

COMPUTING: SOFTWARE DEVELOPMENT

Written examination

STUDENT NAME:

Reading time: 15 minutes

Writing time: 2 hours

QUESTION AND ANSWER BOOK

Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	6	6	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 provided

- Question and answer book of 27 pages.
- Insert containing a case study for Section C in the centrefold.
- Answer sheet for multiple-choice questions.

Instructions

- Remove the insert from the centre of this book during reading time.
- Write your **name** in the space provided above and on the multiple-choice answer sheet.
- 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.

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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

As part of a new software system design, a document is created containing an outline of the necessary properties of an instantiated class.

This type of document is typically referred to as

- A. pseudocode.
- B. a data dictionary.
- C. an object description.
- D. internal documentation.

Question 2

Eva is working on a new piece of software to track heart rates through a wearable fitness band. A heart rate (also known as a pulse) is based on a person's heartbeat and is usually defined as how many times the heart beats in a minute.

The most efficient data type to store heartbeats per minute is

- A. string.
- B. integer.
- C. Boolean.
- D. character.

Question 3

A network security specialist has put in place some equipment security controls at her company. When people arrive at the workplace, they are now required to place their thumb on a scanner to log into their computers.

This type of equipment control is referred to as

- A. biometric.
- B. access log.
- C. zoned security.
- D. Transport Layer Security (TLS).

Question 4

A sports betting company uses data mining to predict likely winners of sports games so that the company is unlikely to lose money on bets.

When considering specific factors that influence the integrity of the data, the most important factor for the company to consider when analysing the data is its

- A. data characteristics.
- B. storage medium.
- C. accuracy.
- D. security.

Question 5

Rest-U-Want is a mobile application that finds local restaurants based on a phone's GPS location and a five-star ranking system. When a user selects 'find', the app will search its database for the highest-ranked restaurant within a radius that can be set by the user; the default is 2 km. The developer of the application wants to use an efficient algorithm to sort the database, as it contains over 500 000 restaurants.

In terms of sort time, the sort algorithm that would be the fastest, on average, is

- A. selection.
- B. binary.
- C. linear.
- D. quick.

Question 6

Kimberly has just finished writing a sort algorithm and is testing it to make sure that it works. Below are her trace tables at two different stages of testing; she is sorting a random set of eight elements.

Initial Stage

aSort	aList	<table border="1"> <tr> <td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> </tr> <tr> <td>8444218</td><td>7579544</td><td>4205715</td><td>2589167</td><td>5112747</td><td>4049341</td><td>7837985</td><td>3033127</td> </tr> </table>								0	1	2	3	4	5	6	7	8444218	7579544	4205715	2589167	5112747	4049341	7837985	3033127
	0	1	2	3	4	5	6	7																	
	8444218	7579544	4205715	2589167	5112747	4049341	7837985	3033127																	
	i	0																							
	smallest	0																							
k	1																								

Stage x

aSort	aList	<table border="1"> <tr> <td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td> </tr> <tr> <td>2589167</td><td>7579544</td><td>4205715</td><td>8444218</td><td>5112747</td><td>4049341</td><td>7837985</td><td>3033127</td> </tr> </table>								0	1	2	3	4	5	6	7	2589167	7579544	4205715	8444218	5112747	4049341	7837985	3033127
	0	1	2	3	4	5	6	7																	
	2589167	7579544	4205715	8444218	5112747	4049341	7837985	3033127																	
	i	1																							
	smallest	3																							
k	7																								

The Initial Stage represents the list before any sorting has occurred. Stage x represents the list after the algorithm has traversed it for the x^{th} time.

Given the two lists, what is the most likely value of x ?

- A. 5
- B. 4
- C. 3
- D. 1

Use the following information to answer Questions 7, 8, 9 and 10.

