

STUDENT NUMBER           Letter

# APPLIED COMPUTING: SOFTWARE DEVELOPMENT

## Written examination

Friday 11 November 2022

Reading time: 3.00 pm to 3.15 pm (15 minutes)

Writing time: 3.15 pm to 5.15 pm (2 hours)

## QUESTION AND ANSWER BOOK

### Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	6	6	20
C	16	16	60
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

### Materials supplied

- Question and answer book of 28 pages
- Detachable insert containing a case study for Section C in the centrefold
- Answer sheet for multiple-choice questions

### Instructions

- Detach the insert from the centre of this book during reading time.
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

### At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.
- You may keep the detached insert.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.**

**SECTION A – Multiple-choice questions****Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

**Question 1**

Which of the following is **true** about functions and methods?

- A. Functions and methods are the same. They process data the same way in any programming language.
- B. Functions and methods are the same. They process data exactly the same way in any object-oriented programming language.
- C. Functions and methods are different. A function is called by name and must always pass and return data, whereas a method can only be called when an object of a class calls it.
- D. Functions and methods are different. A function can be called at any time during a programming solution, whereas a method can only be called when an object that has been declared calls it.

**Question 2**

Factors influencing the design of a solution can include

- A. economic, legal, technical, social and usability.
- B. usability, reliability, portability, robustness and validation.
- C. affordance, interoperability, marketability, security and usability.
- D. integrity, accuracy, authenticity, correctness, reasonableness, relevance and timeliness.

**Question 3**

The owners of a small cafe have decided to introduce a loyalty program to encourage customers to keep visiting their cafe instead of going to major coffee chain stores. In addition to offering a free coffee after a certain number of purchases, the owners would like to offer other incentives based on each customer's purchasing habits.

Which one of the following functional requirements will **not** be relevant to the cafe's information system goal?

- A. Count the number of coffees purchased.
- B. Record every item a customer purchases.
- C. Sort a customer's purchase history by date.
- D. Search a customer's record for frequently purchased items.

**Question 4**

Jackie is designing a new piece of accounting software and is searching the internet for ideas. He finds a code repository with free open-source modules. Jackie thinks that because the code is open-source, the modules should be safe to download.

Before downloading any modules, what should Jackie do to reduce any potential risks?

- A. Make sure his antivirus software is up to date.
- B. Conduct a security audit of any modules he wants to download.
- C. Register an account with the code repository to enable authentication.
- D. Connect to a virtual private network (VPN) to encrypt the downloads.

**Question 5**

When a version of a software that is being developed undergoes a major update, the updating software creates a new directory called 'Previous\_Version' and copies specific files to that folder.

This procedure may be described as

- A. archiving the previous version.
- B. backing up the previous version.
- C. releasing storage space for re-use.
- D. deleting files that are no longer necessary.

**Question 6**

Why is creating a software requirements specification (SRS) important in the process of developing a software solution?

- A. An SRS provides all the detailed requirements of a software solution.
- B. An SRS creates a contract between the development team and the client.
- C. An SRS provides a summary of the requirements of the software solution.
- D. An SRS provides the programmers with the detailed design of the software solution.

**Question 7**

Fagan is a junior employee for a software development company. He is having difficulty developing a security module for a health app and is considering asking a friend, who works for another software development company and who is knowledgeable about security, to share the code from one of their security modules.

Which one of the following key pieces of legislation is the most important for Fagan to consider before approaching his friend?

- A. the *Privacy Act 1988*
- B. the *Copyright Act 1968*
- C. the *Health Records Act 2001*
- D. the *Privacy and Data Protection Act 2014*

**Question 8**

Felicity is developing a customer database for her online store. She needs a unique customer code that comprises the first three letters of a customer's surname and a random four-digit number.

Which one of the following data types should Felicity use as her unique customer code?

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

**Question 9**

Pat is required to assess the efficiency of a software solution.

Pat could do this by

- A. interviewing users.
- B. posting a questionnaire.
- C. measuring the speed of execution.
- D. counting the number of users online.

**Question 10**

Hamid is part of a team that is responsible for developing a new software solution. The users of the software solution will be five data entry operators who have limited experience in their role.

