Chapter 1: Test your knowledge answers

Data types and structures

1 Select the most appropriate data types and structures for the following data (p. 30):

a 222

Integer, as it is a whole number.

b 2.95

Floating point, as it has decimal places.

c True

Boolean

d panda

String

e 019234

string, as it has a leading 0.

f Customer: { Phoebe, Corp, 08/08/2018, 123 Fourth Street, Fifthsville, VIC, 3888 }

Record, as it is a collection of related data with differing data types.

g Players: { Wanda, Greg, Tuan, Rishad, Dillon, Nicole, Shveta, Ramesh}

Array, as it is a collection of related data of the same data type (string).

h Stock: { “potatoes”: 300kg, “cauliflower”: 344kg, “peas”:120kg, “carrots”:403kg }

Dictionary, as it is a series of (key, value) pairs.

i –

Character, as it is a single punctuation unit.

j 0

Integer or Boolean. It is a whole number, but it is also the integer representation of “False”.

2 A computer program runs an algorithm on very large numbers and displays an incorrect output number: 2,147,483,647. Explain what has most likely occurred. (p. 30)

The program has most likely experienced an integer overflow, which occurs when an integer exceeds the maximum or minimum value it can be assigned in that operating system. The number returned by the program suggests that the program is running on a 32-bit operating system, which has a maximum signed value of 2.14 billion.

3 What is the difference between a hash table and a dictionary? (p. 30)

A hash table differs from a dictionary as it uses a hash function to compute the key index at which the element of value will be stored. Dictionaries use (key, value) pairs that do not undergo additional computation.

4 When would you use a record over an array to store a collection of related values? (p. 30)

A record could be used over an array when storing a collection of related values that have different data types – arrays generally only support single data type collections.

5 A café would like a new ordering system to process orders that get sent to the kitchen so that orders are cooked in the order in which they are received. Which data structure is the most appropriate to store kitchen orders? (p. 30)

The data structure that is most appropriate is a queue. The orders are processed in the order they are received, which emulates a “first in first out” data structure. This is the definition of a queue.

6 An application to store song playlists has been written so that when a new song is added to the play list, it is queued so that it plays next, in front of any other song on the play list. Which data structure is the most appropriate to use for the play list? (p. 30)

The data structure that is most appropriate is a stack. The play list queues songs by putting the most recently selected song at the front of the list, pushing back all of the other songs that are in the list. This emulates a “last in first out” data structure. This is the definition of a stack.

Naming conventions

7 Use the pseudocode below to answer the questions that follow (p. 30):

```
Input strFileName

dAll ← {}

elTree ← fnReadFromFile( strFileName )
```

```
elRoot ← elTree.fnGetRoot()


For elSubEl in elRoot
  dAll[elSubEl.fnGetEl("height")] ← elSubEl.fnGetAttrib("height")
EndFor


return dAll
```

a Which variable is a string?

strFileName

b What data structure is dAll?

Dictionary, as it takes (key, value) pairs

c What data structure is elRoot?

Element of an XML tree

d What naming convention is being used?

Hungarian notation with user-defined prefixes

Design Briefs

8 What is contained within a design brief? (p. 31)

An outline or description of the problem, opportunity or need. A description of the constraints on the proposed system and the scope of the project.

9 Define ‘scope’. (p. 31)

Scope outlines the boundaries or parameters of the solution so all stakeholders are aware of exactly what the solution will contain. The scope of the solution consists of two elements – what the solution will do, and what the solution will not do.

10 Define ‘constraints’. (p. 31)

Solution constraints are factors that may limit or restrict solution requirements. At the stage when a design brief is created, these constraints are described only in general terms. Typically, constraints involve economic, technical, social, legal and usability factors.

11 Explain how scope can affect the success of a solution. (p. 31)

Determining the scope of a solution can affect the success as it can reduce the risk that a project cannot be completed as per the customer’s

specifications. For example, reducing the scope of a project can help achieve success when the delivery date is a constraint.

12 A developer is writing an application for a mobile phone. What are two constraints the solution will have? (p. 31)

One constraint is the size of the mobile phone – this has an impact on usability.

Another constraint is the system resources of the phone (RAM, disk space, etc) – this is a technical constraint.

Another technical constraint would be the method of input into the phone – this is a technical constraint as well as a usability constraint.

Further constraints are most likely to be technical, due to the mobile nature of the system.

13 Why is it important to design a system before writing source code? (p. 31)

Problems can be found in the design stage that are much quicker to fix than if they are foud durig programming or af ter programming has been completed. There is less risk of not successfully building the solution if the system has been designed beforehand.

Representing designs

14 What is a data dictionary and what is its purpose? (p. 31)

A data dictionary is a table that lists every variable's name, data type or structure. It may also include the data's purpose, source, size, description, formatting and validation. The purpose of a data dictionary is to plan the storage of software elements including variables, data structures, and objects such as GUI textboxes or radio buttons. Data dictionaries are valuable when code needs to be modified later by other programmers and the purpose of a variable is unclear.

15 What is an object description and what is its purpose? (p. 31)

An object description is a way of describing all of the relevant properties, methods and events of an object. Object descriptions are valuable when code needs to be modified later by other programmers and the properties of the object are unclear or unknown.

16 What is pseudocode and what is its purpose? (p. 31)

Pseudocode, also known as Structured English, is a quick, flexible, and language-independent way of describing a calculation strategy – halfway between English and source code. Once an algorithm is sketched out in pseudocode, it can be converted into source code for any desired programming language.

17 What is the difference between ← and = in pseudocode? (p. 31)

← represents assignment, while = represents a comparison for equality.

18 State the values that will be returned or displayed in the following examples of pseudocode (p. 31):

a “mango”; b “pear”

Files

19 What is the difference between a text file and a binary file? (p. 32)

Text files store data as easily readable plain text, while binary files store data in binary form, such as with images and sound. Binary files are not easily readable and are therefore more secure than text files.

20 What are delimited files? (p. 32)

A delimited-separated value (DSV) text file is a text file where data values are separated by a programmer-selected character. This character is referred to as the delimiter. The most common delimiters used in DSV files are commas, tabs and colons. Delimited files allow for the storage of two-dimensional arrays in a structured, readable format.

21 What is a CSV file? (p. 32)

When a comma is used as a delimiter in a delimited file, the file is referred to as a comma-separated value file, or CSV file.

22 What is the difference between XML and HTML? (p. 32)

HTML has pre-determined tags (elements) with meaning, such as “<head>” and “<table>” whereas XML has user-defined tags.

23 What is the purpose of XML? Provide an example as part of your explanation. (p. 32)

The advantages of using an XML file over a plain text file is that XML is industry standard, widely used and cross-platform. It allows rules to be set and used on data in a way that text files cannot. XML also allows storage of data in a way that does not rely on a user interface – the same data can be displayed in different formats and interfaces. For example, user preference files can be written in XML and be used for cross-platform applications where the same software is used by a user across two or more devices i.e.: Google Drive on a PC, via the web, and on a phone.

24 Describe a situation where you would use a CSV file over an XML file. (p. 32)

CSV would be used over an XML file for small amounts of data, such as when data is exported from a spreadsheet. CSV files are faster to read into memory than XML files, so when there is only a small of data, it is simpler to use CSV.

25 Describe a situation where you would use an XML file over a CSV file. (p. 32)

XML would be preferred over a CSV file when data needs to be transferred across systems, in particular when those systems are not within the same organisation.

Programming languages

26 Name three high-level programming languages. (p. 32)

Python, C#, Swift (any three will do)

27 What is the difference between a high-level programming language and a low-level programming language? (p. 32)

High-level programming languages are human-readable, such as Python or Visual Basic, whereas low-level programming languages are machine-readable, such as assembly or binary.

Internal documentation

28 Explain the purpose of internal documentation. (p. 32)

Internal documentation includes information about the program as a whole, including information about each of the classes, functions, methods, objects, algorithms, etc within it. It is often combined with meaningful, well-named variables to create manageable and effective code.

29 What are three conventions of internal documentation that should be included in source code? (p. 32)

Any of the following:

- A header comment, containing the name of the file, a brief description of the program, the author's name, and date the program was first created
- Documentation of classes and methods, describing their behaviour and how they are used, including any expected inputs and outputs and their respective data types
- Function and subroutine comments, describing their purpose, as well as describing all inputs and outputs and their respective data types
- Single line comments, providing brief summaries of portions of code
- Multi-line comments, explaining a complex algorithm within the code tself
- Descriptions of how to test aspects of the software
- Extra information on upgrades, changes or enhancements made to the program

30 Does internal documentation slow down a software solution? Explain. (p. 32)

No, internal documentation has no impact on the speed of a software solution as comments in code are ignored by the compiler.

Naming conventions

31 Name two types of naming conventions. (p. 32)

Camel case, Snake Case and Hungarian notation are all acceptable responses. (p. 32)

32 Why are naming conventions important in source code? (p. 32)

Naming conventions are a consistent and meaningful way of labelling each element included in a program so that they are easily read and understood. The most useful naming conventions allow a programmer to know the purpose of an element and, if relevant, its data type or structure. This positively impacts the efficiency of the programmer.

Chapter 2: Test your knowledge answers

Variables and instructions

1 Which of the following are most likely to be variables?

a) getUmbrella()

No, this is a function.

b) isFound

Yes.

c) customer.firstName

No, this is a field within a record.

d) True

No, this is a Boolean value.

e) 2018

No, this is an integer.

f) “cake”

No, this is a string.

g) apple

Yes

Control structures

2 Give an example of an instruction that is a definition.

a ← 4

3 Give an example of an instruction that is a statement.

```
Print “Hello.”
```

4 What is the difference between a definition and a statement?

A definition is an instruction that assigns a value to a variable, whereas a statement executes a single action.