The XML file below is a sample set of data from a language program that translates between English and Indonesian.

```

indo.xml  x
1  <?xml version="1.0" encoding="UTF-8"?>
2  <dict>
3    <termEntry>
4      <langSet lang="1">
5        <term>person</term>
6        <term>individual</term>
7        <term>someone</term>
8        <term>somebody</term>
9        <term>mortal</term>
10       <term>soul</term>
11     </langSet>
12     <langSet lang="2">
13       <term>orang</term>
14     </langSet>
15   </termEntry>
16   <termEntry>
17     <langSet lang="1">
18       <term>food</term>
19       <term>nutrient</term>
20     </langSet>
21     <langSet lang="2">
22       <term>makanan</term>
23     </langSet>
24   </termEntry>
25 </dict>

```

Question 7

In XML, the use of `termEntry`, such as on lines 3 and 16, is an example of

- A. a tree.
- B. a root.
- C. an element.
- D. an attribute.

Question 8

The purpose of line 1 in the XML file is to

- A. act as a prolog.
- B. describe the syntax.
- C. represent the tree structure.
- D. set the schema that describes the structure.

Question 9

In the language program, the word a user enters is checked against the words in the XML file. If a word matches, the translated word is returned to the user.

The most appropriate control structure that would be used to process all of the terms (`term`) in a language set (`langSet`) to see if a term matches the word the user entered is

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

Question 10

Given that the language program must allow for easy searching of terms (`term`), the most appropriate data structure to represent a single `termEntry` is

- A. record.
- B. hash table.
- C. associative array.
- D. one-dimensional array.

Question 11

When documenting a client's need or opportunity, a tool that is used to describe the interaction between a user and a solution such that it represents what the system must do is a

- A. use case diagram.
- B. data flow diagram.
- C. functional requirement.
- D. non-functional requirement.

Question 12

Lisa works for a medical imaging company in Sydney. As part of her job, she needs to enter patient information into a local database that is stored on the servers inside the company.

This data is legally protected by the

- A. *Privacy Act 1988.*
- B. *Copyright Act 1968.*
- C. *Privacy and Data Protection Act 2014.*
- D. *Charter of Human Rights and Responsibilities Act 2006.*

Question 13

Whitefish Marketing Solutions is a company that focuses on delivering marketing material to people via social media websites. The company uses platforms such as Facebook, Twitter and LinkedIn to deliver advertising content directly to users based on the information that the company gathers from the users' profiles. The software it uses scans user profiles for email addresses as well as hobbies, job history and location to select the most appropriate content to deliver to the user. This content is sent to the user's email address.

To comply with the *Spam Act 2003*, Whitefish Marketing Solutions must ensure that all advertisements are

- A. relevant to the user.
- B. appropriate and tasteful.
- C. purely factual and contain no misleading content.
- D. from companies that the user has purchased from in the past.

Question 14

Dante is a quality assurance tester for a large development company. His job requires that he perform validation testing on all new software algorithms with the goal of releasing error-free software. Dante has recently completed a test of a new algorithm, where he deliberately entered invalid or incorrect information in some of the entry fields. For example, in an entry box expecting the number 10 for the month of October, Dante entered 'Mocktober' instead.

The type of validation checking that Dante is completing is referred to as

- A. type.
- B. logic.
- C. range.
- D. existence.

Question 15

A software developer has been working on a website application via remote access. She logs into her company's system by establishing a point-to-point connection that exists over a dedicated connection. This connection has traffic encryption to make sure her code is kept secure while being transferred to and from her company's main computer systems. She also has the ability to use resources available in the company's network, such as sending items to her manager's printer remotely.

The connection that the developer is using is commonly known as

- A. a virtual private network (VPN).
- B. a local area network.
- C. a wide area network.
- D. an intranet.

Question 16

Jana is writing an application for a smart watch that displays the temperature of the current environment. It uses sensors that are built into the watch to determine the temperature of the immediate surroundings of the person who is wearing the watch.

Which type of modern architecture is the most appropriate for Jana to use for her application?

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

Question 17

A manager at a local company meets with her board of directors, and together they come up with the following four statements:

1. increase customer base by 10%
2. increase staff morale
3. double the amount of radio advertising
4. provide superior customer service

Which of these statements are organisational goals, and which are organisational objectives?

- A. 1 and 3 are goals; 2 and 4 are objectives.
- B. 2 and 4 are goals; 1 and 3 are objectives.
- C. 1 and 2 are goals; 3 and 4 are objectives.
- D. 3 and 4 are goals; 1 and 2 are objectives.