The best way for Hamid to determine the needs and requirements of these operators so that they can use the new system is to

- A. create an online survey for all the employees of the company to rate their current system.
- B. view reports about the current system.
- C. individually interview the operators.
- D. observe the operators.

**Question 11**

Which one of the following actions is a part of a software auditing strategy?

- A. a usability test
- B. a functional test
- C. an existence test
- D. a penetration test

**Question 12**

Type checking is a method of

- A. testing.
- B. checking.
- C. validation.
- D. verification.

**Question 13**

Celeste and her design team have been given a generic set of requirements for a new software solution. She gives her design team five minutes to generate as many ideas as possible for the design of the software solution.

This technique is an example of

- A. IPO.
- B. brainstorming.
- C. storyboarding.
- D. mind mapping.

**Question 14**

SeeMePoze is a new social media app. The following information was posted on the developer's website: 'SeeMePoze allows a diverse range of users to share their creativeness with the rest of the world through its distinctive editing features. Get Pozing!'

This information is an example of

- A. a marketing strategy.
- B. a goal of an information system.
- C. an objective of an information system.
- D. a mission statement of an organisation.

**Question 15**

One factor that influences the effectiveness of the agile development model is

- A. reducing the time of each sprint.
- B. increasing the time of each sprint.
- C. shortening the time of the daily scrums.
- D. improving communications between the scrum master and the project manager.

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**Question 16**

```

1 number = 2
2 print number
3 For i from 1 to 3
4     number = number + 5
5     print number
6 print "done"
    
```

Which one of the following trace tables represents the algorithm shown above?

**A.**

Line	number	i	Output
1	2		
2	2		2
3	2	1	2
4	7	1	2
5	7	1	7
3	7	2	7
4	12	2	7
5	12	2	12
3	12	3	12
4	17	3	12
5	17	3	17
6	17	3	Done

**B.**

Line	number	i	Output
1	2		
2	2		2
3	1		2
4	1	7	2
5	1	7	7
3	2	7	7
4	2	12	7
5	2	12	12
3	3	12	12
4	3	17	12
5	3	17	17
6	3	17	done

**C.**

Line	number	i	Output
1	2		
2	2		2
3	2	1	2
4	7	1	2
5	7	1	7
3	7	2	7
4	12	2	7
5	12	2	12
3	12	3	12
4	17	3	12
5	17	3	17
6	17	3	done

**D.**

Line	number	i	Output
1	2		
2	2		3
3	2	1	3
4	7	1	3
5	7	1	7
3	7	2	7
4	12	2	7
5	12	2	12
3	12	3	12
4	17	3	12
5	17	3	17
6	17	3	done

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Use the following information to answer Questions 17 and 18.

The algorithm shown below will be used for data entry.

```
Begin
  Input eligible
  If eligible >= 18 Then
    If eligible > 75 Then
      status ← "Require doctor endorsement"
    Else
      status ← "Approved"
    End If
  Else
    status ← "Not approved"
  End If
  Output status
End
```

#### Question 17

Which one of the following validation techniques is being applied in this algorithm?

- A. an age test
- B. a type check
- C. a range check
- D. an existence check

#### Question 18

This algorithm makes use of

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

#### Question 19

Naz is leading a large software development project that has many stakeholders. The client is unsure of the key requirements of the software solution. Regular meetings about the progress of each phase of the solution are necessary and an early version of the solution is needed.

The most appropriate development model for this project is

- A. agile.
- B. spiral.
- C. waterfall.
- D. build-and-fix.

**Question 20**

The following (*key, value*) data has been added to the hash table below:

- (1, 20)
- (2, 70)
- (14, 32)
- (37, 98)
- (25, 25)

Array index	Value
1	20
2	70
14	32
17	98
5	25

Two more pieces of data are to be added to the hash table. They are:

- (39, 6)
- (26, 2)

The array index for each of these values will be

- A. 6 and 2
- B. 19 and 6
- C. 20 and 6
- D. 39 and 26

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

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

**Question 1** (3 marks)

For each of the statements in the table below, circle the best file type – XML, TXT or CSV.