5 How does a sequence differ from an iteration?

A sequence executes line-by-line, whereas an iteration executes a number of times that depends on if a condition is met.

6 What is the difference between a WHILE loop and a DO/WHILE loop?

While both run sections of code for as long as a condition is met, a WHILE loop may not necessarily run at all if the condition is not met initially, whereas a DO/WHILE loop always runs at least once.

7 Mary writes some code to loop over a set of data. It runs exactly once, but no conditions have been met. What types of iterations could Mary have written?

Mary could have written a DO/WHILE loop or a REPEAT/UNTIL loop.

a
```
a ← 4
b ← 2
c ← 3
If (a > c) or (b > c) Then
    return True
Else
    return False
EndIf
```

This will return True, as a is greater than C. Only one of the two statements needs to evaluate as True for the entire condition to be True, as the logical operator is an “OR”.

b
```
age ← 10
If age < 10 Then
    return "Child"
ElseIf age < 18 Then
    return "Teenager"
Else
    return "Adult"
EndIf
```

This will return “Teenager”

8 State te valu that will e etuned o dsplad in the following examples of pseudocode:

Functions, classes, methods

9 How do you get a function to run within source code?

You “call” it.

10 How are functions represented in pseudocode?

functionName()

11 What is the difference between a function declaration and a function definition?

A function declaration only names a function and its arguments, whereas a function definition is the function as a whole.

12 How is a class different to an object?

A class is a stateless blueprint or template representation of an object. It is like the plans for a house. In comparison, an object has state and is an instantiated representation of a class. It is like the house that has been built from the plans.

13 What is the relationship between a method and an event?

An event is a special type of method this is “triggered” based on if an object’s state changes. It is designed to react to changes within an object.

14 How are methods represented in pseudocode?

objectName.methodName()

Algorithms for sorting

15 Explain the steps taken to perform a selection sort, using a worked example as part of your explanation.

- Assume the frst elemet t he smallest element
- Compare the first element to every other element in the array, one by one
- Each time the element compared to the first element is smaller than it, swap the irt elment wth he smaller element
- Compare the(possiblynew) irst element with the rest of the array
- Repeat the whole process, starting with the second element in the array
- Repeat the whole process, starting with the third element in the array
- Continue repeating the whole process until all elements in the array have been checked

Students could use any worked example, such as the one given in the text.

16 Explain the steps taken to perform a quick sort, using a worked example as part of your explanation.

Unless the array contains only a single element, complete the following steps:

- Select an element from the array at random – this is referred to the pivot. Often, this “random” eemet is thelast element in the array
- Check each other element in the array and reorder it so that all elements with values less than the pivot come before it, while all elements with values greater than the pivot come after it (equal values can go either way). This involves swapping, much like in selection sort, but the elements are not sorted based on anything else except the pivot when they are swapped
- Take all of the elements that are less than the pivot (all the elements to the left of the pivot) and repeat the process of quick sort on these elements, selecting a newpivot
- Take all the elements that are greater than the pivot (all of the elements to the right of the pivot) and repeat the process of quick sort on these eemens selectig a new pivot
- If the array contains only a single element, return just that element

Students could use any worked example as part of their explanation, such as the one given in the text.

17 Which is faster, quick sort or selection sort? Is this always the case? Explain.

In general, quick sort is faster than selection sort. However, a quick sort performs the same as selection sort in a worst-case scenario. One example of a ‘worst-case’ scenario for quick sort is if all elements to be sorted are identical.

Algorithms for searching

18 Explain the steps taken to perform a linear search, using a worked example as part of your explanation.

Linear search involves checking every element in a list in order, one-by-one.

Students could use any worked example as part of their explanation, such as the one given in the text.

19 Explain the steps taken to perform a binary search, using a worked example as part of your explanation.

Binary search requires a sorted list. It works by selecting an element from the very middle of the data set being searched and checking it against the search item. If it matches, the search halts. If it doesn’t match, it will search the data to the left of the element in the middle if it is less than that element, otherwise it will search the data to the right of it. This process is repeated until the item is found or there are no more elements to search through.

Students could use any worked example as part of their explanation, such as the one given in the text.

20 Roland executes a linear search and then a binary search on a very large set of data. He searches for the same item in each of the searches. The linear search was much faster than the binary search. How is this possible?

Binary search is better than linear search in the average case and worst case. In a best-case scenario, however, linear search could find the item in the first place it checked. This would occur if the item was right at the front of the list. If the list were of size n, binary search would take O($\log_2 n$) time, as it would only find the item after checking and discarding the entire list first. For example, if there were 1000 items, a linear search would need to check 1 item to find it, and a binary search would need to check 10.

Validation techniques

21 Cerie needs to perform all three validation techniques on a particular input. What order should Cerie perform these checks when she writes her source code? Why?

Cerie should write the existence check first, then the type check and then the range check. There is no point checking the type and range if nothing has been enteed, and a range ceck can only be per formed on some data types, so the data type would need to be checked first to avoid a runtime error.

22 Annotate the following pseudocode to show where each validation technique is being used.

```
Algorithm validateInput()
Begin
    Input fullName
    Input age

    If fullName = blank Then
        Print "Please enter your full name."
    EndIf
    If isInteger(age) = False Then
        Print "You must enter age as a whole number."
    ElseIf age < 0 Then
        Print "Invalid age."
    EndIf
```

existence

type

range

End

Meeting design specifications

23 What steps can be taken to ensure design specifications are being met?

Internal testing, external testing and client testing

24 What is the difference between a test case and test data?

A test case is a set of steps that a tester uses to determine if the element being tested works correctly, whereas test data is what is used to perform the tests that have been written into the test cases.

25 What is the difference between a syntax error and a runtime error?

A syntax error is an error in the grammar of the programming language that does not allow the program to compile or run, whereas a runtime error occurs while the program is running, typically due to invalid input.

26 Dina executes some code on her computer and everything seems to slow down. Eventually, her computer crashes. What has most likely occurred within the code?

The code has most likely gotten stuck in an infinite loop.

27 Why is it important for software companies to release patches?

Software programs will contain bugs, such as those that produce runtime errors. Companies are likely to lose customers, reputation or money if they don't release patches to repair their code. Unpatched code can also result in security risks.

28 What is the purpose of a truth table in relation to testing?

Truth tables are a systematic method of determining all of the potential outcomes of a conditional statement. This can help determine the test data that needs to be used to test all of those outcomes.

29 Explain what a boundary value is.

A boundary value is the maximum and/or minimum values available for any given input.

30 Why are trace tables useful to use when debugging?

Trace tables allow a programmer to simulate the flow of execution of a program. The programmer can work through code step-by-step to help find logic errors.

Chapter 3: Test your knowledge answers

What is a software solution?

1 What is meant by a software solution? (p. 119)

A software solution is the use of computer software to meet the needs and requirements of a client in solving a problem.

Project management

2 What is meant by project management? (p. 119)

Project management is the process of planning, organising and monitoring a project in order to ensure it is completed on time and within budget and scope. Identify two consequences of a badly managed project. (p. 119)

Loss of time and loss of money.

3 Why is a Gantt Chart used? (p. 119)

- lists all tasks in a project
- orgaises the asks in order
- shows which tasks must wait for other tasks to finish before they can begin
- allocates people and resources to tasks
- tracks the progress of tasks and the entire project.

4 Differentiate between concepts and processes in project management. (p. 119)

Concepts = the milestones and dependencies within a project timeline

Processes = task identification, sequencing and allocation of time and resources within a project timeline

6 Differentiate between predecessors and successors on a Gantt Chart. (p. 119)

A predecessor is a task that must be completed before another one can be performed, whereas a successor is a task that must be completed after another task.

Collecting data

7 How does a survey differ from an interview? (p. 119)

Surveys require users answer sets of questions, typically close-ended questions. These are normally completed individually, and often in the privacy of their own home or office. In comparison, interviews are face-to-face meetings that are consultative in nature. The questions asked in an interview tend to be open-ended questions and follow-on questions frequently occur. While surveys can contain open-ended questions, they do not have the ability to ask follow-on questions.

8 When would an observation be a preferred method of collecting data? (p. 119)

An observation is preferred when what is being observed is too complex to provide a written or verbal description. It is also preferred if the cause of a problem within a system is not known exactly, as observation can reveal issues that users are not necessarily aware of. Observations are also preferred as methods of collecting unbiased data that does not rely on the opinions, judgements and memories of users.

9 What are three advantages of an interview? (p. 119)

Interviews allow for open-ended questions and follow-on questions.

Clarifying questions can be asked quickly, at the time that clarification is needed.

People often provide more information when interviewed than if they complete a survey or write a report.

10 What are two disadvantages of using reports as part of data collection? (p. 119)

One disadvantage is that you are reliant on the accuracy of the author of the report. For example, they may have an incentive to interpret data in ways that benefit their own needs.

Another disadvantage of using a report is that they provide manipulated, secondary data that is historical in nature; the data may no longer be relevant.

Functional and non-functional requirements

11 How is a functional requirement different to a non-functional requirement? (p. 119)

Functional requirements directly relate to what a system will do, whereas non-functional requirements relate to how well a system will behave or what qualitative characteristics it will have. Functional requirements are unbiased, factual and objective, whereas non-functional requirements can be biased and subjective.

12 Categorise each requirement as functional or non-functional. (p. 119)

a) A report must print to a printer.

Functional

b) All font colours must be green.

Non-functional

c) A discount must be applied to a product.

Functional

d) The drone must be able to navigate a path through a maze.

Functional

e) The body mass index of a person will be calculated.

Functional

f) A typical 6-year old should understand all the words displayed.

