**Victorian Certificate of Education
2013**

STUDENT NUMBER

Letter

Figures

Words

INFORMATION TECHNOLOGY: SOFTWARE DEVELOPMENT
Written examination

Friday 15 November 2013

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	6	6	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 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.

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SECTION A – Multiple-choice questions

Question 1

In data flow diagrams, various symbols are used to represent different features.

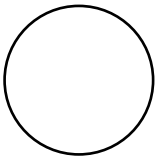Which one of the following is the symbol for a data store?

A.

B.

C.

D.

Question 2

A software project has been completed and the software solution has been running successfully for a few months. Simon is collecting all the documentation that was created during the project. In one of the documents he notices this statement: 'When executed, the program must occupy no more than 10 MB of main memory.'

During which stage of the problem-solving methodology was this statement most probably written?

A. design

B. analysis

C. evaluation

D. development

Question 3

Frank rings his computer-repair person. He explains, 'I'd just finished using a new application program that I downloaded from the internet and my computer suddenly went crazy. I shut my computer down and, when I restarted it, I noticed that all my photos had been deleted'.

Based on his explanation, Frank has most likely fallen victim to

A. spyware.

B. a Trojan.

C. a hard-disk failure.

D. poor programming.

Question 4

A program contains an object called **person**. The following line of code appears in the program.

person.clearAll

It causes all the data held by the object to be cleared.

The part of the code after the point, clearAll, is most commonly called a

A.   control structure.

B.   sequence.

C.   method.

D.   loop.

Question 5

A program contains a data structure that can be visualised as shown in the diagram above. The program enters the values 5, 9, 11, 12 into the data structure in that order. Later, the values are read from the data structure in this order: 12, 11, 9, 5.

The data structure is

A.   a stack.

B.   a queue.

C.   an integer.

D.   a 2-D array.

Question 6

A dictionary of computer terminology for secondary students has the following definition.

'A system that uses internet protocols to allow the sharing of information across an organisation's local area network. Usually only accessible from a computer within the local area network, it can be protected from unauthorised external access through the use of a network gateway or firewall.'

This is a definition for

A.   an intranet.

B.   the internet.

C.   a virtual private network.

D.   an organisation's website.

Use the following information to answer Questions 7 and 8.

Freya is writing a short program to calculate the circumference of a large number of circles. She knows the formula is $C = 2\pi r$, where C is the circumference of the circle and r is the radius of the circle. She decides to name π as myPi and set $\pi = 3.14$, and use the variable names Circum for C and Rad for r.
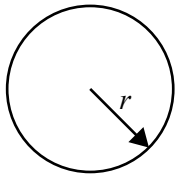
Question 7

For the program to be useful in all circumstances, Freya must ensure that the program treats

A. Rad as an integer and Circum as an integer.

B. Rad as an integer and Circum as a floating point number.

C. Rad as a floating point number and Circum as an integer.

D. Rad as a floating point number and Circum as a floating point number.

Question 8

Freya's program will read values for the radius from a file. It will write the answers to another file.

Which one of the following algorithms appears to be the most efficient?

A.
    While not end of file
        Read Rad **from** file
        myPi ← 3.14
        Circum ← 2 × myPi × Rad
        Write Circum **to** newFile
    EndWhile

B.
    myPi ← 3.14
    While not end of file
        Read Rad **from** file
        Circum ← 2 × myPi × Rad
        Write Circum **to** newFile
    EndWhile

C.
    While not end of file
        Read Rad **from** file
        my2Pi ← 6.28
        Circum ← my2Pi × Rad
        Write Circum **to** newFile
    EndWhile

D.
    my2Pi ← 6.28
    While not end of file
        Read Rad **from** file
        Circum ← my2Pi × Rad
        Write Circum **to** newFile
    EndWhile

Question 9

Fast Ethernet is a local area networking technology. One of the standards it is based on is known as 100BASE-T, which specifies a 100 megabits per second transmission rate using multi-level signal encoding over a twisted pair cable.

From this description, which layer of the Open Systems Interconnections (OSI) model does 100BASE-T deal with?