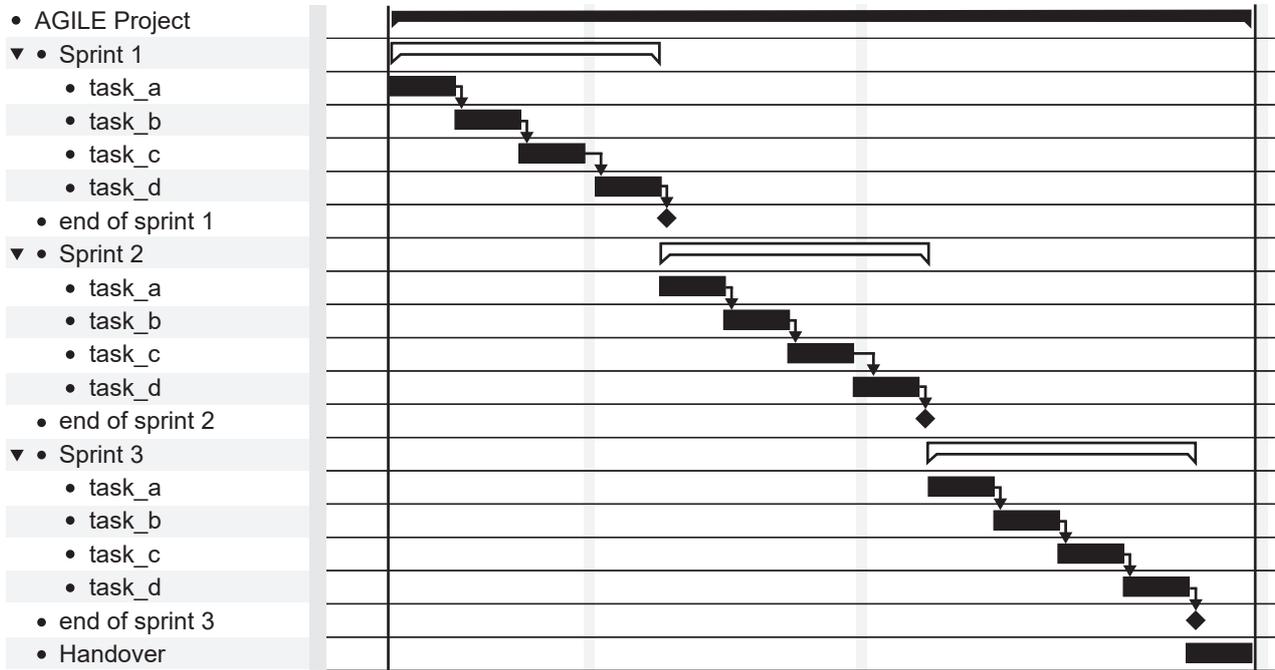
Statement	File type (circle one)
File contents can be unstructured.	XML      TXT      CSV
Data can be more effectively transferred between different information systems.	XML      TXT      CSV
File contents can be more easily read by both humans and computers.	XML      TXT      CSV

DO NOT WRITE IN THIS AREA

**Question 2** (6 marks)

An organisation is considering how it will develop a software solution for a major client. It is deciding whether to adopt the agile development model or the waterfall development model.

**Model 1 – Agile**



**Model 2 – Waterfall**



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- a. Identify and describe one advantage of each model.

4 marks

Model 1 – Agile \_\_\_\_\_

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Model 2 – Waterfall \_\_\_\_\_

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- b. Identify **two** additional pieces of information that would help the organisation decide on the better model to adopt.

2 marks

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**Question 3** (2 marks)

A software developer is trying to convince a client that authentication of users is an important security consideration when designing a software solution.

Explain how authentication of users can be achieved.

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**Question 4** (4 marks)

Jamie is writing an algorithm with two positive numbers as input. During each cycle, the two numbers are increased by different amounts. The cycles repeat until the smaller number becomes greater than the other number. The number of cycles is recorded.

```

Begin race
  Read small
  Read big
  cycles  $\leftarrow$  0
  Repeat
    small  $\leftarrow$  small * 2
    big  $\leftarrow$  big + 3
    cycles  $\leftarrow$  cycles + 1
  Until small > big
  Print small, big, cycles
End

```

- a. Complete the test table below, given the test data provided.