Question 18

Pavli is a junior developer at a local software company. He has just finished writing a piece of software for a client and is satisfied that it does everything that it was meant to do. A focus group has been brought in to use his software and Pavli observes them, taking notes and recording any difficulties, confusion or problems they have when using the features within his system.

What type of testing is Pavli conducting?

- A. code testing
- B. stress testing
- C. range testing
- D. useability testing

Question 19

Programmers frequently need to select data structures based on the type of data they are storing to ensure that they are using the most appropriate data structure.

For example, a programmer would choose a record data structure over a one-dimensional array when

- A. the sets of data to be stored will all have the same data type.
- B. the sets of data to be stored may have different data types.
- C. the number of elements to be stored is unknown.
- D. the number of elements to be stored is known.

Question 20

A government organisation uses an algorithm to select Australian postcodes when choosing local councils to audit. Postcodes are allocated to one of seven categories based on a hash function that divides the postcode by 7, using the remainder as an index value. Once all postcodes have been allocated to the appropriate hash place, all hash places that have at least two postcodes assigned to them within the associative array will have their contents sent to another program to process the audit.

Some sample data sent to the hash function is: 3872, 5383, 5909, 6759, 8592, 9545, 9622.

Once the sample data has been processed, the postcodes to be sent to the other program will be

- A. 3872, 5909
- B. 6759, 9545, 9622
- C. 5383, 5909, 9545, 9622
- D. 3872, 5909, 6759, 9545, 9622

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

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

Question 1 (4 marks)

Jasmine and Eleni are discussing linear and binary search algorithms. Jasmine insists that linear search is the worse of the two search algorithms to select when efficiency is the primary goal of a software system. Eleni does not agree, and states that there are some cases where a linear search would be preferred over a binary search in terms of efficiency.

Explain why both Jasmine and Eleni believe themselves to be correct.

Question 2 (2 marks)

One technique used in developing software is constructing a trace table.

What are trace tables and how are they used?

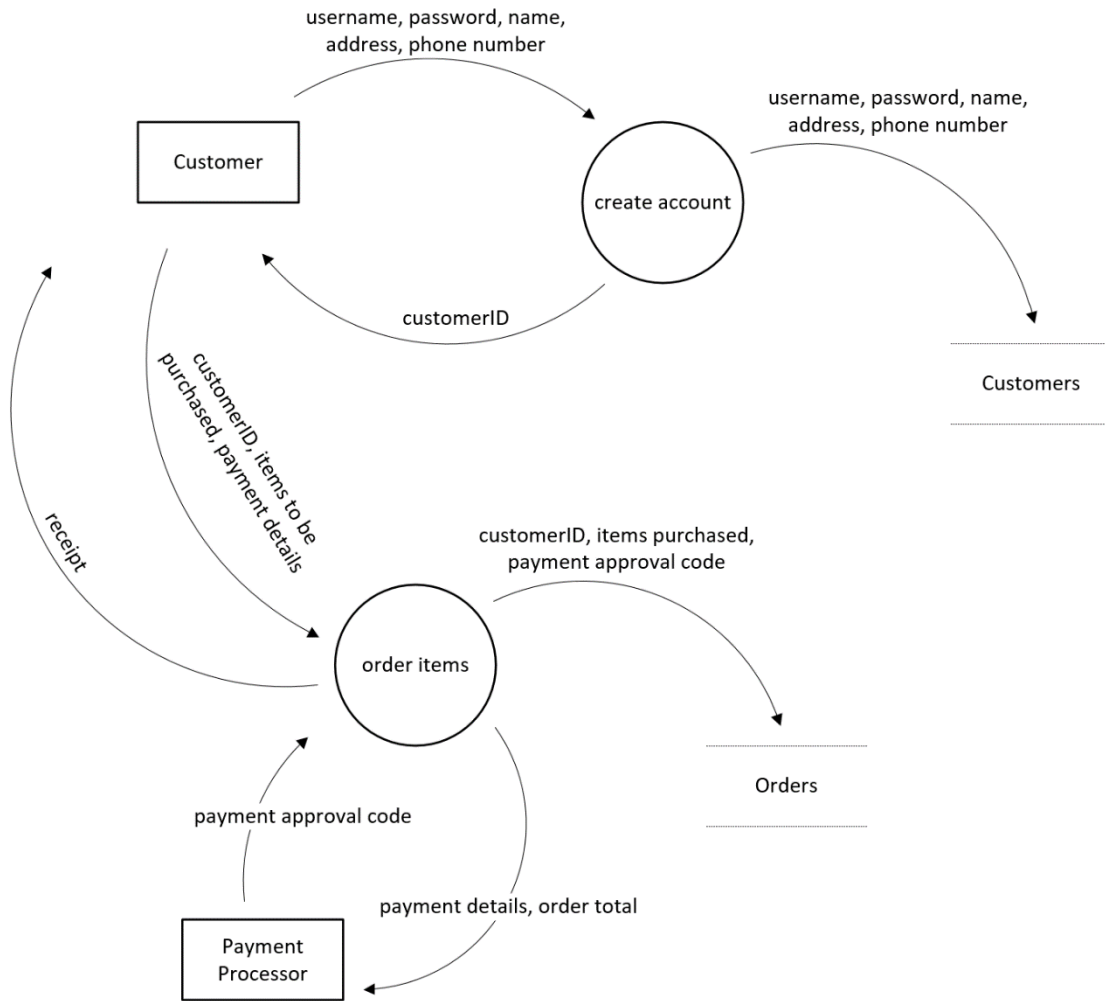
Question 3 (4 marks)