A. the network layer

B. the data link layer

C. the physical layer
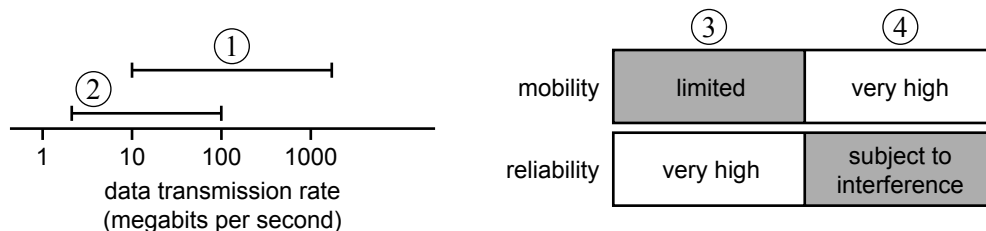
D. the transport layer

Question 10

John is using a text editor to help write his program.

A text editor is an example of a

A. file.

B. utility.

C. compiler.

D. programming language.

Question 11

The charts below provide some comparisons between wired and wireless networks.

In the diagram

A. label ① should read 'wired network' and label ③ should read 'wireless network'.

B. label ② should read 'wired network' and label ④ should read 'wireless network'.

C. label ① should read 'wired network' and label ④ should read 'wireless network'.

D. label ② should read 'wired network' and label ③ should read 'wireless network'.

Question 12

Pseudocode is used to represent

A. a set of logical steps for analysing a program.

B. a sequence of logical steps for solving a problem.

C. a sequence of steps for developing a programming language.

D. a set of program instructions written in a specific programming language that solves a problem.

Use the following information to answer Questions 13 and 14.

A company has just installed a new software solution and has provided training for its staff.

The company is also monitoring staff to see how quickly certain tasks are completed when using the new software.

Question 13

By collecting data about how quickly certain tasks are completed, the company is evaluating

A. the efficiency and effectiveness of the solution.

B. the efficiency and effectiveness of the users.

C. the effectiveness of the software solution.

D. the efficiency of the software solution.

Question 14

Which one of the following is the best type of documentation to provide to users of this new software?

A. online help

B. an installation guide

C. internal documentation

D. network documentation

Question 15

A validation check used to ensure that entered data is a number is called

A. a type check.

B. a range check.

C. a character check.

D. an existence check.

Question 16

An application is designed that will record a person's heart rate every 10 minutes and keep a record of the heart rate readings for a week.

What would be the functional requirements for this software?

A. The application is reliable and stores the heart rates for a week.

B. The application records the heart rates and stores them for a week.

C. The application is easy to turn on and off, and keeps accurate readings.

D. The application records the heart rates and provides a user-friendly screen.

Question 17

To review the security of a company's network, an IT technician could

A. install antivirus software.

B. reset all users' passwords.

C. check the network audit trails.

D. ensure the network is shut down every night.

Question 18

Network technicians can use error logs to measure the

A. speed of a network.

B. usability of a network.

C. reliability of a network.

D. maintainability of a network.

Use the following information to answer Questions 19 and 20.

Jessica is setting up a home computer but, as yet, has no security measures installed. From home, she would like to securely access her files that are stored on her company's network.

Question 19

Which one of the following provides the most secure method?

A. the company's intranet

B. a virtual private network

C. a wireless internet connection

D. a broadband internet connection

Question 20

Jessica will need to protect the files on her home computer. She can back up and restore her files, but is unsure of the additional security measures that she requires.

Which of the following is the best set of additional security measures for her home computer?

A. antivirus software, anti-spyware and file recovery software

B. antivirus software, a firewall and file recovery software

C. a firewall, anti-spyware and video conferencing

D. a firewall, anti-spyware and antivirus software

SECTION B – Short-answer questions

Instructions for Section B

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

Question 1 (3 marks)

The following are three structures used in programming languages.

Briefly describe each.

- selection control structure

_____

_____

_____

- procedure

_____

_____

_____

- function

_____

_____

_____

Question 2 (3 marks)

Complete the following algorithm so that, at its end, the variable **largestAge** contains the largest number in the 1-D array of integers, **ages**. The array contains 1000 elements and ages [0] is not used.