2 marks

Test data	Expected result	Actual result
small = 1 big = 10	32, 25, 5	32, 25, 5
small = 10 big = 15		
small = 10 big = 1		
small = 3 big = 3		

- b. Identify the cause of the error in the algorithm.

1 mark

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- c. Suggest a change to the algorithm so that the correct output is produced.

1 mark

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**Question 5** (2 marks)

Explain how an SQL injection can be a risk to a secure web application.

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**Question 6** (3 marks)

A new jet engine manufacturer completed a risk management audit of its security practices and the report highlighted a number of security vulnerabilities.

The following security vulnerabilities were found:

- issues with weak passwords
- unlimited login attempts
- computers left unattended
- no protection of files on their servers

Select **one** security vulnerability from the list above and suggest a strategy that the manufacturer could use to minimise the risk.

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**SECTION C – Case study****Instructions for Section C**

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

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

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

**Question 1 (5 marks)**

The IszCool Canteen app is an online ordering system. IszCool Solutions is keen to ensure that the new app is well received and used by the students at Centurion Secondary College.

- a. Describe two data collection methods that IszCool Solutions could use to determine the students' expectations of the new canteen app.

2 marks

Method 1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Method 2 \_\_\_\_\_

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- b. After the list of features for the IszCool Canteen app has been prepared, Shane realises that there could be several issues with developing this software solution that are beyond his control.

As part of his analysis, Shane has considered the constraints that will influence the development of the software solution. The following three constraints have been identified: economic, technical and legal.

Describe how each of these constraints will have an impact on the development of the IszCool Canteen app.

3 marks

Economic \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Technical \_\_\_\_\_

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\_\_\_\_\_

Legal \_\_\_\_\_

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**Question 2** (4 marks)

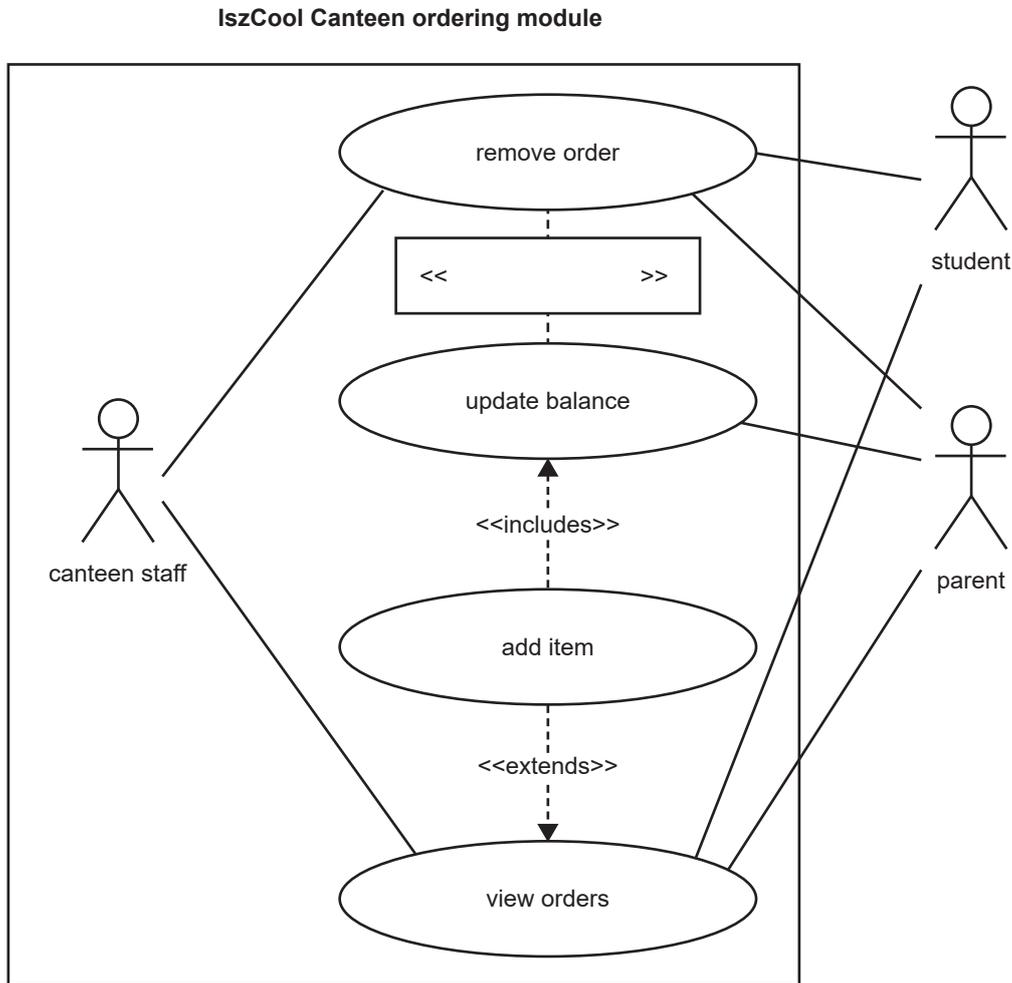
Refer to the data flow diagram (DFD) on page 3 of the insert. The table below lists some of the features of the DFD.