Non-functional

g) Button sizes must be big enough for touch-screen capability.

Non-functional

h) Input can be via voice or keyboard.

Non-functional

13 What is the difference between reliability and robustness? (p. 119)

Reliability relates to how much a piece of software can be relied upon to work and continue to work in the future. In this scenario, “work” is interpreted as “suits the needs of the user”. Robustness relates to how a piece of software handles errors when it encounters them and if that software keeps working. Often these errors are based on bad input by a user and cause system crashes. In this scenario, “work” is interpreted as “continues to run”. These two elements are closely related, as if a piece of software is not robust, it will crash frequently, which affects how reliable it is in continuing to work over time.

14 What does it mean for a software solution to be maintainable? (p. 119)

A maintainable software solution is one that can continue to run and work with very little required of a developer or administrator. This can be evaluated in terms of the number of times bugs have had to be fixed within the code or the amount of time an administrator has had to spend installing the software on computer systems. In more physical terms, it could involve conidration of the number of times hardware related to the software has had to be replaced.

15 What does it mean for a software solution to be usable? (p. 119)

Usable software is software that can be easily learned by a user. This involves not only the initial learning, but also the ability for a user to return to the software at a later point in time and remember how to use it without needing to be re-trained. A usable piece of software is intuitive and clear.

16 Explain portability in terms of non-functional requirements. (p. 119)

The portability of a solution relates to how easily it can be moved or used in different operating environments. It also involves how easily the software can be installed and re-installed on different machines with the same operating environment.

Software requirements specifications

17 Why are software requirements specifications written? (p. 120)

Software requirements specifications (SRSs) are effective as a documented agreement between a client and a developer as to what will be built for the client. This helps prevent scope-creep, where clients request additional functionality once the project has already begun. SRSs are also useful to provide clear and systematic descriptions to a developer as to what needs to be built within the system, particularly with the documenting of functional and non-functional requirements. The diagrams within an SRS are very useful as a method of visually representing the system's functionality, required inputs and required outputs.

18 What is contained within an SRS? (p. 120)

SRSs contain a description of the scope of a solution, the constraints upon that solution and the functional and non-functional requirements.

Interfaces between solutions, users and networks

19 What is the purpose of a use case diagram? (p. 120)

A use case diagram helps describe the core actions that can be completed in a proposed system. This is the first step to breaking down a system into its component parts. The visual representation of a use case diagram is complementary to worded descriptions as someone reading it can quickly see the main functions of the system.

20 What is the purpose of a context diagram? (p. 120)

A context diagram helps show the required data coming into a system and coming out of a system. This is useful to understand not only the movement of the data, but also the external entities that are involved in the data transfer.

21 What is the purpose of a data flow diagram? (p. 120)

Data flow diagrams are helpful to visually show the movement of data as inputs and outputs to the functions of a system. The processes of a data flow diagram are almost synonymous to the functions within a software system and it is therefore a very useful diagram to have available in the design stage of the problem-solving methodology.

22 Explain the difference between include and extend in a use case diagram. (p. 120)

In a use case diagram, a use case that is included in another use case is always used by that other use case. For example, if an application required a user to log in before they could post a message, a use case called log in would be linked to the use case post message via an <<include>>. In contrast to this, a use case that is extended is one that has available to it the functionality of another use case, but this functionality does not necessarily get used every time. For example, use cases called use oven and use stove would be extensions of a use case called cook food and therefore linked using <<extend>>.

23 Explain the difference between an association and a generalisation in a use case diagram. (p. 120)

An association is the default method of representing a relationship between elements in a use case diagram; there is nothing special about the association that requires further explanation. In comparison, a generalisation is a special type of relationship that indicates a parent-child relationship between two elements. For example, an actor called chef could have two generalised actors called sous chef and pastry chef.

24 How does a process differ between context diagrams and data flow diagrams? (p. 120)

A process in a context diagram represents the whole system as a generalised concept, while a process in a data flow diagram represents each of the functions within the system itself.

25 A proposed food ordering system has two types of users, a chef and a server. The server places food orders given to them by customers. A chef confirms orders and flags orders as cooked so a server knows they can take the food to the customer. Once a server has delivered the food to the customer, they remove the order from the queue. All orders are stored in a file. (p. 120)

a Draw a use case diagram to represent this system.

b Draw a context diagram to represent this system.

c Draw a data flow diagram to represent this system.

Answers will vary.

Security considerations

26 What is the difference between symmetric key encryption and public key encryption? (p. 120)

Symmetric key encryption uses the same key to encrypt and decrypt plain text data. Public key encryption, also known as asymmetric key encryption, uses different keys.

27 Which is best to use for security on a web server, TLS or SSL? Why? (p. 120)

TLS is best to use as it is currently the industry standard. SSL contains many vulnerabilities and more continue to be discovered. As of 2015, SSL is considered a deprecated protocol.

28 What type of authentication involves entering a username and password? (p. 120)

Single-factor authentication.

29 When would it be advisable to use two-factor authentication over single-factor authentication? (p. 120)

When there is a risk that a username and password may be easily compromised. For example, due to the rise in mobile phone banking applications, most banks have now enabled two-factor authentication.

30 When would it be advisable to use multi-factor authentication over two-factor authentication? (p. 120)

When security is paramount. As multi-factor authentication tends to involve expensive authentication processes such as biometric security, it is advisable to use it only when it is critically important that data remain secure. Federal governments and agencies concerning national security would be examples of environments that may require this level of security. Similarly, data centres typically use biometric data such as hand geometry analysis and facial recognition to ensure no unauthorised personnel gain access.

Chapter 4: Test your knowledge answers

Generating design ideas

1 What is the difference between convergent thinking and divergent thinking? (p. 161)

Convergent thinking involves coming up with a single, well-established answer to a problem. All avenues are explored when considering possible solutions, and the best solution is found, ignoring all constraints.

Divergent thinking is more creative than convergent thinking. It involves exploring many possible solutions using spontaneous, free-flowing techniques, such as mind mapping, brainstorming, meditation and role-playing. These techniques typically produce unexpected solutions that may not necessarily have been considered using convergent thinking techniques.

2 What is the most important rule to follow when you are conducting a brainstorming session? (p. 161)

The only rule is that no idea is criticised or rejected; every idea, no matter how outrageous or silly, goes onto a list of possible solutions.

3 Why is it important to show your solution to the end user? (p. 161)

Your solution, and all information solutions, will be used by real people. Thus, it makes sense to include real people in the design stage, rather than wait for the testing and evaluation stages of the problem-solving methodology (PSM) to find out what they think of the solution.

4 Explain how you would use mind mapping to follow up a brainstorming session. (p. 161)

Mind mapping is an ideal technique to complement the process of brainstorming. Mind mapping involves quickly generating and linking ideas. It is a creative and flexible tool that enables you to add, connect, organise and reorganise ideas (see Figure 4.2). Mind-mapping software is generally flexible enough that you will not need to stop very often to learn how it works while mapping; in other words, your creative flow will not be interrupted.

5 Provide one example of an historical breakthrough. What technique was used to get to that breakthrough? (p. 161)

Responses will vary. Possibly, observation of situations similar to the problem they were attempting to solve. Going from the familiar to the unfamiliar situation. Play Doh, Post-It Notes, potato chips, Velcro, Teflon, Cellophane, insulin, Dynamite, stainless steel, Super Glue, Cornflakes and vulcanised

rubber were all found by observant people after accidents or failed attempts to invent something else.

Evaluating efficiency and effectiveness

6 What is the difference between effectiveness and efficiency? (p. 161)

The efficiency of a solution concerns how much time, cost and effort has been applied to achieve the intended results. The effectiveness of a solution relates to how well a solution achieves its intended results. This typically requires measurements of the quality of the solution in relation to its completeness, readability, attractiveness, clarity, functionality, accuracy, accessibility, timeliness, report formats, relevance, usability and communication of message.

7 Explain how an improvement in efficiency may cause a decrease in effectiveness. (p. 161)

An increase in efficiency may require a reduction in time or resources, this will restrict effectiveness as quality to be thorough is no longer available. Quality often suffers with increases in efficiency, or “cost-effectiveness”.

8 Describe how efficiency and effectiveness might be measured. How might these quantities be measured? (p. 161)

Efficiency is measured by observation of time and costs.

Effectiveness is measured by survey and interviews, e.g. customer satisfaction in terms of completeness, readability, attractiveness, clarity, functionality, accuracy, accessibility, timeliness, report formats, relevance, usability and communication of message

9 The statement, “Testing is not evaluation” suggests that evaluation is not about test tabls and input –output expected results. Identify some of the quantities that evaluation will measure. (p. 161)

Evaluation measures user acceptance and whether the solution delivers the promises of the SRS.

10 When should evaluation take place? (p. 161)

Evaluation usually takes place after implementation or installation, to determine the user experience.

Software development life cycle

11 Why can the Waterfall method be described as a linear model? (p. 161)

Development travels forward and does not return to issues previously dealt with.

12 What is the Agile methodology when it is applied to software development? (p. 161)

Agile provides repeated opportunities to deal with issues, incremental development of the solution.

13 Describe any similarities and differences between the Waterfall software development method and an Agile SDLC method. (p. 161)

The stages of development are similar, the same issues are dealt with in a similar order, however, Waterfall having considered the issue, moves on. Agile can re-visit the issue in a later cycle.

Goals and objectives of organisations and information

14 Explain the difference between an organisational goal and a mission statement. (p. 161)

Goals, which are usually short term, define the organisations purpose and provide a way to measure progress and identify areas for improvement. Mission statements outline what is important to the organisation.

15 What is a vision statement? (p. 161)

A short-term goal which can be measured.