Begin

largestAge $\leftarrow$ 0

For i $\leftarrow$ 1 **to** 1000

EndFor

End

Question 3 (4 marks)

A software development company has just completed a software solution for the plumbing faculty of a college. The software will randomly generate sets of multiple-choice questions that will test students on various parts of a plumbing course. The software will be able to assess the test and provide immediate results to the students and their teachers.

a.   What is acceptance testing and who should be involved in the acceptance testing of this software solution?   2 marks

_____

_____

_____

_____

_____

b.   Suggest **two** specific evaluation criteria to measure the effectiveness of this solution for the plumbing faculty.   2 marks

_____

_____

_____

_____

_____

Question 4 (4 marks)

A personnel file is being created. The table below shows some of the fields that are required in each record. From the list of data types, select the **most appropriate** type for each field.

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

Data	Use	Data type
GivenName	to store the given name	
Status	F for full-time employee or P for part-time employee or V for volunteer	
FirstAid	Do they have first-aid qualifications? True or false?	
HomePhoneNumber	stored in the form (09) 9999 9999	

Question 5 (2 marks)

When discussing the storage of data, people often use the terms 'records' and 'files'.

a.   What is a record?   1 mark

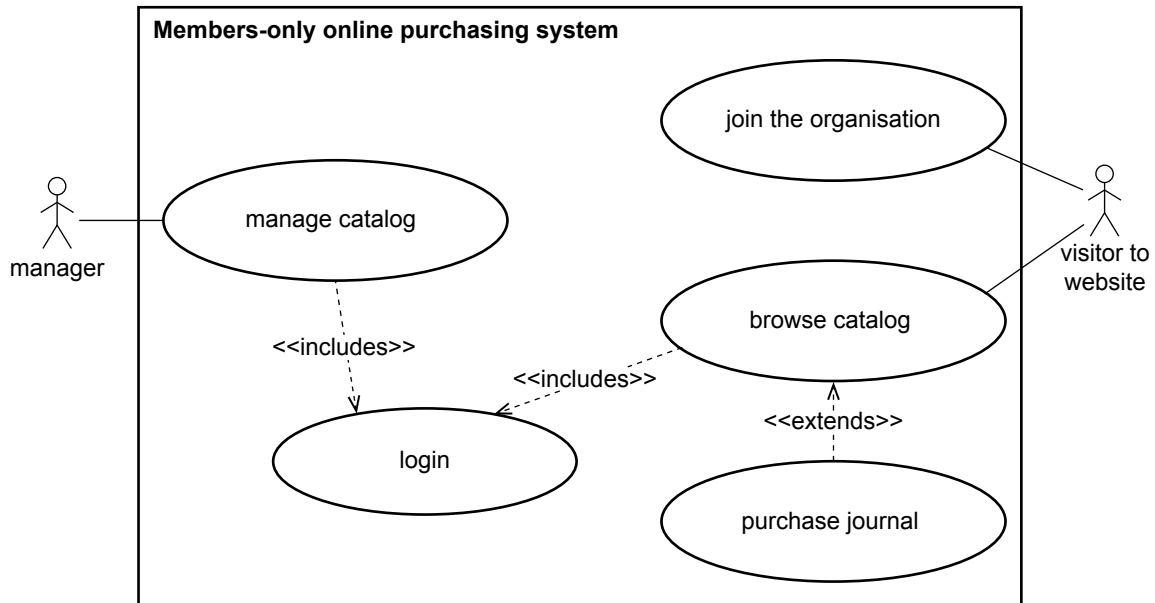**b.**   What is a file?   1 mark

Question 6 (4 marks)

An organisation publishes a monthly journal that it sells online to its members.

The following use case diagram shows the organisation's online purchasing system.

a.   What does the diagram suggest that **any** visitor to the website can do?   1 mark

_____

b.   What does the diagram suggest that the manager must do before the manager is able to
manage the catalog?   1 mark

_____

c.   Describe the difference between a visitor's interaction with the 'login' use case and their
interaction with the 'purchase journal' use case.   2 marks

_____

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END OF SECTION B

SECTION C – Case study

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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.

</div>

Question 1 (3 marks)

Drone Solutions has determined that it has four months to develop the software solution for the Aerial Animal-Detection System (AADS). Melanie, who is leading the development team at Drone Solutions, has prepared a chart to help her monitor all aspects of the project.

a. Melanie will use the chart to monitor the tasks required to complete the project. One of the major tasks she has scheduled on the chart is designing the AADS software.