Indicate if each feature is an error by writing 'yes' or 'no' in the spaces provided.

Feature	Error (yes or no)
'Purchaser' is shown twice in the DFD.	
The 'parent' external entity is connected directly to the 'accounts' data store.	
'Check balance' has the same data flow going out as going in.	
'Enter order item' does not have a data flow to the external entities.	

**Question 3 (5 marks)**

A use case diagram for the IszCool Canteen app is shown below. An order is removed from the system if it is cancelled by a parent or student, or if it is collected by a student. If an order is cancelled, the payment is refunded to the affected account.



a. The representation of the actors in the use case diagram has an error.

State the nature of this error and how it could be corrected.

2 marks

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b. Identify the actor who initiates the 'remove order' use case when an order is collected.

1 mark

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c. Complete the use case diagram to show the link between 'remove order' and 'update balance' as either an <<includes>> or <<extends>> and show the direction with an arrow.

2 marks

**Question 4** (2 marks)

Refer to the DFD on page 3 of the insert. A section of the data dictionary for the app is shown below.

Specify the most appropriate data type – integer, Boolean or string – for each of the variables listed.

Variable	Data type	Description
account_balance		amount of money in the account, in cents
spend_warning		message sent if purchaser tries to spend too much in one day

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Use the following information to answer Questions 5 and 6.

**Mock-up A**

**Mock-up B**

**Question 5 (2 marks)**

Shane has developed two mock-ups – Mock-up A and Mock-up B – for the IszCool Canteen app. He is currently considering several factors that will influence the design of this software solution. One of these factors is affordance.

- a. Define the term ‘affordance’. 1 mark

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- b. Provide an example of how affordance has not been demonstrated in Mock-up A. 1 mark

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**Question 6** (6 marks)

- a. Three criteria for evaluating the mock-ups are provided in the table below.

Classify each evaluation criterion in terms of efficiency or effectiveness by writing the term 'efficiency' or 'effectiveness' in the spaces provided.

3 marks

Evaluation criterion	Efficiency or effectiveness
Can users from different language backgrounds easily use the app?	
Does the user interface enable input on a range of devices?	
Are users able to quickly update their payment details?	

- b. Using the evaluation criteria provided in **part a.**, select your preferred mock-up – Mock-up A or Mock-up B – and justify your response.

3 marks

Preferred mock-up \_\_\_\_\_

Justification \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Question 7** (2 marks)

It is necessary to ensure that the data entered into the app is correct.

- a. Identify the first validation check that needs to be performed when entering an order item. 1 mark

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- b. Describe a validation check that would be performed on the total cost of a lunch order. 1 mark