Elmore and Levi are self-taught programmers who work for a small software company. The company has been receiving more and more work from clients, and the programmers have been told by their manager that they must start including a project plan, such as a Gantt chart, for all of their projects from now on. Elmore and Levi both think this is unnecessary work, as their projects in the past have been small and they are the only two developers in the company.

Describe two advantages of project plans that could change Elmore and Levi's minds.

Question 4 (3 marks)

The following is a portion of a data flow diagram (DFD) representing a customer creating an account and purchasing from an online store.



Give an example of each of the following from the DFD.

Data store _____

Entity _____

Process _____

Question 5 (4 marks)

Paula owns a financial planning business in the outer suburbs of Melbourne. She is planning the construction of a new office for her business and is working with an architect to plan the layout of her office spaces. Part of the discussion she is having with the architect involves her planned network setup. She currently has two options for her business network:

Option 1

Cat-6 cabling would be installed throughout the building during construction. Outlets would be placed on the walls of each room, with all of the wiring hidden behind walls or under floors.

Option 2

Wireless access points would be installed throughout the building, hidden behind decorative panelling in the ceilings of the offices that require it. All the business systems would connect wirelessly to those access points.

Outline the advantages and disadvantages of each of Paula’s options.

Question 6 (3 marks)

Describe the techniques you used in your programming this year to construct internal documentation and apply appropriate naming conventions.

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.

Question 1 (1 mark)

Mark wants the drone system put in place so that he does not have to hire seasonal labourers to pick the fruit, thus increasing the company's profits. He has done the calculations, including the initial costs of the drones and the software, and believes that over the next five years he will be able to decrease labour costs by 75%.

Is Mark's belief an organisational objective, or an organisational goal?


Question 2 (5 marks)

Mark would like the entire system online before the next picking season. Due to the timing of delivery of the drones, the development company will only have 60 days to complete development and testing.

a. Given the following tasks and durations, complete the Gantt chart below to show how the project can be delivered on time while acknowledging all dependent tasks.

- Collect data requirements: 5 days
- Write laser drone code: 15 days
- Test and debug laser drone code: 10 days
- Write carrier drone code: 15 days
- Test and debug carrier drone code: 10 days
- Test and debug entire system: 10 days
- Conduct useability tests: 5 days
- Respond to useability tests, including testing and debugging: 10 days

4 marks

Task	Days												
	5	10	15	20	25	30	35	40	45	50	55	60	
Collect data requirements													
Write laser drone code													
Test and debug laser drone code													
Write carrier drone code													
Test and debug carrier drone code													
Test and debug entire system													
Conduct useability tests													
Respond to useability tests, including testing and debugging													
Demonstrate complete system to Mark													

b. Explain what the diamond represents on the Gantt chart.

