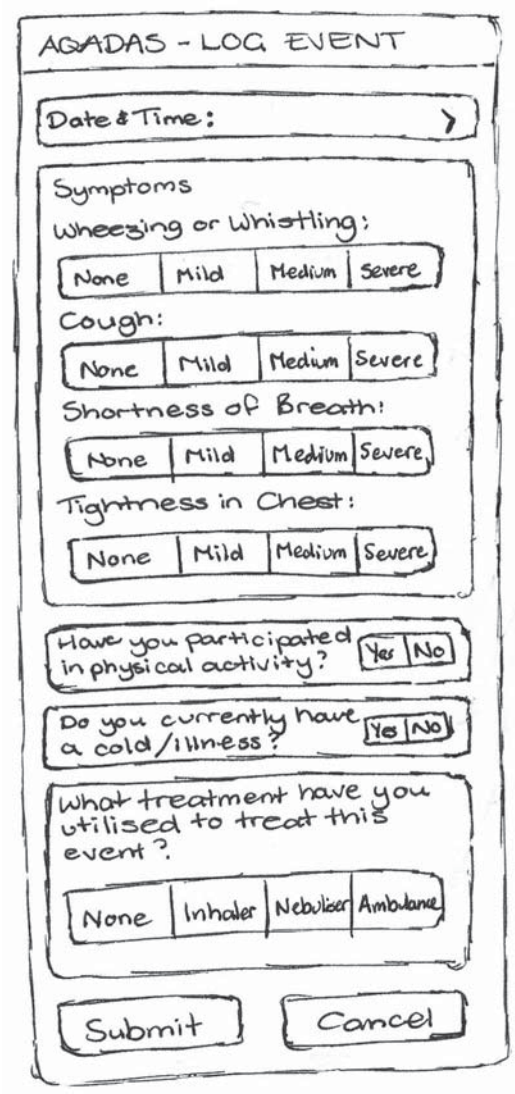
Maria's designs for the mobile phone user interface

Legend

Scrollable list of options – The user must touch the box to open the list, then touch the desired option. The selected option will be displayed in the box.

Option buttons – The user must touch the option to select it. The selected option will become shaded.

Design 1



Design 2

END OF CASE STUDY INSERT FOR SECTION C