16 How are values important to the content of mission and vision statements? (p. 161)

The value will determine the method of achieving the goal. For example: A company has the choice between raising prices or reducing its workforce. If the value is 'good customer experience', then prices will be increased. If the value is 'providing the lowest possible prices', then staffing numbers will be cut.

17 Where does the purpose of mission and vision overlap? (p. 161)

When longer term and short-term goals coincide, mission and vision offer the same message.

18 Why are mission and vision important for organisational goals and objectives? (p. 161)

Mission and vision provide immediate ways of achieving the goals of the organisation.

19 Apart from making a profit, think of an organisational goal for each of the following types of organisations:

a) a veterinary clinic

Provide quality care for injured pets

b) a large shopping centre

Offer an exciting shopping experience

c) an airline

Expand the number of flights from the base hub

d) a brewery

Increase the availability of the brew

e) a pui library

Increase nd improve the service to the community

Information management strategies

20 Explain why an organisation must comply with legal requirements. (p. 162)

Legal requirements have sanctions, usually fines, which will penalise the organisation and office bearers when (if) detected and prosecuted. The organisation will choose between the risks of compliance or non-compliance. Fines have been set at a maximum of $340,000 for individuals and $1.7m for organisations in an attempt to establish a significant deterrent.

21 Briefly summarise the role and scope of the three key laws affecting privacy of information. (p. 162)

The *Federal Privacy Act 1988*, with 2014 amendments, provides coverage on all data handling by private organisations. The data can be used for the purpose it was collected. Contact with citizens is restricted to require consent. A citizen's personal information cannot be distributed without consent.

The *Victorian Privacy and Data Protection Act 2014* has ten IPPs which are similar to the 13 federal APPs these apply to Victorian government agencies.

The *Victorian Health Records Act 2001* offers 11 regulations regarding health records, consent, privacy, and access.

22 Why have these laws been introduced? (p. 162)

Too many organisations and individuals were taking advantage of personal information without permission or authorisation.

23 If you believe that the privacy of your information has been breached by the Australian Taxation Office, to whom can you complain? (p. 162)

Make complaints and raise concerns with the Office of the Privacy Commissioner.

24 What are the penalties for breaches of the *Privacy and Data Protection Act 2014*? (p. 162)

Penalty units are adjusted each July. One penalty unit is $161.19 from 1 July 2018 to 30 June 2019.

Non-compliance for organisations is 3000 penalty units ($487,520) and 600 penalty units for individuals ($96,714).

25 For each of the following breaches of privacy, suggest which privacy law would apply. (p. 162)

a) You find that your employer has published your Tax File Number on the Internet.

Federal Privacy Act 1988

b) Medical records are found at the tip.

Victorian Health Records Act 2001

c) A bank refuses to give you a loan because the manager claims your credit record is poor, when it should actually be very good.

Federal Privacy Act 1988

d) A consultant working for the Victorian government passes on your VCE results to a friend without your permission.

Victorian Privacy and Data Protection Act 2014

e) A website you visit asks for personal information from you, but does not display its privacy policy.

Federal Privacy Act 1988

Apply your knowledge

1 Match the evaluation criteria with the method of evaluation. Identify which criterion is efficiency and which is effectiveness. (p. 163)

a	The system should have over 95% availability.	Opinion interviews of 500 users at random
b	User survey should achieve a very high satisfaction level.	Operators record time on task and other duties
c	20% less operator time with adoption of the new system	Online survey of users
d	Usability of the system should be rated highly	A log of faults records the time and duration of system failure.

a-h

b-g

c-f

d-e

2 A large Australian financial institution sends a policy document to all clients on how the company handles personal information. The document includes the following statements:

Your personal information

Personal information is information or opinions that allows others to identify you. It includes your name, age, gender, contact details, as well as your health and financial information. We will act to protect your personal information in accordance with the National Privacy Principles or an industry privacy code. We collect personal information to provide you with the products and services you request as well as information on other products and services offered by or through us.

How we use your personal information

Personal information may be used and disclosed within the company to administer our products and services, as well as for prudential and risk management purposes and, unless you tell us otherwise, to provide you with related marketing information. We also use the information we hold to help detect and prevent illegal activity. We cooperate with police and other enforcement bodies as required or allowed by law.

a) Explain why the document is sent to clients. (p. 163)

Compliance with *Federal Privacy Act 1988* requires notification of information held and declaration of the information and its intended use.

b) Provide reasons for including these statements within the document. (p. 163)

Federal Privacy Act has penalties for corporations who do not comply with requirements for the *Privacy Act*.

Also included in the document is the following statement:

We disclose relevant personal information to external organisations that help us provide services. These organisations are bound by confidentiality arrangements. They may include overseas organisations.

c) How should the organisation ensure that a client's privacy is protected if they need to send personal details overseas? (p. 163)

Arrangements and agreements must be in place to ensure the intent of the *Australian Privacy Act* are maintained. Data cannot be used for purposes other than as stated when originally collected.

3 The Children's Singing and Dancing Academy is an organisation that runs singing, dancing and acting classes specifically aimed at school-age children. The company offers classes after school on most weeknights and on weekends in various locations around Melbourne. Children from many suburbs participate in this extracurricular activity. The company is a not-for-profit organisation set up specifically to broaden children's interest in the performing arts. The Academy has a webpage and advertises its classes and locations through this medium. Pictures taken of students during their end-of-semester performances are used for advertising the company. The company relies on technology usage by creating brochures, updating their webpage and storing clients' data. Although the data stored is primarily about the children, data on the parents/guardians of the children is also stored.

a) What particular data on children is stored at the Children's Singing and Dancing Academy? (p. 164)

Data collected and held by the Academy:

- images of the children
- names

b) What particular data on the parents/guardians is stored at the Children's Singing and Dancing Academy? (p. 164)
    - names
    - contact eails aess, email, phone number
    - payment details
    - consent for recording and use of photographs

c) Why does the company need to store data on their clients? (p. 164)

The application of the *Privacy Act* requires records to be kept. Australian Tax Office requires receipts and GST to be paid on transactions.

d) If you were to write an organisational goal for the Children's Singing and Dancing Academy, what would it be? (p. 164)

Responses will vary. For example: To improve access to performing arts for school age children

e) What does the Children's Singing and Dancing Academy need to do to ensure they are compliant with the *Privacy Act 1988*? (p. 164)

Any data or information, including photographs, are collected, held and only used for stated purposes with specific approval and consent by parents/guardians.

f) What measures are needed for the Children's Singing and Dancing Academy to protect the integrity of data and information? (p. 164)

Introduce security on their records. Only authorised persons have access to the details of parents/guardians on a "need to know" basis. Security passwords and secure archives of data and records will also be required.

Chapter 5: Test your knowledge answers

Managing files

1 Why do files need to be organised? Explain how a directory hierarchy might work. (p. 206)

An easily understood filing system allows you to go directly to the folder or file. Good file management practices always save time. Managing files on a computer requires a consistent method of allocating locations for those files. Responses include the following:

- Keep folder names short, but meaningful.
- Separate work in progress from finished tasks.
- Avoid deep and wide folder structures. If there are so many sub-folders that the display is cut off, consider alternatives.
- Limit the number of files kept. Many files are unnecessary to keep once they have been read and action has been taken.
- Consider using shortcuts and aliases instead of creating multiple copies that may later become 'orphans' and never be updated. Single source of truth (SSOT) is a management approach that attempts to reduce duplication of files.

2 You are asked for advice on how to keep your software application and data safe and secure. What would you recommend? (p. 206)

- Implement a RAID (RAID-0) redundant array of independent drives storage system
- Adopt 3-2-1 backup strategy
- Clone the entire drive regularly, monthly, save incremental backups weekly or daily

3 How can an HDD be securely wiped? How is this different to just deleting a file? (p. 206)

To make a drive permanently unreadable, the drive will need to be overwritten with 1s and 0s multiple times. SDelete on WINDOWS or secure erase on macOS will wipe or scrub a drive completely so data cannot be recovered. Deleting a file removes the directory entry indicating where the file is located on the drive, however, the data remains untouched on the drive. The expectation is the next 'save' will overwrite that location as the directory indicates that location is available.

Organising and manipulating data using data structures

4 Explain the difference between an array and a record. Include reference to data type. (p. 206)

An array can hold elements which could be any one of a variety of data types. Each element is indexed uniquely by an integer, usually starting at 0. A record consists of a number of fields which may have different data types within the one record.

5 When is a data dictionary useful for programming? Explain how you would convince someone who thinks the programming language will keep track of variable names and datatypes. (p. 206)

Data dictionaries are most commonly used when code needs to be modified at alater date by programmers. It allows them to understand the purpose of a variable or array that may be unclear without it. Data dictionaries may need to be kept up to date during the development stage, when changes are introduced to the initial design.

Features of a programming language

6 Briefly explain how any programming language works. Include reference to control structures. (p. 206)

Any programming language operates at three layers, interface layer, logic layer and data layer. Through the use of syntax and control structures instructions are given to manipulate and display the data to achieve a purpose. Control structures provide sequential, selection or repetition instructions to be executed as statements to be evaluated as a program.

7 What is iteration? Why is it useful? Give an example using an array with ten elements. (p. 206)

Iteration is repetition, or loops. To read an array of ten items, count to ten then stop or move on to next instruction.

```
//initialise loop count number (n) to zero
n <- 0
//compare loop count to loop limit of ten, if less or equal continue
//WHILE .. DO is an alternative
IF n <= 10 THEN {
        Read Array[n]
        PRINT Array[n]
        n = n + 1
        // an alterative could use n = n++
}
```

Efficient and effective solutions

8 Effectiveness is often subjective. Who will you ask to determine the effetiveness of your software solution? How will you ask so you know they didn't just make up their response? (p. 206)

Evaluation will be by users of the software solution. Effectiveness relates to accuracy and the output must suit the client's purpose. Only the client knows that for certain, so suitable survey techniques must be used. Cross checking when asking survey questions to verify reliability can be embedded in questionnaires and interview questions. Observation is a reliable method of determining client behaviour, though is open to interpretation by the analyst.