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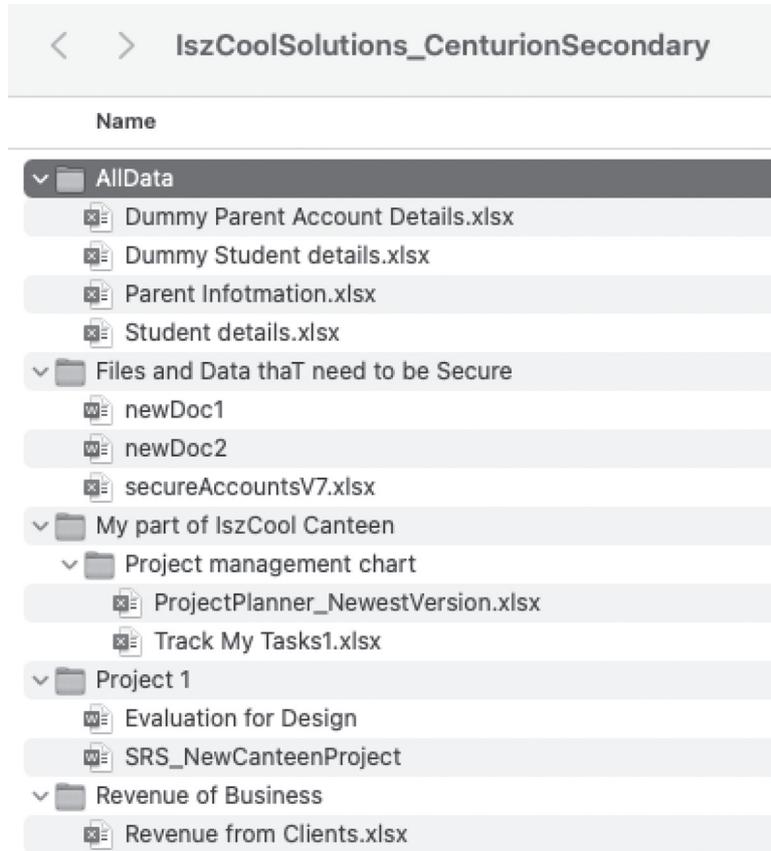
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**Question 8** (4 marks)

IszCool Solutions currently has a company policy in place that allows its staff to work from home. Staff are expected to save all files and data that are created throughout the project on a shared drive.

The image below shows an example of the folders and files that are in the shared drive of IszCool Solutions.



Outline two concerns that IszCool Solutions should have regarding the handling and managing of files and data by the business. For each concern, recommend a procedure that IszCool Solutions can implement to ensure the proper handling and managing of files.

Concern 1 \_\_\_\_\_

\_\_\_\_\_

Procedure \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Concern 2 \_\_\_\_\_

\_\_\_\_\_

Procedure \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Question 9** (3 marks)

IszCool Solutions is deciding on a data structure to organise data. The data structure will initially store parent and student details before parents create their first order using the app for their children. The data structure will store data temporarily, before the data is written into a file.

The data that a parent must provide before their first order is as follows:

- StudentID
- parent's name
- parent's email address
- phone number
- name on credit card
- credit card number
- credit card expiry date and CVV number
- daily limit for student order

- a. Identify the type of data structure that IszCool Solutions should use. 1 mark

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- b. Explain why the data structure identified in **part a.** is the most appropriate type to store the data. 2 marks

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**Question 10** (4 marks)

Shane is aware that three basic control structures will be used to develop the software solution for the IszCool Canteen app. The sequence control structure refers to the line-by-line execution of instructions, beginning at Step 1 and proceeding sequentially through Step 2 and Step 3.

- a. List the other two control structures. 2 marks

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

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

- b. When canteen staff process a student's order, they may need to edit the order.

Select **one** of the control structures listed in **part a.** and state why this control structure is the most appropriate in this case. 2 marks

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**Question 11** (4 marks)

Two programmers will be involved in writing the code for the app. Each programmer has a different approach to writing the code. One programmer, Ming, argues that the internal documentation is not functional and slows down the writing of the more important code modules. Another programmer, Soula, believes that internal documentation is just as important as the code.

- a. Which programmer – Ming or Soula – has the more acceptable approach and why? 2 marks

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- b. Assume that internal documentation is to be used in the app.  
Describe two characteristics of internal documentation. 2 marks

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

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

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**Question 12** (3 marks)

One of the programmers of IszCool Solutions is developing the code for a 'User purchase' feature. This feature must be tested before the next part of the code can be developed.

Shown below is a section of the code that needs to be tested.