Outline two tasks that you would expect to see scheduled before the software design task. 2 marks

task 1 _____

_____

_____

_____

task 2 _____

_____

_____

_____

b. In addition to monitoring the tasks required to complete the project, identify **one** other area that the chart should monitor. 1 mark

_____

_____

Question 2 (5 marks)

Melanie has started a data dictionary for the context diagram (Diagram 4). It is incomplete.

a.   Complete the table below by writing the appropriate data flow names from the context
diagram into rows 3, 4 and 6.   3 marks

	Data flow	**Composition**
1	visualised_telemetry_data	GPS_data + image_data (formatted for display)
2	GPS_data	reading_time + latitude + longitude
3		reading_time + optical_image_data + infrared_image_data
4		['take-off' / 'land' / 'fly to' / 'circle'] + latitude + longitude
5	flight_log	time + latitude + longitude + altitude + *optional* [hot_spot_images + animal_spotter_id + animal_spotter_response]
6		*sequence* of [latitude + longitude]

b.   To state the position of any animal found, longitudes will be entered as numbers, for example,
97.73858. When creating the data dictionary for individual data items, Melanie has a choice of
setting longitude to 'integer' or 'floating point'.

Which should she choose? Justify your response.   2 marks

choice _____

justification _____

_____

_____

_____

Question 3 (3 marks)

Software will have to be written for the PNPW computer, the drone and the tablet computers to be used by park rangers. Melanie has worked out the main processes for the AADS. These are shown and numbered in the incomplete data flow diagram (DFD; Diagram 5).

Which process will run on each of the computer systems below? (You may write just the process number.)

the PNPW computer _____

the drone _____

the tablet computers _____

Question 4 (3 marks)

Melanie has not yet labelled the data flows in her DFD (Diagram 5).

What labels should be shown on the data flows A, B and C?

A _____

B _____

C _____

Question 5 (4 marks)

The data store in Melanie's DFD will contain a sequential list of global positioning system (GPS) coordinates. The coordinates will be entered in flight order, with the first coordinate entered being the first point the drone flies to. Before take-off, more points could be added to the end of the list if required.

In her design notes, Melanie has indicated that this data store should have a stack structure. A colleague suggests that it should be a queue data structure.

Which would you choose? Justify your choice.

choice _____

justification _____

_____

_____

_____

_____

_____

Question 6 (5 marks)

George, one of the programmers for Drone Solutions, has been doing some research on the internet and has found some software, written for a drone, that was developed overseas. He downloads the software and begins altering it. Melanie sees what he is doing and orders him to look up the code of ethics for Drone Solutions.

a. Explain the purpose of a code of ethics.   3 marks

_____

_____

_____

_____

_____

_____

b. What should George do to resolve this ethical dilemma?   2 marks

_____

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_____

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_____

Question 7 (5 marks)

When a drone detects a hotspot (a temperature above 20 °C), it immediately interrupts its preset patrol path and begins monitoring the hotspot. This new path will allow the drone to continuously view the hotspot. This is done in a function called StartMonitoring. It will continue to monitor for five minutes before returning to its patrol path unless told to continue monitoring or to resume its patrol path immediately. This message is received in a variable AlertReply. If told to continue monitoring, it will do so for five minutes or until another AlertReply is sent. When it has finished monitoring, it automatically resumes its patrol path using a function ResumePatrol.

The following is a section of the algorithm.

> **Get** DetectedTemp
> **If** DetectedTemp > 20 **Then**
> > **Call** StartMonitoring
> > FinalTime ← CurrentTime + 5 mins
> > **Send** Alert
> > **Repeat**
> > > **Get** AlertReply
> > > **If** AlertReply = Monitor **Then**
> > > > FinalTime ← CurrentTime + 5 mins
> > >
> > > **Endif**
> >
> > **Until** (CurrentTime > FinalTime) **And** (AlertReply = Patrol)
> > **Call** ResumePatrol
>
> **Endif**

a. George decides to desk check the **loop** in this algorithm by using various values of CurrentTime and AlertReply to see if the loop behaves as required.