1 mark

Question 3 (4 marks)

Donna is the lead designer at the software development company that Mark is using. She has just begun constructing a software requirements specification (SRS) for Mark’s new system.

Outline two data collection techniques Donna should use to determine the needs and requirements of Mon-Cheri Orchards.

Question 4 (4 marks)

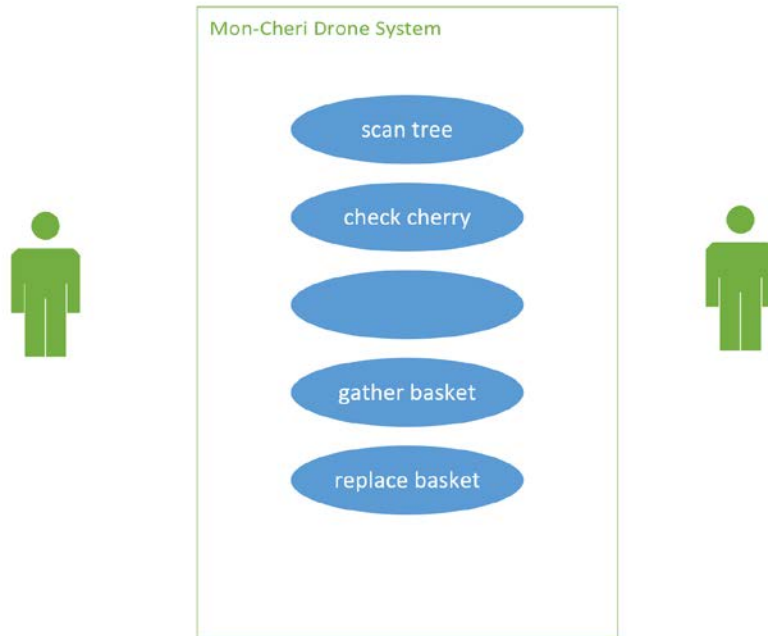
Mark currently has 12 staff members at Mon-Cheri year-round. Some are horticulturalists, who work on growing new cherry varieties or maintaining the health of the trees in the orchards. Others are technicians and engineers working on orchard equipment. During picking season, Mark employs seasonal labourers to do most of the manual picking, but he frequently insists that everyone help manually pick cherries, even if picking is not part of their job description.

Outline the potential advantages and disadvantages for the stakeholders affected by the new drone system.

Question 6 (4 marks)

Etienne was in the middle of creating a use case diagram for the Mon-Cheri system when he was unexpectedly called away from the office, leaving it unfinished.

Using the information provided in the case study, complete the use case diagram below by labelling all actors and use cases and showing all associations.

**Question 7** (4 marks)

Using the information provided in the case study, state four functional requirements of the Mon-Cheri laser drone.

Functional requirement 1 _____

Functional requirement 2 _____

Functional requirement 3 _____

Functional requirement 4 _____

Question 8 (9 marks)

Both the laser drones and the carrier drones collect and store data within their internal hard drives while they are in operation. Some of this data includes date and time, GPS coordinates, weather conditions, and success and fail rates of cherry picking (for a laser drone) and basket collecting (for a carrier drone). The drones are all equipped with Bluetooth technology.

Rather than simply deleting this data every day, Mark would like to store it for long-term analysis. He already has a networked computer system in the packing warehouse used for his orchards, consisting of a desktop computer, a laptop, printers and photocopiers. The network is connected via Cat-5 cabling, except for the laptop, which is wirelessly connected via a wireless access point. Mark has a dedicated internet connection in the packing warehouse.

- a. Select and justify the hardware that Mark should purchase for long-term storage of data, including where the hardware should be placed.

3 marks

- b. Select and justify appropriate processes, including scheduling, that Mark should put in place for the storage, communication and disposal of data from the drones.

6 marks

Storage _____

Communication _____

Disposal _____

Question 9 (2 marks)

Select and justify an appropriate data structure to use when storing the RGB colour scale data for a cherry.

Question 11 (3 marks)

The software development company has scheduled useability tests to occur on the new system after all of the main development has been completed.

Describe how useability testing might be conducted for the tablet application that Mark will use to control the drones.