9 Efficiency is usually measured. What can be measured to demonstrate the efficiency of a software solution? (p. 206)

Efficiency is an objective measurement. Examples include:

- The processing time taken to achieve a result.
- The number of keystrokes required to navigate a user interface, from login screen to data entry screen.
- Productivity achievements when reports or transactions are completed.

Techniques for checking coded solutions

10 What are some techniques for checking code? (p. 206)

Responses may vary, and will include some of the following:

- Integration tests verify that the different modules used by your application are working together. Multiple parts of the solution must be up and running for this test to be worthwhile.
- Functional tests are only interested in whether the SRS are met. The output is checked, and not intermediate stages.
- The difference between an integration test and a function test may be that integration just verifies that the database can answer a query, while a function test will expect a specific value.
- Acceptance testing is a formal test that verifies whether the SRS has been satisfied and the client will accept the final version of the software.
- Performance testing will observe response times, user behaviour and how the system behaves in a production setting. Performance testing often indicates where further improvements can be made to the software.

11 Explain how "black box" testing occurs. How is that different to "white box" testing? (p. 206)

Black box testing observes inputs and outputs only. The internal process is unknown.

White box testing considers processes within the component to achieve the correct output.

Validation techniques

12 How is validation different to testing? (p. 206)

Validation checks that input data are reasonable. Validation does not and cannot check that inputs are accurate.

13 Create a table listing what validation does and does not do. (p. 206)

Validation can check	Validation cannot check
Existence	Accuracy
Data type	Whether the number is correct
Range checks	If the calculation is working
Format	Wrong data
Consistency	
Reasonableness	

14 List three types of validation. (p. 206)

Responses will vary, and will include three of the following:

1 Existence checks ensure that a value has been entered and the field is not blank, or <null>.

2 Type checks ensure data is of the right type;

3 Range checks ensure that data is within acceptable limits or comes from a list of acceptable values.

4 Format checks ensure that data is in the correct format.

5 Consistency checks perform a comparison between different entries. Survey responses are often cross-checked to ensure the responses are based on fact, and not made up.

6 Reasonableness checks consider whether the details are plausible.

Testing

15 If you cannot test everything, what do you test? Explain why. (p. 207)

- Test for expected errors.
- By considering common possible inputs, most likely outputs can be predicted and made acceptable.
- Valid data – data that is perfectly acceptable, reasonable and fit to be processed.
- Valid but unusual data – data that should not be rejected even though it seems odd.
- Invalid data – to test the code's validation routines.

- Boundary condition data – data that is on the borderline of some critical value where the
- Behaviour of the code should change. These are known as ‘tipping point’ errors and a frequent cause of logical errors in programming.
- Wrong data – data with an inappropriate format would be expected to generate an error.
- Absent data – a blank field entry will test how the system handles a ‘no entry’ entry.

16 What is a “testing table”? What does it record? (p. 207)

A testing table documents all steps as a summary table and provides record of evidence for functionality testing. The table will have columns for: Name of test, test method and input, expected output, actual output and action taken.

Recording the progress of projects

17 Why are developers strongly advised to keep an accurate daily log journal? (p. 207)

Project logs are a record of all the small and large steps a project takes on its way to completion.

Project plans are living documents and things change quickly and often so that a memory of whatwa done and in which quence may not be sufficient to resolve a later issue. Keeping a journal will provide evidence and allow other interested parties to observe progress.

Factors influencing the effectiveness of the development model.

18 The PSM has been referred to many times, in which each of the stages has specific tasks to be completed. Effectiveness might be seen as the ability of the developer to deliver the promised software. Why is a structured development model helpful in achieving the development plan? (p. 207)

The PSM, problem solving methodology, is an approach which allows progress to be planned and monitored. Organisation of the use of time and resources is often the difference between a successful project and an unsuccessful project. Effective and efficient allocation of limited resources is the main aim for a project plan, so having a clear organisational structure allows all participants to understand the intended timeline, sequence of intended events and expected milestones and completion dates.

19 List some of the advantages and disadvantages of the “single pass” PSM. Can you suggest an alternative? (p. 207)

A single pass PSM is like the Waterfall method (p.144) each stage of the project is visited just once, then move on. The PSM is suitable for small projects, one client and one developer, and the specifications are well known and unlikely to change.

Advantages:

- Simple to use and understand
- Each phase is clearly defined
- Progress is simple to observe
- End of project is well defined

Disadvantages:

- Rigid process
- Long process with few shortcuts or efficiencies
- Amlified delas with single track
- Limited opportunities to identify test and fix problems

Alternative methodologies are “agile” which have short development cycles with quick modifications of the software solution. The client is closely involved which requires good communication and being responsive to changed demands. The constant reviewing of work already done will extend the timelines for a completed project, however.

Evaluating the efficiency and effectiveness of solutions and project plans

20 What are some of the reasons that a plan may not finish on time? (p. 207)

- Client has a change of opinion when user testing begins
- Slls to develop thesftware solution may not be up to the task
- Resources and hardware may not allow the project to proceed according to the completion schedule
- Unforeseen interruptions may introduce delays. Illness, school business (GAT, Formal, Sports days), family commitments, etc.

21 How does a critical path assist with modifying a project plan? Could you have arranged your plan to make better use of the available time? (p. 207)

Responses will vary.

Critical path indicates the minimum time the project can be completed. By altering a component on the critical path, the completion date is altered as well.

Use of time can always be improved, though hindsight is a wonderful planning tool. Time is precisely known after the event. Before the event the duration of known and unknown activities are an estimate.

22 What advice would you give to someone who is thinking of starting their Unit 3 Gantt chart? (p. 207)

- Use GanttProject software (or better alternative)
- Enter all known dates for holidays, birthdays, school events, SACs in a priority colour
- Identify tasks by reading the Applied Computing study design
- Create a work break down structure diagram (p.78)

- Enter the PSM stages first
- Acquire the key dates and submission milestones from your teacher early in Unit 3
- Assemble tasks into time order sequence
- Estimate duration
- Connect any predecessors
- Lst any resources necessary for the task
- Keep a daily journal for thoughts and actions, enter journal details onto the Gantt chart on alternate weeks or each month.

Apply your knowledge

1 How would you apply validation to the following user input? (p. 208)

a Country of birth

Dropdown menu

b Age

Enter year of birth.

c Agreement to terms and conditions

Check box

d Email address

Text entry with filter to check for valid email address.

e Victorian residence address (give two methods)

Use address lookup where all residential addresses are listed.

Check postcode corresponds to range 3000 to 2999.

f Date of birth (give two methods)

Use drop down for day, month and year.

Use check box for day, month and year.

2 Write a pseudocode algorithm for a new member to enter a username and a new password. Include verification of the password, without displaying the characters. Provide a “Re-enter password” message if the passwords do not match, and an acknowledgement message if there is a match. (p. 208)

Responses will vary.

3 How would you adjust the sort algorithms to sort from largest to smallest? (p. 208)

Responses will vary.

4 Write the following as pseudocode, then select and apply suitable test data for the following data entry:

a A person is an adult if their age is 18 years or older. (p. 208)

```
BEGIN
    IF age  < 18 THEN {
        PRINT “You are under 18 years old”
    }
    ELSEIF {
        PRINT “You are over 18 years old”
    }
    ENDIF
END
```

Test data

Age	Expected output
17	You are under 18 years old
18	You are over 18 years old
19	You are over 18 years old

b Data entry of daily maximum and minimum temperatures in Victoria. (p. 208)

```
BEGIN

checkTemperature function (temperature)
IF (temperature < -15)  OR (temperature > 50) THEN {


    PRINT “Enter Maximum temperature and date”
    ENTER temperatureMax, date
    checkTemperature function (temperatureMax)
```

Test data

-20

50

c Ages of clients for a local dental surgery. (p. 208)

```
BEGIN
    ENTER age
    WHILE (age <3) OR (AGE >100) DO {
        PRINT “Please re-enter Age”
        ENTER age
    }
    PRINT “ The age entered is “ age
END
```

Test data	Expected output
-35	re-enter age
0	re-enter age
2	re-enter age
10	10
55	55
105	re-enter age
1000	re-enter age

d Car registration number plates. (p. 208)

```
//in 1939 Vic number plates were XX-NNN (two letter-three number) format
//from 1972 XXX-NNN (three-three)
//since 2013 the format is N-XX-N-XX (one-two, one-two)

BEGIN
//check for valid number plate with function
//check limited to total number of letters
//check position of letters and digits as additional challenge
validNumberPlate function (plateNumber)
IF plateNumber =(twoLetters)(threeDigits) OR (threeLetters)(threeDigits) OR (twoLetters)(fourDigits) THEN {
    (validNumberPlate function = true)
}
```

```
ELSEIF {
        (validNumberPlate function = false)
}
RETURN
//enter number plate
(validNumberPlate function = false)
        ENTER plateNumber
//validate number plate
        WHILE (validNumberPlate function (plateNumber) = false) DO{
                PRINT "RE-ENTER VALID NUMBER PLATE"
                ENTER plateNumber
        }
        ELSE {
                PRINT " VALID NUMBER PLATE ENTERED"
        }
        ENDWHILE
END
```

Test data	Expected output
A-1	RE-ENTER VALID NUMBER PLATE
A-12	RE-ENTER VALID NUMBER PLATE
AA-123	VALID NUMBER PLATE ENTERED
AA-1	RE-ENTER VALID NUMBER PLATE
AA-12	RE-ENTER VALID NUMBER PLATE
AAA-123	VALID NUMBER PLATE ENTERED
AAAA-123	RE-ENTER VALID NUMBER PLATE
1-AA-1-AA	VALID NUMBER PLATE ENTERED
Additional challenge	
12-AAAA	RE-ENTER VALID NUMBER PLATE
123-AAA	RE-ENTER VALID NUMBER PLATE
AAAA-12	RE-ENTER VALID NUMBER PLATE

e A system accepts values between 1 and 20 entered as input. (p. 208)

```
BEGIN
    ENTER number
    IF number < 1 OR number > 20 THEN {
        PRINT “Please re-enter”
    }
    ENDIF
    PRINT number
END
```

Test data	Expected output
0	Please re-enter
1	1
20	20
20.5	Please re-enter
21	Please re-enter

Chapter 6: Test your knowledge answers

Physical and software security controls

1 What is a “zero-day” attack? Why is it so effective for hackers?

Zero-day attacks leave no time (zero days) to respond to the threat. There has been no preparation, as the threat or vulnerability was previously unknown. These attacks include web application attacks, client-side attacks and buffer overflow attacks.