**Begin**

```

If accountBalance >= totalPurchase
    If totalPurchase <= dailyLimit
        accountBalance ← accountBalance - totalPurchase
        Print accountBalance
    Else
        Print "You have exceeded your daily limit"
    End If
Else
    Print "Top up your account"
End If

```

**End**

Complete the test table below using the 'accountBalance' and 'dailyLimit' values provided.

accountBalance	dailyLimit	totalPurchase	Output
20	15	20	You have exceeded your daily limit.
20	15		
20	15		
20	15		

**Question 13** (4 marks)

Several modules of the IszCool Canteen app are being developed simultaneously.

Copies of the software have been installed on various notebooks and desktops for testing and editing. The latest working version is always accessible to the development team through a browser online. However, there are issues with unauthorised copies being accessed by people other than the development team.

- a. List one physical security control and one software security control that could protect the development of the IszCool Canteen app. 2 marks

Physical security control \_\_\_\_\_

\_\_\_\_\_

Software security control \_\_\_\_\_

\_\_\_\_\_

- b. Identify and describe how the use of a software security control would ensure that there is always a working version of the IszCool Canteen app accessible to the development team. 2 marks

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**Question 14** (4 marks)

The team at IszCool Solutions is ready to perform usability testing. The team will select a number of different school community members to test the IszCool Canteen app.

- a. Suggest **one** feature of the IszCool Canteen app that IszCool Solutions would want to test with different users. 1 mark

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- b. Explain why a variety of tests should be performed with different users of the IszCool Canteen app. 3 marks

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**Question 15** (4 marks)

For the IszCool Canteen app to be usable and to meet requirements, IszCool Solutions needs to ensure the integrity of the data that it uses.

- a.** Identify two relevant characteristics of data that has integrity. 2 marks

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

\_\_\_\_\_

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

\_\_\_\_\_

- b.** Select **one** of the characteristics identified in **part a.** Explain the impact on IszCool Solutions if the integrity of data with that characteristic is not maintained. 2 marks

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\_\_\_\_\_

\_\_\_\_\_

**Question 16** (4 marks)

Shane has been surfing the internet and has discovered that an earlier version of the IszCool Canteen app is available on a 'free download' site. Shane decides that security will need to be improved to prevent further leaks of the software solution.

- a.** Propose two components of a security strategy as part of an effective risk management plan to improve IszCool Solutions' security practices. 2 marks

Component 1 \_\_\_\_\_

Component 2 \_\_\_\_\_

- b.** Select **one** component proposed in **part a.** and explain how it will improve security. 2 marks

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\_\_\_\_\_

\_\_\_\_\_

**Insert for Section C – Case study**

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

Shane has just completed his degree in software engineering at university. He recently spoke to his friends about their secondary school days and their experiences using school canteens. A common experience they shared was time wasted standing in a queue waiting to order their food. Their complaints included the following:

- Queues were often so long that on rainy days students at the end of the queue would get wet.
- By the time students got to the front of the queue, the best items would have sold out.
- By the time students got their food, there would be barely any time left to eat before the next class started.
- Some students would ‘jump the queue’ by handing their money to someone closer to the front of the queue who would buy their food for them.

Shane and his friends agreed that a method of pre-ordering and collecting food would have been useful, so they decided to start their own business, IszCool Solutions, to develop software for an online ordering system for canteens called IszCool Canteen.

Being a start-up business with limited funds, Shane and his friends will primarily work from home. Sometimes they will use a shared meeting room at the local business hub.

Shane spoke with the school council of his former secondary school, Centurion Secondary College, and has been given approval to develop a prototype of the software for the school. If successful, IszCool Solutions will then sell the software to other schools.

### **The initial analysis**

IszCool Solutions will develop an app with the following features:

- Parents will be able to create an account and add credit to that account.
- Both parents and students will be able to enter orders for that day or pre-orders for the next week through the account.
- To prevent students from ordering too much, parents will be able to set a daily limit.
- Students will be able to collect their orders by scanning their student ID card. This will set the status of the order to ‘waiting’.