Question 12 (6 marks)

Mark would like to use the data from the drones that has been stored on the central server system to track his harvest amounts per day each season, across multiple seasons. He would like to match up the drone data with weather data from the Bureau of Meteorology (BoM), the Australian government’s official weather agency, to see if there is a correlation between weather predictions and the amount of cherries harvested. Mark suspects that the drones would only be efficient if they could pick a certain amount in a day, and that it would be cheaper to employ manual labour if it was predicted that the drone would not be able to pick enough.

- a.** Explain how Mark could use the data acquired from the BoM to meet his goal of reducing operating costs. Provide examples as part of your explanation.

3 marks

- b.** If Mark decides to use the BoM weather predictions to schedule manual labour, then he will be reliant on the data provided by BoM for his day-to-day operations.

Explain what this means in relation to data integrity.

3 marks

Question 13 (4 marks)

Mark's local community has learnt about his drone system plans, and he is approached by one member of the community, Harry, whom he has never met before. Harry would like to lease Mark's system over the non-picking season so he can use a version of the cherry-picking code for his own purposes. Harry states that he will modify the code himself so that Mark does not have to do any extra work. When Mark asks Harry what he will use the code and drones for, Harry avoids answering.

Mark is very interested in this proposal, as it would provide him with extra income over the non-picking season.

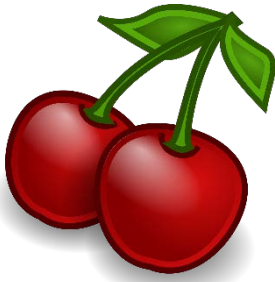
Outline the legal and security concerns that Mark should consider before agreeing to Harry's proposal.

END OF QUESTION AND ANSWER BOOK

Instructions for Section C – Case study

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

Mon-Cheri Orchards



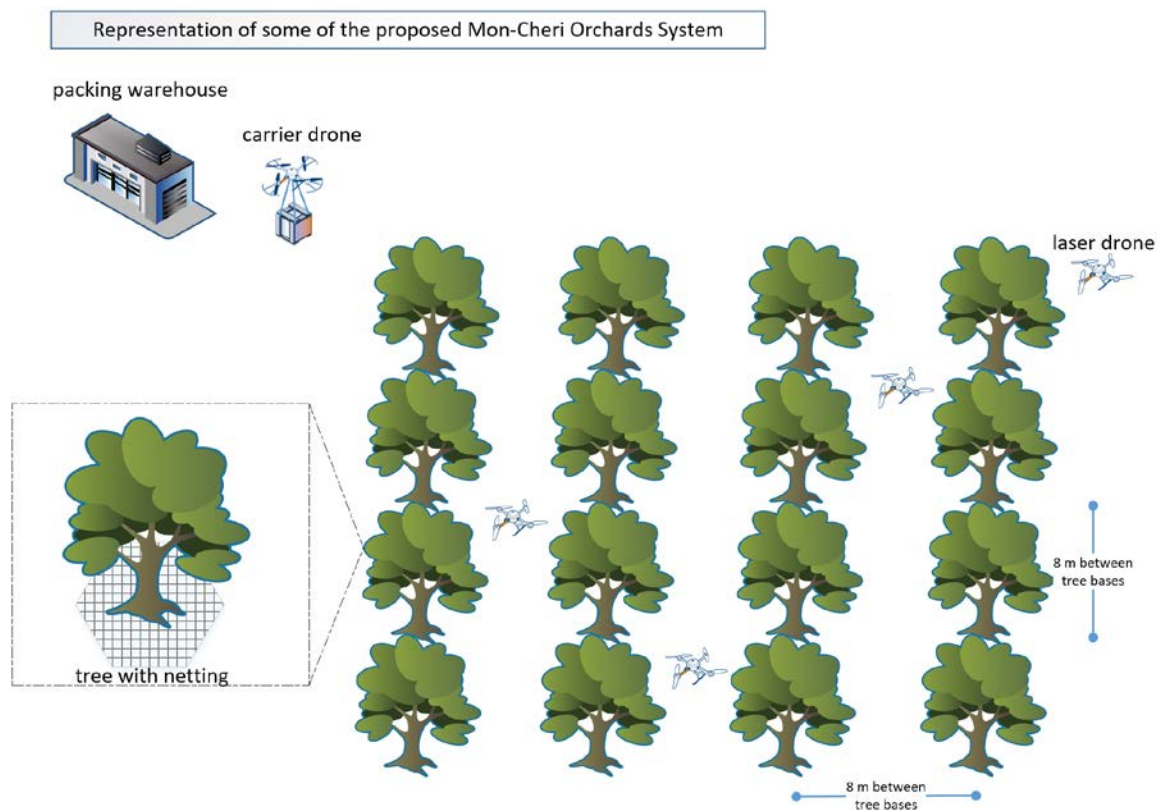
Mark is the manager of Mon-Cheri Orchards, a medium-sized commercial cherry grower in the Victorian hills. He has recently hired a development company to create an automated fruit-picking system that uses cutting-edge drone technology to pick ripe fruit. Multiple high-powered drones will be used to help with the picking of fruit. Mark will use a tablet device to activate two different types of automated drones operating in the orchards. Laser drones will fly into the orchards to pick cherries straight from the trees, using expensive miniature on-board cameras to detect ripe fruit among leaves and high-powered lasers to cut them from the tree. Carrier drones will be used to transport baskets of cherries from any tree back to the packing warehouse. Mark has already entered an agreement with a drone supplier to provide these drones on an ongoing basis.