   Complete the following table if the value for FinalTime on entering the **loop** is 11:00 am.   3 marks

	CurrentTime	AlertReply	Action observed
test 1	10:58	NULL	drone continues to monitor hotspot
test 2	10:58	Monitor	
test 3	10:58	Patrol	
test 4	11:04	NULL	

Working space

b.   Identify the major logic error in this algorithm.   1 mark

_____

_____

_____

_____

c.   Rewrite **one** line of the algorithm to correct the major logic error.   1 mark

_____

_____

Question 8 (3 marks)

George says it will not take him long to create the screen design for the software on the tablet that will be used by the park rangers, as the screen design will be easy and everyone uses tablets these days.

Outline **one** concern with George's approach to the screen design and suggest what George could do to ensure that his screen design is effective.

_____

_____

_____

_____

_____

_____

_____

Question 9 (5 marks)

Before a park ranger can give directions to a drone via the software on a tablet computer, they must enter a username and password.

Using the variable names Username and Password, write an algorithm that accepts the username and password entered by the user, and checks that they match the variables CorrectUserName and CorrectPassword.

If they are correct, the algorithm should start the monitoring program, and if not, it should display an 'incorrect username/password' message.

Question 10 (3 marks)

Each park ranger will be asked to provide a password for the monitoring program. This password must contain more than four characters that are only letters or numbers. The following algorithm is created to check this.

It uses a function **Length**(string) to give the length of a string and a function **Midchar**(string, position) to give the character that is in each position from the start.

Begin

    Get Password

    LengthPassword ← **Length**(Password)

      If LengthPassword > 4 **Then**

          Position ← 0

          ValidChar ← True

          Repeat

               Position ← Position + 1

               PasswordChar ← **Midchar**(Password, Position)

               If PasswordChar **Not alphabetic And** PasswordChar **Not numeric then**

                    ValidChar ← False

               Endif

          Until Position = LengthPassword

          If ValidChar = False

               Display Message Password contains invalid characters

          Endif

      Else

          Display Message Password too short

      Endif

    End

Complete the table below with three passwords that will test each of the different circumstances listed.

Test no.	Password	What is being tested?
1		message 'Password too short' displayed
2		a valid password is accepted
3		message 'Password contains invalid characters' displayed

Question 11 (6 marks)

George talks to Melanie, who points out a major flaw in his password system. The aim is to have one tablet per monitoring station, not one per user, to reduce costs. A file of all usernames and passwords (expected to exceed 1000 over time as staff move between parks) will be on this tablet. Maximum memory will be needed on the tablet to display the high-resolution video, so Melanie suggests that the file is searched each time a user logs in instead of reading the whole file into memory. She suggests that the file be a random access file, and that the username and password are located using a binary search.

a. To allow a successful binary search on username to occur, describe what must be done with the records in the file before the search begins. 1 mark

b. Describe the process that the binary search will use to locate the given username. 2 marks

c. Explain the difference in the way records are accessed when using a random access file compared to a serial access file and why Melanie has suggested using a random access file. 3 marks

Question 12 (2 marks)

Brenda suggests to George that instead of using tablets to display the data coming from the drone, they should use mobile phones as these are cheaper and everyone has one, so tablets would not have to be purchased.

Explain why the tablet is a better choice.

_____

_____

_____

_____

_____

_____

Question 13 (4 marks)

When the drone lands, the data files, including video and GPS coordinates, will be downloaded onto a notebook computer. The files will then be deleted from the drone so that there is space for data files from the next flight.

a.   Is this an example of backup or archiving? Give a reason for your answer.   2 marks

_____

_____

_____

_____

_____

b.   Describe another procedure that would reduce the chance of these files being lost.   2 marks

_____

_____

_____

_____

_____

_____

_____

Question 14 (6 marks)

A major security concern for the software being designed to run on the drone is that hackers (unauthorised users) could take over control of the drone.

State two measures that could prevent this from happening. Clearly explain how each would prevent unauthorised access to the drone.

measure 1 _____

explanation _____

_____

_____

_____

measure 2 _____

explanation _____

_____

_____

_____

_____

Question 15 (3 marks)

Once the software has been accepted by PNPW, all park rangers will be required to use it. The park rangers are very unhappy about this as they have no idea how the new software will work and so they complain to the PNPW management.

Explain how management could resolve this conflict.