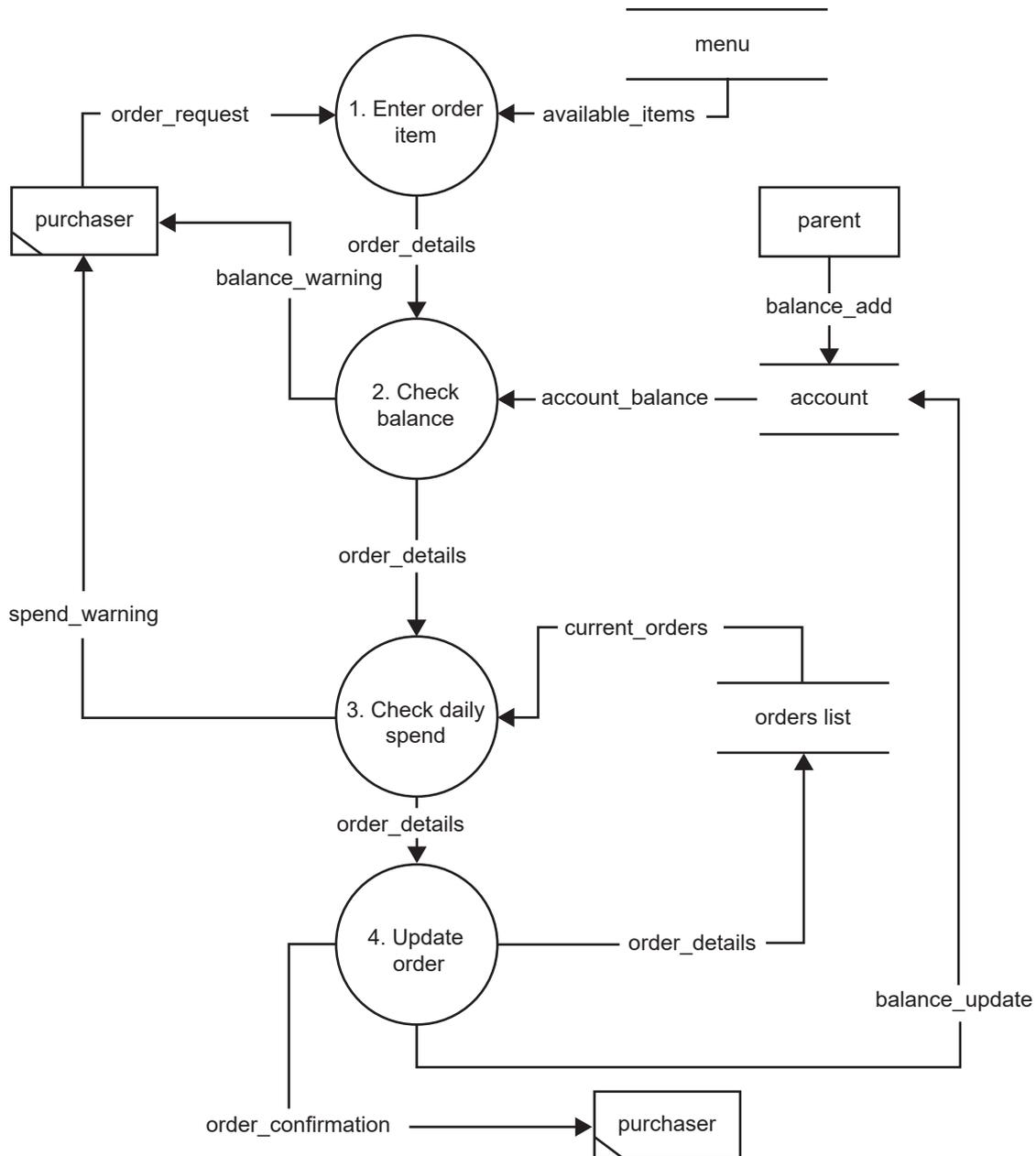
A different version of the app will run in the canteen. This app will show the list of ‘waiting’ orders. Once canteen staff have collected all items in a waiting order, they will be able to click on the order in the app to set the status to ‘completed’.

The school council has also requested the following features:

- Orders must be allocated to either recess or lunch collection.
- Orders cannot be edited by parents or students after 8.30 am on the day of collection.
- If an item is unavailable, canteen staff can edit an order to substitute the item or provide a refund for that item.
- Orders can be collected only by the student with their ID card and no-one else.

A partial Level 0 data flow diagram (DFD) is provided below to show how a student or parent (purchaser) will place an order using the IszCool Canteen app.

### Level 0 DFD – IszCool Canteen module



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