VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2020

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER | | | | | | | | | Letter |

APPLIED COMPUTING: SOFTWARE DEVELOPMENT

Written examination

Friday 27 November 2020

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	4	4	20
C	14	14	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 25 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

The most appropriate data type to store a value that reflects the length of a window frame in millimetres is

A. string.

B. integer.

C. Boolean.

D. floating point.

Use the following information to answer Questions 2–5.

Ruby notices that popular items are frequently sold out at her school canteen. She proposes that, if the canteen staff keep track of their stock using a software solution, orders for items that need to be restocked could be generated automatically and students would not miss out on their favourite snacks. Ruby decides to investigate this proposal.

Question 2

Which one of the following is a suitable technique for documenting this need or opportunity?

A. making a journal entry

B. writing a problem statement

C. maintaining a log or annotations

D. completing a software requirements specification (SRS)

Question 3

An appropriate way for Ruby to determine the solution constraints for this project is to

A. find out how students are using the current canteen technology.

B. research an online shopping environment to gather design ideas.

C. interview students to find out what new products should be stocked.

D. check the available product list against the school's 'healthy eating' policy to identify a new product list.

Question 4

Ruby realises that the product list will need to be searched by name.

Which search algorithm would be the best choice if the canteen staff want the fastest option?

A. quick search, if the list is sorted

B. linear search, if the list is unsorted

C. binary search, if the list is unsorted

D. selection search, if the list is sorted

Question 5

Which set of test data should be used to check a validation rule that limits all item prices to values between 50 cents and $8.00?

A. 0, 50, 8, 9

B. 0.4, 0.5, 0.8, 0.9

C. 0.49, 0.50, 0.51, 8.00, 8.01

D. 0, 49, 50, 51, 79, 80, 81

Question 6

Assuming that time is not a constraint, which one of the following is the most appropriate technique to collect detailed and authentic data about an existing information system?

A. reports

B. surveys

C. interviews

D. observations

Question 7

Having a limited amount of time to complete a software solution is an example of

A. a usability constraint.

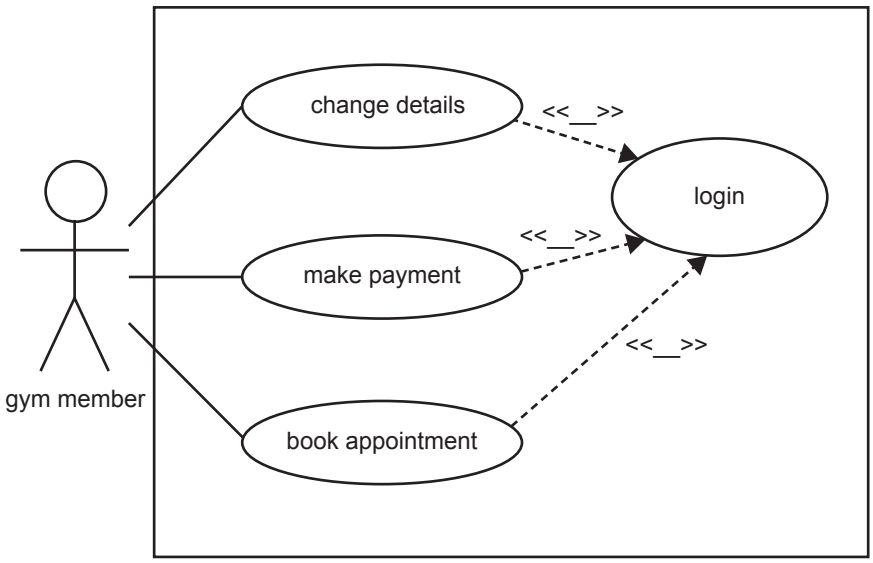
B. an economic constraint.

C. a technical requirement.

D. a non-functional requirement.

Question 8

Consider the following partial use case diagram, which shows how a gym member interacts with a booking system for personal trainers.



What is the word that is missing from the diagram, as indicated by the line in the symbol <<___>>, next to each dashed arrow?