2 What is the difference between a vulnerability and an exploit?

A vulnerability is a weakness in an application, an exploit is when an agent makes use of that weakness to take advantage of an insecure situation.

3 Only certain users are permitted to view the information because they have

A confidentiality.
B availability.
C integrity.
D authorisation.

Answer: D

Access to confidential and sensitive information is available only to those who have authorisation; anyone not authorised is denied access. Implementation relies on usernames, passwords, access control lists and encryption.

4 Defence against attackers is increasingly difficult due to: (more than one answer)

A complexity of attack tools.
B weak patch distribution.
C greater sophistication of attacks.
D delays in patching software products.

Answer: A, C, D

Threats are increasing due to availability of software tools, complexity and improved planning of attacks and delays once vulnerabilities have been identified.

5 The process that ensures an individual is who they claim to be is known as

A authentication.

B access control.
C certification.
D verification.

Answer A

Typical processes to identify authorised personnel are: Security passes to authorise access to secure areas; biometric authentication for authorised personnel.

6 Using a brute force attack, what is the average number of combinations that will be attempted in order to crack a cryptosystem that is based on 32-bit key? The estimated number is an average of 1, being the first combiation attempted and the maximum number of combinations, being the last combination if none of the others were the key. The actual combination will be between the first and last options.

Answer: 2.1 trillion combinations
32 bit key has 2^32 possibilities which equals 4294967296 combinations or 4.2 x 109 or 4.2 trillion combinations.

The 'average' number (50%) of attempts will be 2^31 or 2.1 trillion combinations.

Average time taken to crack the key:
For a current personal computer, approximately 600,000 encryptions per second (SHA512) is possible.
~1.7x10-6 seconds per combination
For a 32-bit key this would take (7158 seconds or ~119 minutes) or about 2 hours.
Always use at least 256-bit key or ten character complex (80 characters) passwords which would provide 2256 and 1080 combinations respectively. This would take many, many years to crack.

Software acquired from third parties

7 After an attacker has explored a network for information, the next step is to

A move on to another system.
B modify security settings.
C corrupt networks and devices.
D overcome any defences.

Answer: D

8 Which of the following are not considered "insiders"?

A Business partners
B Sub-contractors
C Employees

D Cybercriminals

Answer: D

9 Networks of attackers, identity thieves, scammers and financial fraudsters are known as

A script kiddies.
B cybercriminals.
C hackers.
D spies.

Answer: B

10 Which malware requires a user to transport it from one computer to another?

A Worm
B Rookit
C Virus
D Trojan

Answer: C

11 How do viruses differ from worms?

A computer virus is malicious code that reproduces itself on the same computer. The code inserts itself into files and modifies, corrupts or destroys the ability of the file to operate as normal.

A worm isa self -replicating malicious code that can spread across computer systems, which can modify, corrupt or delete data or information.

Software development practices

12 What is the SDLC management strategy adopted to prevent insecure code being included in a final software product?

Project management and version control software has removed the opportunity for insecure code that is 'not ready' or does not meet production requirements. The 'new' strategy does not allow the creation of a potential weakness or vulnerability. Instead, only compliant code can be added to the project; any code that is not yet ready is simply not permitted to be added to the project.

Strategies for minimising potential risks

13 Explain two strategies that are used to minimise potential risks in software development.

Any two of the following:

- An end-to-end strategy ensures that testing takes place at every stage of the software development cycle.

- Software security audit may be conducted separately or as part of a larger overall software audit, carried out by someone independent of the developer team, or by the developer team itself. The software audit may use analysis tools to gather data on the performance of the software for security or for functionality.
- Risk tolerance, also known as risk appetite, is determined by balancing the expense in terms of financial resources and usability of information assets against financial liability, loss of information assets and reputational damage if the risk is exploited.
- Penetration testing identifies security vulnerabilities in web applications. This is achieved by challenging every page and line of code in the application for known weaknesses.

Identifying software and data vulnerabilities

14 Web application attacks cannot be blocked by traditional networking security devices. Why not?

More than 40 per cent of all criminal activities are perpetrated by people who haveiside nowledge or access to the IT systems. Other attacks rely on human behaiour or are the result of criminal behaviour. Many of these risks cannot be automatically checked and blocked.

15 What is an SQL injection attack?

SQL or database instruction request for data is constructed to be always true and gains control of the entire database. Another method grants code access to the entire server, without authorisation.

16 What is an XSS attack?

Cross site scripting relies on a web page interface allowing access to the server and to data held on the server. One XSS method is to ‘steal’ or hijack the login credentials of another session which will provide authorised access to the server.

17 What is an XML injection attack? How is this different to SQL or XSS attacks?

Extensible markup language (XML) carries data with instructions. XML injection exploits user query inputs.

18 How does a distributed denial-of-service attack (DDoS) differ from a denial-of-service attack (DoS)? Which is the more dangerous, and has the largest impact? Why?

DoS originates from one computer while DDoS can originate from many hundreds or thousands of ‘zombie bots’ or botnets. The attack takes place by requesting to access the same URL or IP address simultaneously which causes the website to cease to function.

Strategies to protect against web application risks

19 What are some tactics to defend against an SQL injection attack?

To avoid SQL injection flaws, developers must i) not use dynamic queries and ii) prevent user supplied inputs, containing malicious SQL code, from affecting the logic of the query. Appropriate measures to prevent SQL injections are to validate all user input before passing the query to the SQL database, use only prepared statements for database queries to eliminate unvalidated user input, Parameters can be adjusted for narrowing any query, use stored procedures for users to choose from, rather than entering untested inputs, whitelist input validation, which requires input redesign to ensure query names come from established names rather than input by the user.

20 If no user input can be trusted, how should this be checked (validated)?

No user input should be used without being treated and any active script removed before the query request is passed to the SQL server.

21 What are some tactics to defend against an XSS attack?

Dynamic and interactive websites are frequently exposed to the threat of cross-site scripting. XSS flaws occur when an application includes user-supplied data in a page sent to the browser without properly validating or escaping that content prior to acceptance at the server. Simply, just sanitise and validate all user input.

22 What is a buffer overflow attack? How could this vulnerability be prevented?

Protection against buffer overflow attacks can be provided by ensuring all code that accepts input from users via an HTTP request is reviewed to make sure it provides appropriate size checking on all such user inputs. Java and Python are interpreted programming languages and are immune to these attacks.

23 How can a server be defended against a DoS, or DDoS attack?

Be vigilant.

- Identify out-of-date browser agents, which often disguise legacy bots. Access to the website can be denied by blocking superseded versions of common browsers; An alternative is to insist on human logic for login access, such as using the captcha process.
- Monitor website traffic. Spikes in traffic can be assessed and the sources identified. Failed logins may also indicate bad bot activity.
- Be alert for public data breaches. Whenever credit cards details are stolen, they are quickly deployed to run the credentials into your website.

24 How is the management of security achieved with third-party software?

One direct result of the subscription model is to maintain the distributed user base of software and ensure software is up to date. Automatic software updates prompt the user to ensure that the latest security patches will be installed. Other software purchased and installed may have been registered with the developer. This registration usually provides update notifications or access to a web page that provides information about security issues and fixes.

25 What are the limitations on this strategy?

Overall, the user is reliant on the software developer or distributor for notification about necessary improvements and modifications to the original product.

Integrity of data

26 Why is integrity of data important?

Data integrity is the basis of trust which creates confidence in the operation of the software. If there is no integrity, the software cannot be trusted and will not become a central part of any decision-making operation.

27 What are the threats to data integrity?

- Accidental, event-based and deliberate.
- Mistakes and accidents rarely 'just happen' contributing factors often include; user inattention or carelessness; confusing screen design with lookalike interface; lack of confirmation before execution; all changes are 'live' with no simple backup process; inappropriate permissions, which allow untrained users access to modify or delete strategic files or settings.
- Event-based threats include: failure of storage; e.g. HDD or SSD; power failure; file corruption; using cloud storage where power outage, software malfunction or data breach occurs; using third-party software where software malfunction or data breach occurs; acts of nature; for example, fire, flood, earthquake, lightning strike/power surge
- Deliberate attacks come in many forms, including: (see table 6.5) malicious software or malware, cyber attackers, social engineering attacks

28 What are the characteristics of data integrity?

The factors of data integrity that must be maintained by a properly functioning information system include:

- accuracy (correctness, completeness, consistency, clarity)
- autheticity
- reasonableness
- relevance
- timeliness.