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END OF QUESTION AND ANSWER BOOK

CASE STUDY INSERT FOR SECTION C
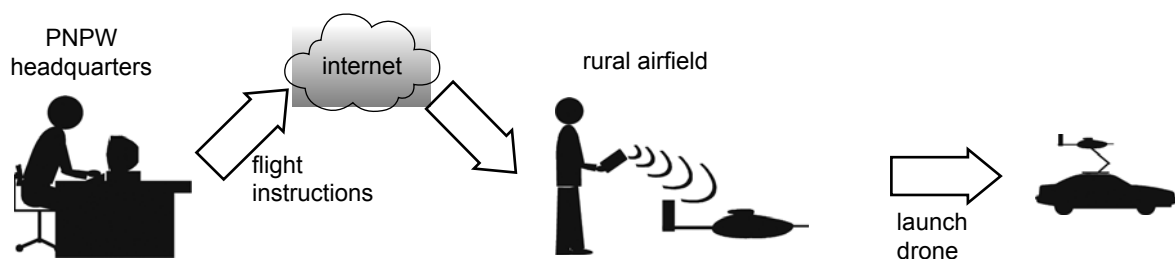Please remove from the centre of this book during reading time.

Case study

An organisation called the Protection of National Parks and Wildlife (PNPW) is responsible for monitoring the health of native animals and controlling wild animals across all national parks in Victoria. Currently this is achieved in three ways.

- a network of animal-monitoring stations located in the national parks, where park rangers monitor animal activity on a weekly basis
- the use of aircraft to actively locate animals using heat-detection cameras in the very remote areas
- reports from staff who work in the parks, the general public and other emergency service organisations

As a result of recent budget cuts, PNPW needs to find ways to reduce its costs. The animal-monitoring stations are important and relatively inexpensive to run. However, the use of aircraft requires the hiring of several aircraft and pilots every week.
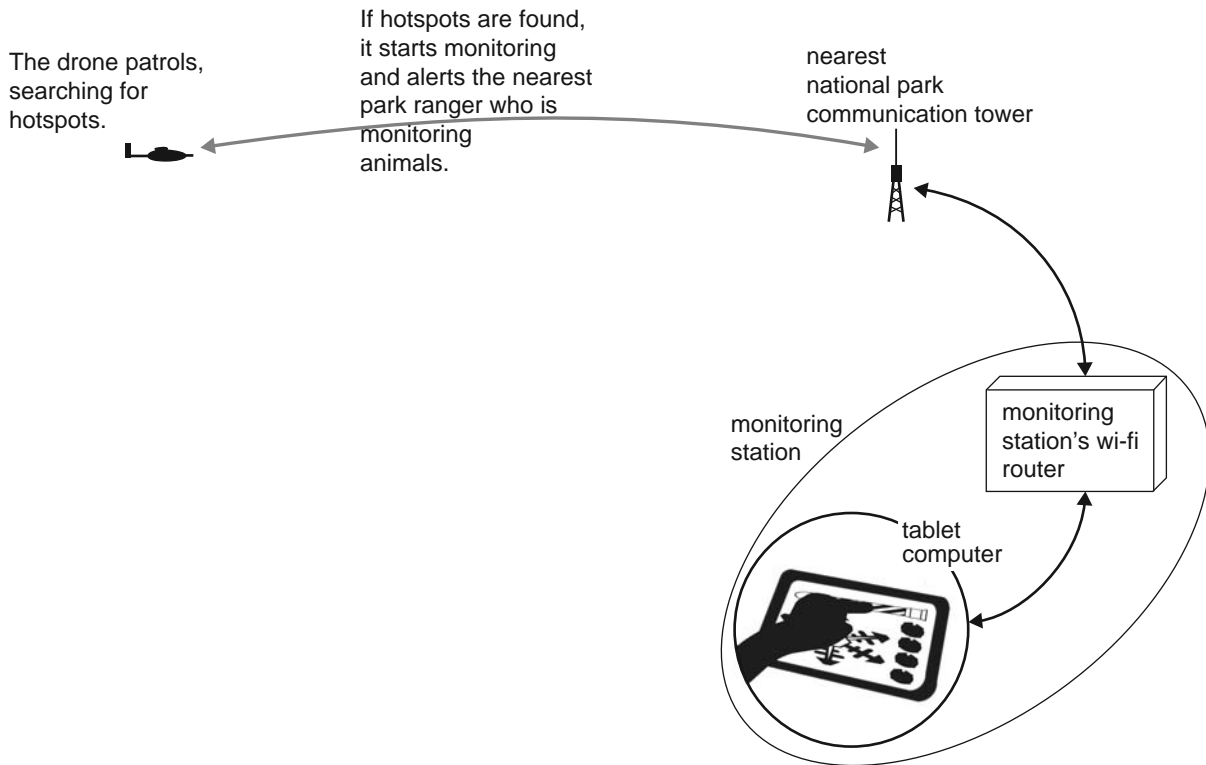
Brenda Benbow, the manager of PNPW, has been working on a plan for using a drone (an unmanned aircraft) to monitor the native animals. This will cut down on the annual cost associated with the hiring of aircraft and pilots. She has chosen a model that can pilot itself once it has been given simple instructions. This model is fitted with a standard micro-video camera, an infra-red camera and global positioning system (GPS) technology. It also has two communication channels: a standard wireless network interface card and a radio transmitter/receiver. The radio has a range of about 50 km.