A. 'actor'

B. 'extends'

C. 'includes'

D. 'initiates'

Question 9

After an SRS has been completed, designs need to be created.

Which of the following are valid techniques for generating different design ideas?

A. algorithms and mock-ups

B. mind maps and pseudocode

C. brainstorming and mind maps

D. mock-ups and data dictionaries

Question 10

Richard is designing a software solution that will require users to register before they can use the solution. Once registered, they will need to be able to interact with the solution using a variety of devices and operating systems that will in turn be used with another software solution.

The most important design factors that Richard should consider in the design of his software solution are

A. affordance and security.

B. usability and interoperability.

C. marketability and affordance.

D. interoperability and marketability.

Question 11

An organisation disposed of files in January 2019.

In November 2020 those files

A. cannot be recovered.

B. can be recovered from archives.

C. can be recovered from desktop trash.

D. can be recovered from backups stored offsite.

Question 12

Wesley has a collection of Australian landscape photographs that he has sold to an online magazine. The photographs are on his computer and have an average file size of 5 megabytes.

To upload each photograph using a wireless connection running at 20 megabits per second will take approximately

A. 0.8 seconds.

B. 1.3 seconds.

C. 2.0 seconds.

D. 2.7 seconds.

Question 13

Genna is considering the data structures for a software solution that will track members of her local running club. A data structure needs to store member names, gender (M, F or X), age groups (J for junior, A for adult, V for veteran), preferred run length (5 km or 10 km) and best time. A sample entry is shown below.

GivenName	FamilyName	Gender	AgeGroup	Run	BestTime
Bryce	Wallis	M	A	5	24.55

Which one of the following is the name of the data structure shown above?

A. record

B. hash table

C. one-dimensional array

D. two-dimensional array

Use the following information to answer Questions 14 and 15.

```
1  Begin
2          A ← 7
3          B ← 1
4          Repeat
5                  C ← A * B
6                  A ← A - 1
7                  B ← B + 1
8          Until A < 4
9          Print C
10 End
```

Question 14

What is the output of the pseudocode shown above?

A. 7

B. 12

C. 15

D. 16

Question 15

Arvid intends to modify the pseudocode shown above to allow users to enter their own numbers for variables A and B. He wants to include validation to check that the user has entered only positive numbers.

This type of validation is called

A. fact checking.

B. type checking.

C. range checking.

D. existence checking.

Question 16

When developing a software solution, the data used for testing validation, including range checks and type checks, would include

A. correct and incorrect data.

B. incorrect data only.

C. correct data only.

D. symbols only.

Question 17

Remi's friends provided him with a USB flash drive containing various third-party applications. Remi installed these applications on his new computer. He soon notices that he is receiving login notifications from devices he does not own.

Apart from changing his password, what could Remi have done before installing the applications to prevent them from sharing his data?

A. set up a firewall

B. read the terms and conditions

C. installed antivirus software and run it frequently

D. checked reviews online for the applications to see if other users have had issues with them

Question 18

Which one of the following would be a suitable criterion for evaluating the efficiency of a software solution?

A. The solution's appearance is attractive.

B. The solution generates accurate results.

C. The final output has all the required components.

D. The solution requires fewer steps to complete tasks.

Question 19

Version control is used in software development to

A. help developers keep track of the correct version.

B. make sure there are multiple versions to present to clients.

C. fully test solutions to ensure functional requirements are met.

D. preserve older versions of software solutions in case developers need to refer to them.

Question 20

Cross-site scripting occurs when a

A. website accesses another website.

B. web browser becomes infected with malware.

C. web application delivers malicious script to the user's web browser.

D. web server returns exception errors, such as internal server errors.

END OF SECTION A
TURN OVER

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SECTION B – Short-answer questions

Instructions for Section B

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

Question 1 (4 marks)

Albert is part of the design team for a university project and he has provided a snippet of his data dictionary, shown below, to his supervisor, Dr Sarish.

Variable name	Data type	Description
Var1	string	input student's first name
Var2	integer	length of string

a. Dr Sarish recommends that Albert use a naming convention to improve his data dictionary.