29 Why could validation be unsatisfactory, and how can the reasonableness of data be tested?

Validation checks for reasonableness, not accuracy. Data entered may be reasonable but misleading or fraudulent, or just wrong. A range of expected or plausible values may be allowed.

A recently established software development company is considering expanding its workforce and relocating to the top floor of a three-storey building.

The original directors will be joined by four others, who will be responsible for web design, database design, Python language development and sales and marketing.

Each designer will have their own office, and the web designer will also be the reception and phone-switch operator. Each worker will be provided with a notebook, which can be taken home, and a desk station with an external monitor.

The wi-fi will be shared with a friendly company that resides on the second floor.

The servers will be kept in the basement. The building has a lift.

The Internet connection will be on a basic (NBN12) plan with off peak speeds of 1Mbps upload and 12Mbps download.

DogMatch WebAPP details:

- The first software project will be a dating WebAPP that will match dog owners with a common interest in a variety of categories.
- The WebAPP will collect personal information, pictures of the dog and owner, and provide a match according to an algorithm.
- A meetup will be organised at a mutually acceptable safe location by swapping contact details.
- The WebAPP will be written in Python, uses an SQL database and will be available on any web browser.
- Members of the DogMatch WebAPP will pay a monthly subscription after entering credit card details or direct debit details into a web form and paying the initial joining fee.
- New members will be sent a confirmation email with BSB bank account details for them to arrange a bank account direct debit.
- Login to the WebAPP will be through a four-digit number passcode with a limit of 30 tries before a 30-minute timeout.

Apply your knowledge

1 Design a secure physical arrangement for the software company. Include any hardware that will be necessary to ensure sensitive, and expensive, equipment and information can be retained within the building.

Responses will vary

Restricted access, locks, cameras, swipe passes or other security authentication methods. Door keeper security ensuring identity verification methods and logged entry and exit are followed. The lift has a camera and a security pass system where only authorised users can operate.

2 While developing the software, the Python designer had difficulty completing the final hash algorithm to meet the release deadline. The hash table worked slowly, causing delays on logins, so the developer skipped the final validation and just kept the password as plain text. Identify some of the:

a Physical security issues.

The software can be accessed and taken if sufficient time is available.

b Logical (software) security issues.

The bank account can be accessed, if email has been intercepted. Or brute force break of the 4-digit password, i.e. “on average” 500 tries will break in.

30 tries per session each half hour

500/30 = 17 x 30 minutes = 8.5 hours

c Humanware security issues.

The shared wi-fi is a security issue, where unknown and unauthorised users are sharing the company network. Version control and authorisation within the company structure will need to be identified and enforced.

3 What may the implications for expansion be if the webAPP goes viral?

The NBN12 connection will be inadequate for the increased traffic and demand generated by the webAPP. Multiple servers and redundancy will be necessary to balance load and demand and avoid times when access to the webAPP may be denied.

4 What are the implications if the webAPP gets infected with a virus?

The entire website could be affected. Member details may be vulnerable. The company operation may be imperilled, and operations may cease.

5 Unknown to the directors, there is a security breach when one of the notebooks is stolen. The notebook does not have a login password and uses autofill to login through the browser to an Admin account.

a What are the obligations on the directors when there is a data breach?

The directors may opt-in to notify the data breach.

Credit card details are not permitted to be stored “in the clear”, so the implications are confined to members names, contact information, pet names.

b What are the liabilities for the company if bank account details are lost, with personal details, names, addresses and phone numbers, driver’s licences and dog name(s)?

Credit card details are not permitted to be stored “in the clear”, so the implications are confined to members names, contact information, pet names. However, login details may be changed, and direct debit information may be taken to be used in other scams. Driver’s licence numbers are a threat for ID theft, and once “out” cannot be easily or simply changed.

The company would be liable for any losses incurred as direct result of any theft of the personal details.

If the data were “lost”, the company may not know who to contact and direct debit would continue to be taken. Fee for no service has been a long tradition for Australian banks and has been penalised severely when discovered and proven. Company directors would expect to be personally liable, depending on when they knew, and the company would definitely be liable if deductions continued without service or clear efforts to remedy the situation were taken.

Chapter 7: Test your knowledge answers

Goals and objectives of organisations and information systems

1 Explain the difference between an organisational goal and a mission statement. (p. 289)

A mission statement is based on an organisation's purpose, visions and values. It is the basis for establishing a set of common goals that will help accomplish the organisation's aims. These are the organisational goals. Essentially, an organisational goal explains how the organisation will achieve what is set out in the mission statement.

2 What is a vision statement? (p. 289)

A vision statement describes the organisation as it would appear in a future successful position.

3 How are values important to the content of mission and vision statements? (p. 289)

Once an organisation has developed a strategic plan, a mission statement is developed based on the organisation's purpose, visions and values. (See the answer to Question 1.) The vision statement, describing the organisation in its successful future position, must conider that those original values have been utilised.

4 Where does the purpose of mission and vision overlap? (p. 289)

Mission statements concentrate on the present whereas a vision statement focuses on the future, but both concentrate on possibility and potential. The purpose behind the two is to outline what the organisation wants to achieve.

5 Why are mission and vision statements important for organisational goals and objectives? (p. 289)

Identifying organisational goals is important to understanding how and why organisations operate. This is particularly important when defining the mission and vision statement.

6 Explain why an organisation must comply with legal requirements. (p. 289)

Laws passed by state and federal governments place certain responsibilities on organisations. If organisations fail to comply with a law, they can be taken to court.

Organisations can be fined, and directors imprisoned if found guilty of certain crimes.

Legal requirements

7 Briefly summarise the role and scope of the three key laws affecting privacy of information. (p. 289)

The *Privacy and Data Protection Act 2014* (PDPA) was introduced by the Victorian Government. It replaced the *Information Privacy Act 2000* and the *Commissioner for Law Enforcement Security Act 2005*. The PDPA is intended to strengthen the protection of personal information and other data held by Victorian Government agencies including local councils and contractors working for the state.

The *Privacy Act 1988* safeguards personal information held by federal government departments, use of Tax File Numbers and people's credit details.

The Victorian Government passed the *Health Records Act 2001* with the intention of protecting personal medical information. It was introduced separately to the *Information Privacy Act* described above because it covers both public and private medical sectors.

8 Why have these laws been introduced? (p. 289)

These laws have been introduced in order to control how personal information is acquired (collected), handled and stored by both government and non-government organisations. They have become necessary because of the public concern over just what information was being collected about people and how it was being used.

9 If you believe that the privacy of your information has been breached by the Australian Taxation Office, to whom can you complain? (p. 289)

You can complain to the Office of the Australian Information Commissioner if you believe that the Australian Tax Office has breached your privacy.

10 What are the penalties for breaches of the *Privacy and Data Protection Act 2014*? (p. 289)

Non-compliance will result in a maximum penalty for a body corporate of 3000 penalty units and 600 penalty units for an individual. Penalty units define the amount that needs to be paid for offences in Victoria. Generally, the legislation does not specify the monetary amount. However, it does specify the penalty unit. Each year, the penalty unit is specified and the rate for penalty units is indexed each financial year so that it is raised in line with inflation. Changes to the value of a penalty unit will happen on 1 July each year.

11 List three reasons why people illegally download files. (p. 289)

- It is very quick and easy to download music/movies/files via the internet.
- They do not want to pay for the file.
- They can't afford it.
- Sometimes it is not easy to legally access the TV program or movie in Australia, so people resort to downloading the file illegally so they can watch it.
- Sometimes people only to want to use the file once (i.e. watch the movie once).
- Some people justify their piracy hobbies by stating the fact that the creators (i.e. musicians/film distributors/software creators) already have a huge bank balance and they won't mind one person using their stuff for free.
- They see other family/friends or colleagues doing and so they think it is okay.
- They don't realize that what they are doing is stealing or being a "pirate".

12 Identify a situation where downloading a file may be legal. (p. 289)

When a user has paid for software, they are given a URL to access the files to download.

13 Name the Act outlining laws about copyright in Australia. (p. 289)

The *Copyright Act 1968* (Cth) outlines the laws related to copyright. A breach of the *Copyright Act* 1968 (Cth) could result in fines or imprisonment. Computer software is treated as a 'literary work' under the *Copyright Act*.

14 Define "copyright". (p. 289)

Copyright is a law that gives the owner of a work the right to say how other people can use it.

15 What is the definition of a program according to the *Australian Copyright Act*? (p. 289)

Under copyright law, computer programs are defined as literary works – "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result". This definition can include but is not limited to pseudocode, flowcharts, a program in a book, part of a program, a website or part of a website. It can also include machine code, and various languages.

16 What does copyright protect? (p. 289)

Copyright protects the way in which something is expressed. It does not protect ideas. For example, if you wrote a new computer program to perform a function, the software code would be protected by copyright. Someone else could then write their own computer program to perform the same function.

They would not infringe your copyright unless they copied the software code of your computer program.

17 How can copyright be infringed? (p. 289)

Copyright is infringed when a person other than the copyright owner uses a "substantial part" of the material in any of the ways reserved for the copyright owner without their permission.

18 What copying is allowed in the *Copyright Act*? (p. 289)

Some examples include:

- Making a backup copy of a computer program either to use in place of the original copy, or to store as a backup for use if the original or an earlier backup is lost, destroyed or rendered unusable copying software as part of a normal process of backing up files for security purposes.
- Making a backup copy of a computer program if there are no technological locks to prevent copying on the program.
- When a programmer needs to 'pull apart' a program to find out how it works so that an 'inter-operable' product can be produced that works with the original program.
- Testing the program for security purposes, or for finding faults if there is no other way of doing so.
- "Fair dealing" for research, study, criticism or review, news reporting and giving legal advice.