Diagram 1: A drone

Each drone will be placed at a rural airfield. When a drone has to make a flight, it will be sent flight instructions from PNPW headquarters in Melbourne via a PNPW officer's notebook computer. The PNPW officer will then launch the drone from a car at the airfield.
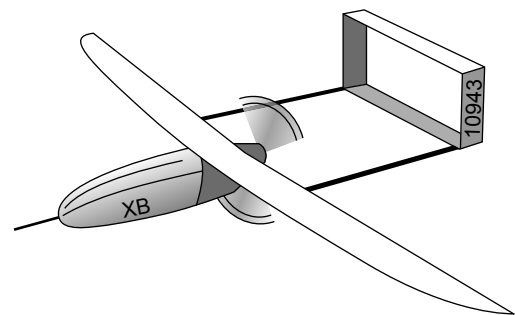
Diagram 2: Data transfer

Once airborne, the drone will fly its preset patrol path. It can detect hotspots as small as 20 cm in diameter. This means that it can 'see' most wildlife. On detection of a hotspot, the drone will interrupt its preset patrol path, start monitoring the hotspot and pass control to a tablet computer at the nearest monitoring station. The drone will also transmit what it is 'seeing' to the tablet computer. The tablet will use wi-fi to communicate with the drone through the monitoring station's wi-fi router. The router uses the national park's communication system to communicate with the drone. The park rangers who are monitoring animals will then decide whether or not the picture shows an animal that requires further monitoring.

Diagram 3: Communication between a drone and park rangers

The drone patrols, searching for hotspots.

If hotspots are found, it starts monitoring and alerts the nearest park ranger who is monitoring animals.