Explain the purpose of a naming convention and how it will assist Albert with improving his data dictionary. 2 marks

b. Suggest changes that would assist Albert with designing his data dictionary. 2 marks

Question 2 (9 marks)

As part of a project for her coding club, Camilla is developing a game called 'Guess the secret number'.

The program for this game initially chooses the number to be guessed by selecting an integer, using a random function, within the range of 1–100. A player then enters a first guess. If the guess is incorrect, the program will continue until the player guesses the correct number. The program will assist the player by providing the hints 'Too low' or 'Too high'.

When the player correctly guesses the number, the program will output the number of guesses with a comment. If the number of guesses is fewer than 15, the program will display 'Well done! You guessed the secret number quickly!' on the screen, otherwise 'It took too long!' will be displayed.

Ivan, who is also a member of the coding club, suggests to Camilla that writing an algorithm in pseudocode before coding is important. Camilla disagrees with Ivan's suggestion.

a. Explain why Ivan suggested that Camilla write an algorithm before coding. 2 marks

b. Using the information provided on page 10, complete the pseudocode for 'Guess the secret number' in the spaces provided below. 7 marks

```
Begin
    secretNum ← random (1,100)

    _____

    Print "Enter the secret number"
    guessNum ← input value from keyboard

    Repeat 15 times Or _____

        Print "Enter the secret number"
        guessNum ← input value from keyboard

    _____

            Print "Too high"
            guessCounter ← guessCounter + 1

    _____

            Print "Too low"
            guessCounter ← guessCounter + 1
        End If
    End Repeat
    print guessCounter

    _____

    _____

    _____

    _____

    _____

End
```

Question 3 (2 marks)

Programming languages use a range of processing features.

Explain why a function would be used to perform a calculation in a program rather than a procedure.

Question 4 (5 marks)

Before Amir starts to develop a software solution, he needs to consider how he will manage the data and files used within the solution.

a. List **two** procedures that could be used to manage the data and files used within the solution. 2 marks

b. Select one of the procedures listed in **part a.** and explain how the selected procedure will be applied to manage the data and files used within the solution. 3 marks

Procedure

Explanation

END OF SECTION B

SECTION C – Case study

Instructions for Section C

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

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

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

Question 1 (1 mark)

Identify **one** information system goal of the FRIDGESMART app.

Question 2 (4 marks)

John is using an agile development model to develop the app.

Justify why John has selected an agile development model rather than a waterfall development model for the development of the app.

Question 3 (3 marks)

John has been working on the project management plan for the app. An extract of this plan is shown in the Gantt chart below.

				Days											
Task no.	**Task**	**Duration**	**Dependencies**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
10	Data collection	0													
11	Sprint planning meeting 1	1													
12	Identify data to be collected	1	11												
13	Identify sources of data	1	12												
14	Identify methods of data collection	1	13												
15	Develop collection tools	2	11, 12, 13												
16	Conduct data collection 1: Interview	1	15												
17	Conduct data collection 2: Reports	3	15												
18	Critically analyse the reliability of collected data	1	16, 17												
19	Data collection complete	0													

a. Identify the tasks that are on the critical path for this part of the project. 1 mark

b. John has heard from the programming team set up to develop the app that interviews have been delayed and may take an extra day.

Explain the impact that this delay may have on the project's timeline. 2 marks

Question 4 (4 marks)

John has completed the software requirements specification (SRS) for the app and has taken it to a meeting with FRIDGESMART and HOMEMADE.

a. Outline the purpose of the SRS. 2 marks

b. Other than functional and non-functional requirements, identify two sections that would be found in the SRS and describe each section. 2 marks