19 Explain how the concepts of copyright and intellectual property are related. (p. 289)

The Copyright Act protects the creator of an original work from unauthorised reproduction, conversion, adaptation, transmission or publication of their intellectual property (IP), which includes:

- Original literary, dramatic, musical and artistic works
- Websites
- Software
- Electronically recorded music, films and books.

20 Outline how artists may be disadvantaged by illegal downloading and streaming. (p. 289)

- Artists can be disadvantaged by not receiving royalties
- It is considered stealing
- Illegal downloads harm the music and film industries – as it deprives new artists of having a chance to be heard.

21 Explain what "phishing" means. (p. 289)

Deceptive attempt to obtain sensitive personal information by disguising as a trustworthy/ legitimate organisation.

22 Name the Act that outlines the laws relating to the storage of medical records in Victoria. (p. 289)

Health Records Act 2001

23 Why are some programs called “bad” or “malicious”? (p. 289)

There are several illegal or unethical features that programmers can design into programs.

For example, they can program the software to:

- Have a back door so that people can bypass security features to gain access to a system
- Contain hidden functions that can monitor the use of a program or a computer
- Gain access to data on a computer system
- Make connections to the Internet and report back to the author.

Some programs will install spyware or adware – these are usually attached to software that is installed via the Internet. The user is generally unaware of the spyware or adware, as it is attached to a program or file the user wanted to download.

Writing viruses and other such programs can also be classified as unethical. Other situations that might be considered problematic include:

- websites being programmed to store “cookies” on computers, which record the activities of the person who visits the site
- programming games with features that challenge normal behaviour and values, such as excessive violence and other features that are discriminatory to particular genders or races
- installing camera surveillance and email monitoring, which can raise some ethical problems, especially if the employees are not informed.

24 What are the privacy principles in the *Privacy Act*? (p. 289)

- APP 1 Open and transparent management of personal information
- APP 2 Aonymity ad pseudonymity
- APP 3 Collection of solicited personal information
- APP 4 Dealing with unsolicited personal information
- APP 5 Notification of the collection of personal information
- APP 6 Use or disclosure of personal information
- APP 7 Direct marketing
- APP 8 Cross-border disclosure of personal information
- APP 9 Adoption, use or disclosure of government related identifiers
- APP 10 Quality of personal information
- APP 11 Security of personal information
- APP 12 Access to personal information
- APP 13 Correction of personal information

Data security

25 List some of the consequences of data loss for a business. (p. 290)

- Organisations that fail to secure the data and information may be subject to penalties or prosecution.
- Unable to pay wages to its staff or pay its suppliers.
- The need to recreate lost or damaged data, and repair or replace damaged, destroyed or stolen equipment, can result in further costs, labour and disruptions.
- If normal business is disrupted, the organisation will also lose income.
- Data security failures may result in organisations losing their trade secrets to competitors.
- The organisation may also sustain damage to its reputation, reducing customer loyalty. Its stock market value may also decline.

26 List four different ways to physically protect data. (p. 290)

- If you use a laptop or tablet and store your data on it, make sure you keep it in a secure place when it is not in use, such as in a cabinet or locked storage.
- Do not let other people use your devices unless you know them well.
- If a friend or family member needs to use one of your devices, make sure they cannot access important data.
- Keep your doors and windows locked to prevent theft of your hardware.
- If you use a desktop computer, keep it switched off when you are not using it.
- Consider using surge-protector power outlets for all of your devices to protect the data stored on them.
- Physical protection includes locks, guards, surveillance cameras, keys and access devices of various types such as smart cards, ID cards and biometric devices.

27 List four different ways to limit threats to software. (p. 290)

- Virus - Limit downloads and unauthorised software. All data and software sources need to be determined to be safe before use by scanning with a virus checker.
- Worm - Limit connections and use a firewall to check for suspicious activity by a program
- Trojan horse - User training to detect unusual activity, especially unusual requests and activity. Use a firewall to detect unusual activity.
- Spyware - Check the fine print carefully when downloading free software. Check special sites that have information about spyware products.

28 Describe the three different ways to backup files. (p. 290)

- A full backup copies all of the files from a device to a storage medium. This can take considerable time and is usually performed at regular intervals (such as once a week, fortnight or month).
- A differential backup copies only those files that have been changed since the last full backup. Restoration of data would involve restoring files from the full backup and then from the differential backup.
- An incremental backup is similar to a differential backup, except that it uses more than two backup media, while a differential backup uses only two media. An incremental backup only copies files that have been changed since the last incremental backup.

Apply your knowledge

The Melbourne Robotics Centre (MRC) is an organisation that runs professional designing, building and programming classes specifically aimed at school-aged children. The company offers classes after school on most weeknights and on weekends in various locations around Melbourne. Children from many suburbs participate in this extracurricular activity. The MRC is a not-for-proit organisation set up specifically to broaden children's interest in science, technology and engineering, with approximately five full-time staff and 30 casual staff. The MRC has a website, where it advertises its classes and locations. Pictures taken of students during the classes are used in the company's advertising. The website and its associated back-end database is developed by a programmer who has modified open-source software for he MRC The MRC collects vast amounts of data on the students, such as their date of birth, home address, medical conditions, living arrangements in relation to custody, and their parents' names and occupations. The MRC relies on all their staff to update the data and their website, even though they are not aware of all the legislation.

1 Can you identify the goals and objectives of the organisation? (p. 290)

The goal is to: to broaden children's interest in science, technology and engineering.

The objective is to: deliver stimulating classes.

2 If you were to write an organisational goal for the Melbourne Robotics Centre (MRC), what would it be? (p. 290)

To increase children's interest in in science, technology and engineering through running engaging workshops.

3 Why did this organisation need to develop software specific to its needs? (p. 290)

MRC realized that data was valuable and also contained highly sensitive information which required it to be stored securely.

4 Why does the company need to store data on their clients? (p. 290)

MRC collects highly personal information about children and their parents to ensure that it has the necessary information to supervise the children in a secure environment and be able to contact parents/guardians should an incident occur. The information it collects include:

- Birth date of child
- Home address
- Medical conditions
- Custody arrangements
- Living arrangements in relation to custody issues
- Parents' details and their occupations.

5 What key legislation should the staff be aware of specifically related to collecting, storing and communicating data? (p. 290)

MRC should be aware of the *Privacy Act 1988*. The *Privacy Act* includes the following:

- Thirteen Australian Privacy Principles (APPs) that apply to the handling of personal information by most Australian and Norfolk Island Government agencies and some private sector organisations. However, this applies to businesses that have an annual turnover of $3 million or those that trade personal information.
- Most small businesses are not covered by the *Privacy Act 1988* (*Privacy Act*), but some are. A small business is one with an annual turnover of $3 million or less. Annual turnover for the purposes of the *Privacy Act* includes all income from all sources. It does not include assets held, capital gains or proceeds of capital sales.
- Small businesses and not-for-profits opting-in to be covered by the *Privacy Act* are making a public commitment to good privacy practice. This option has been made available in order to provide small businesses and not-for-profits with the opportunity to benefit from any increase in consumer confidence and trust that may be derived from operating under the *Privacy Act*. (source: https://www.oaic.gov.au/privacy/privacy-registers/privacy-opt-in-register/)

Even if the small business doesn't opt-in, the Office of the Australian Information Commissioner recommends that protect any personal information held – as best practice.

6 What does the Melbourne Robotics Centre (MRC) need to do to ensure they are compliant with the *Privacy Act* 1988? (p. 290)

As we are not certain that the business turns over $3 million annually, they need to ensure that all information is password protected, backups are in place, and they follow best practice. If they do turn over $3 million, they need to follow the APPs

7 What measures are needed for the Melbourne Robotics Centre (MRC) to protect the integrity of data and information? (p. 290)

They should ensure that they have measures in place such as

- Security
- Password protection
- Levels of access to the data
- Backups
- Disaster recovery plans.

8 Can you identify the possible legal and ethical consequences for ineffective security practices? (p. 290)

- Particularly with custody issues, if the child leaves with the non-custodial parent/guardian – it can be a legal issue (i.e./child kidnapping)
- Pictures of children not securely stored could be used for other illegal purposes
- Data about parents and children can be used to create new IDs
- Normal business can be disrupted such as the payment of goods, services, payment of staff wages etc.

9 Can you recommend a backup solution for the Melbourne Robotics Centre (MRC)? (p. 290)

It will depend on the type of backup strategy MRC chooses. If they choose to store on the Cloud, then backups occur automatically, immediately and continuously. The advantages to do are:

- Relatively cheap
- Off-site storage
- Large (sometimes unlimited) capacities are available
- Every version of a document over time can be recovered.

10 How does the Melbourne Robotics Centre (MRC) protect themselves from security threats? (p. 290)

- Ensure that all computers have an up-to-date virus checker installed.
- Ensure that all staff have a username and password and that they ony have access to their relevant access needs.
- If you use a laptop or tablet and store your data on it, make sure you keep it in a secure place when it is not in use, such as in a cabinet or locked storage. Otherwise, store it out of sight.
- Do not let other people use your devices unless you know them well.
- Consider using surge-protector power outlets for all your devices to protect the data stored on them.
- Encryption of data, so those who are unauthorised cannot read it.
- Biometric security methods, such as fingerprint and retina scanning.

- Keeping logs of activities – which files were used, when and how, and which computer was used.

11 Does the Melbourne Robotics Centre (MRC) require all the data they collect? (p. 290)

One can debate whether they need to know the occupation of the parent, however given that it is a business and not running in a voluntary capacity, they do not need to know what the parents do and ask for assistance.

12 What data should be collected on the children and their parents? (p. 290)

- Medical issues
- Food allergies
- Custody arrangements
- Age of the child
- Home address
- Phone number
- Emil contact
- Payment details.