nearest national park communication tower

monitoring station

monitoring station's wi-fi router

tablet computer

Brenda has hired Drone Solutions to develop the software for the new Aerial Animal-Detection System (AADS). She has provided the company with details of the drone operation, the hardware resources contained on the drone and the requirements of the software operation. Software will have to be written for the computer at PNPW headquarters, the drone and the tablet computers to be used by the park rangers.
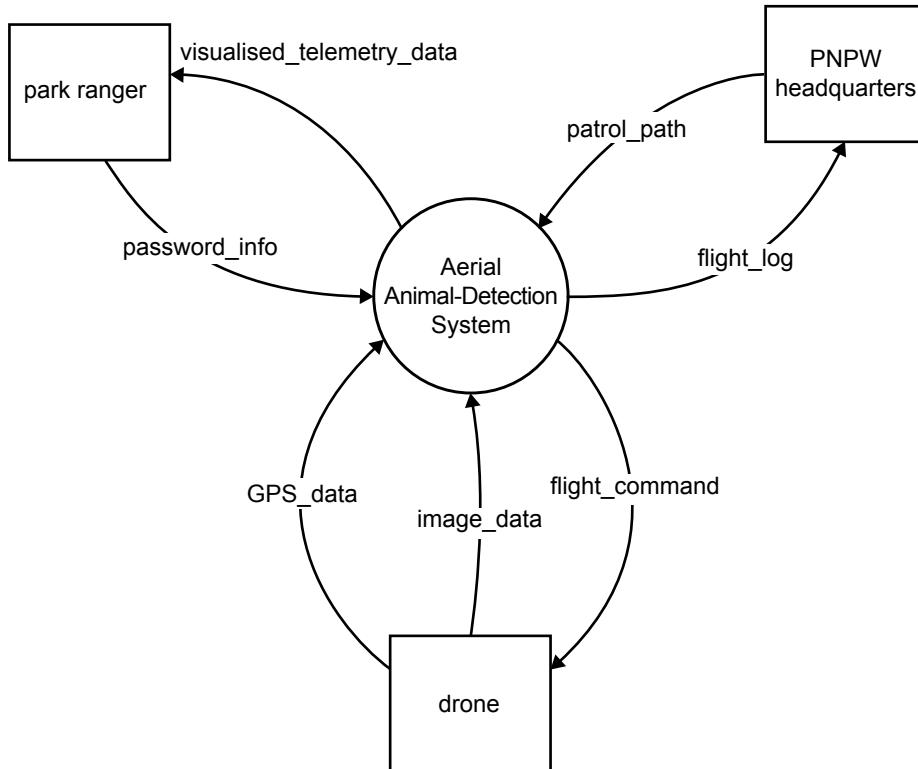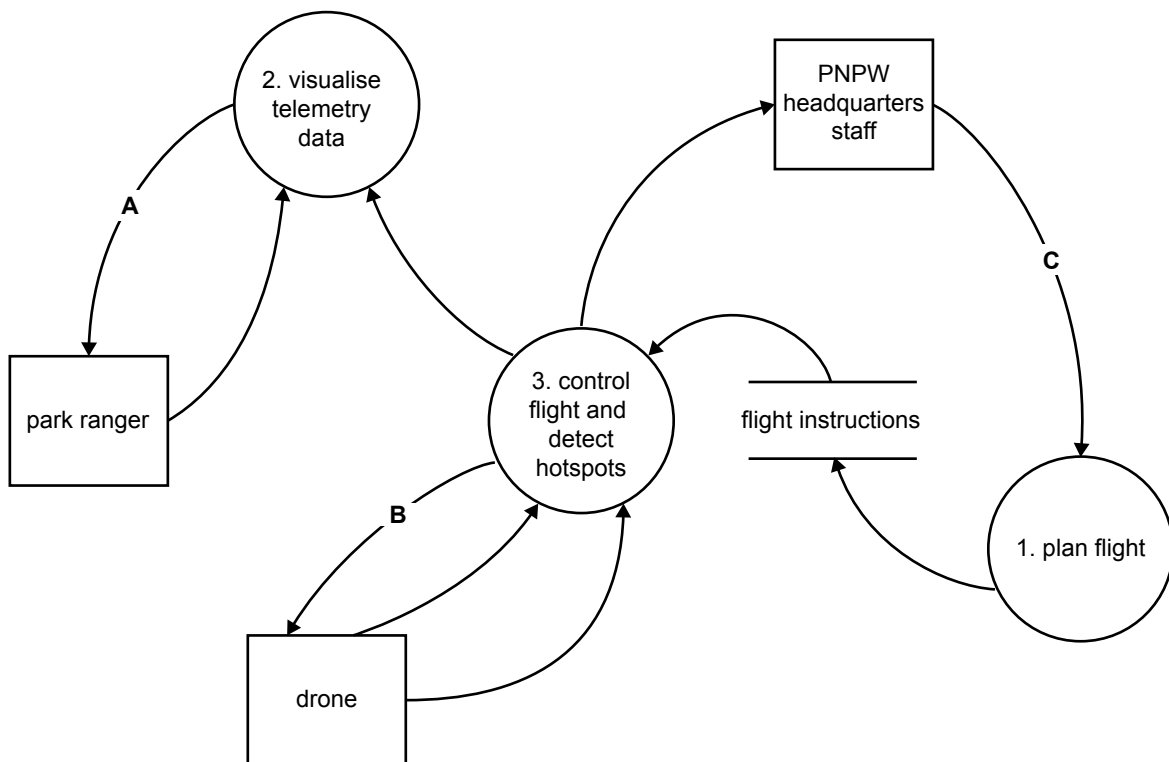
Diagram 4: Context diagram for the new AADS

Diagram 5: Incomplete first-level data flow diagram (DFD) for the AADS

END OF CASE STUDY INSERT FOR SECTION C