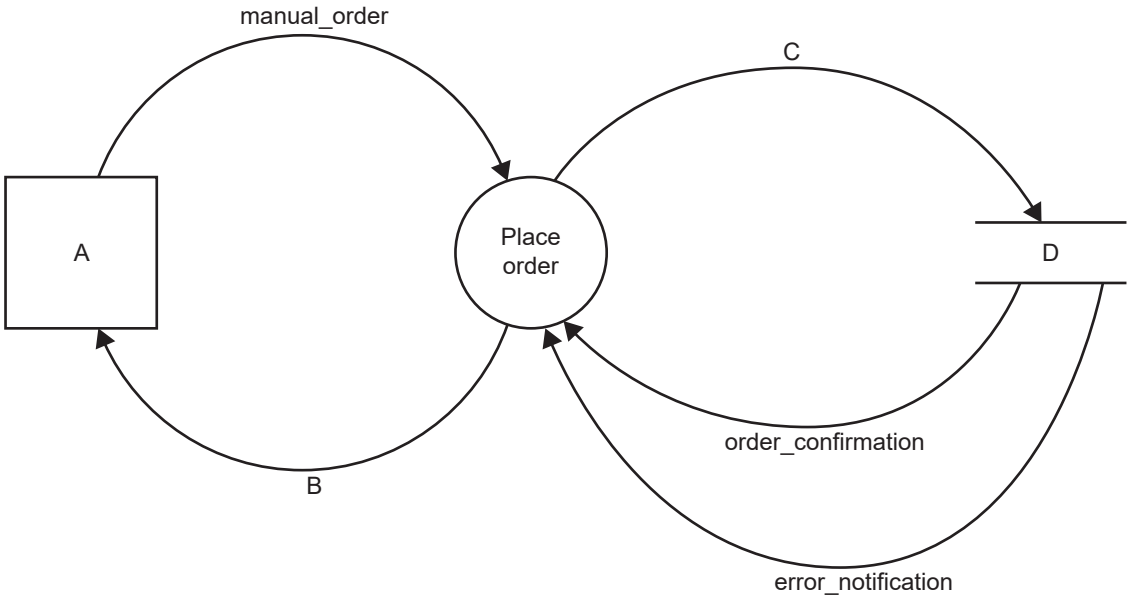
Section 1 _____

Description _____

Section 2 _____

Description _____

Question 5 (4 marks)



The data flow diagram above shows the 'Place order' process for ordering items.

Complete the data flow diagram by writing the correct labels for A, B, C and D in the spaces provided below.

A _____

B _____

C _____

D _____

Question 6 (4 marks)

Version 2.0 of the FRIDGESMART app has been completed as part of the agile development process. John wants to collect feedback on the user interface to find out what potential customers think of the product.

The following customers have been selected to provide feedback. They have one month to review Version 2.0 of the FRIDGESMART app.

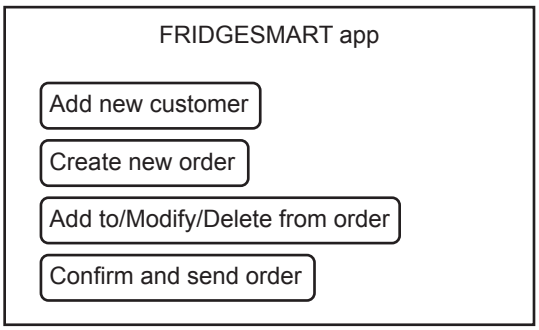
- Maria is 65 years old and will be using the app at home by herself.
- Sebastian is a 42-year-old working parent and will be using the app with his family.
- Pasha is a 21-year-old who has just moved out of home and will be using the app with her new roommate.

Suggest **two** reasons for collecting feedback on the user experience from different types of customers.

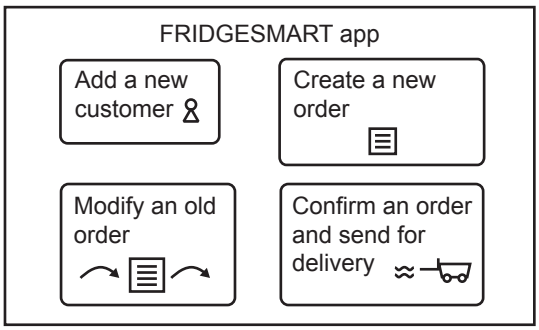
Question 7 (4 marks)

John has sketched two modified designs for the user interface screen based on the feedback collected, as shown below.