In all of the company's orchards, cherry trees have been planted in a grid formation of 64×64 trees that are planted 8 metres apart.

The laser drones would be programmed to fly through the grid and scan every tree. At each tree, a drone will run an initial scan to determine the height of the tree and the number of branches. It will use this information to scan each branch of the tree for cherries. Once a cherry has been found, the laser drone will check if that cherry is ripe. If it is ripe, a high-powered laser attached to the drone will fire at the stalk of the cherry, cutting it from the tree.

Each tree will have a netting system around it so that any fallen cherries will land in a basket that has been placed beneath the tree. The baskets will be gathered and replaced by separate carrier drones.

A representation of the layout of part of an orchard, the drones, and the packing warehouse at Mon-Cheri Orchards is shown in the diagram below.



Cherries that are ripe can be detected using the RGB colour scale. The RGB colour scale is a model where red, green and blue light are added together to reproduce colours. Each colour (R, G and B) can be represented by using decimal values between 0 and 255, where 0 means none of that colour is shown, and 255 means full colour is shown.

Cherries that are ripe tend to have mid-range red colour with very little green or blue. A perfectly ripe cherry would therefore have an RGB of 150, 0, 0. The drones will detect ripe cherries within a range of 130–180 for red; anything under 130 is considered not ripe and anything over 180 is over-ripe and, in both cases, would not be picked. Drones will also accept green and blue colour within a range of 0–60 when determining if what it sees in the camera is a cherry or not. This lets the drone ignore leaves, branches and stalks, which all have green and/or blue colour ranges higher than 60.

Mark would like this new system in place at the beginning of the next cherry-picking season – around November this year.

END OF INSERT

YEAR 12 *Trial Exam Paper*

2017

COMPUTING: SOFTWARE DEVELOPMENT

Multiple-choice answer sheet

STUDENT NAME:

Instructions

Use a pencil for all entries.

Shade the box which indicates your answer for each question.

All answers must be completed as per the example below:

A	B	C	D
---	---	---	---

Marks are **not** deducted for incorrect answers and **no marks** will be awarded if more than one answer is selected for any question.

If you make a mistake, **erase** the incorrect answer – do **not** cross it out.

ONE ANSWER PER LINE					ONE ANSWER PER LINE				
1	A	B	C	D	11	A	B	C	D
2	A	B	C	D	12	A	B	C	D
3	A	B	C	D	13	A	B	C	D
4	A	B	C	D	14	A	B	C	D
5	A	B	C	D	15	A	B	C	D
6	A	B	C	D	16	A	B	C	D
7	A	B	C	D	17	A	B	C	D
8	A	B	C	D	18	A	B	C	D
9	A	B	C	D	19	A	B	C	D
10	A	B	C	D	20	A	B	C	D