Modified design 1



Modified design 2



Select the most appropriate modified design. Justify your selection using the following criteria:

- Menu options are appropriately sized for customers.
- Buttons clearly communicate their purpose to customers.
- The user interface layout is well balanced, appropriately aligned and suitably spaced.

Modified design selected _____

Justification _____

_____

_____

_____

_____

_____

_____

Question 8 (6 marks)

a. An extract from a data dictionary for this project is shown below.

Identify the data type for each of the two items named. 2 marks

Item name	Data type	Description
Barcode		product barcode for an item format is up to 14 digits, including spaces
TimeOut		timestamp of when an item was last removed from the refrigerator format is YYMMDD.HHMMSS

b. Two members of the programming team have been discussing the best file type to use to transfer the data. One team member recommends sending the data in a CSV file, while the other team member recommends using an XML file.

Which file type would be the better option to transfer data? Justify your response. 4 marks

Question 9 (7 marks)

After updating the functional requirements and the user interface design, John has written the pseudocode for generating the automatic ordering of items that have been out of the refrigerator for more than four hours. The pseudocode only checks items that have been removed from the refrigerator since the program's last check.

```
Begin
    Read item
    // Check whether the item has been returned to the refrigerator or whether it
       has already been ordered
    If item.Returned = FALSE Or item.Ordered = FALSE Then
            // If the item hasn't been returned in 4 hours, consider it used and
               needs replacing
            Read currentTime
            If currentTime > item.TimeOut + 4 Then
                    Orders[item.Barcode] ← Orders[item.Barcode] + 1
                    item.Ordered ← TRUE
            End If
    End If
End
```

a. Complete the test table provided below using the following values:

- item.Ordered is FALSE
- currentTime is 15.10

4 marks

Test	Expected result	Actual result
item.TimeOut = 12.53 item.Returned = TRUE	item.Ordered ← FALSE	item.Ordered ← FALSE

b. Identify the line of pseudocode that produces an error. 1 mark

_____

c. Rewrite the line of pseudocode identified in **part b.** so that it produces the correct output. 1 mark

_____

d. What type of data structure is 'Orders'? 1 mark

_____

Question 10 (3 marks)

John wants to test that the 'Place order' process is working correctly when an item is not in the order file at HOMEMADE. He has created a list of sample barcodes, as shown below.

1002	1004	1005	1010	1034	1234	1235	1301	1345	1399	1400

The system is searching for barcode 1050 using a binary search.

a. Identify which barcode will be found in the first iteration of the search. 1 mark

b. Identify which barcode will be found in the second iteration of the search. 1 mark

c. Determine the number of iterations it will take to identify that barcode 1050 is not in the list. 1 mark

Question 11 (3 marks)

Once a weekly order is complete, it needs to be sorted alphabetically for display on the user interface screen. The customer can then add or remove items from the order. The list of items in the order must remain in alphabetical order after an item is added or removed.

John's code utilises a selection sort algorithm. His new intern, Rashana, argues that using a quick sort algorithm may be more appropriate.

Explain why a selection sort is the preferred algorithm rather than a quick sort.

Question 12 (6 marks)

John felt that it would be beneficial to have the app monitor all voices in a customer's home in case of emergency and that this should be done automatically. Emergencies could include break-ins, medical emergencies, fires or a situation in which the word 'help' is used.

As a result, the app is programmed to monitor all speech detected from registered customers. However, the app has started reporting incidents when no-one is at home but a television has been left on.

John's expertise is in transaction security and he believes that the voice data collected does not have to be treated as sensitive information as it contains no personal information, such as credit card details. FRIDGESMART has contracted a cloud service provider to store the voice data from HOMEMADE. The data is backed up automatically. FRIDGESMART does not know where the data is physically stored.

a. Identify the relevant legislation that applies to this type of constant voice monitoring. 1 mark

b. Describe how this type of constant voice monitoring could be considered a breach of the legislation identified in **part a.** 3 marks

c. John suggests adding some functions to the app's voice monitoring feature so that it will not allow foods to be added to an order if there are food allergies or medical conditions to be considered. For example, if the app detects a conversation about an avocado allergy, it will not allow avocados or products containing avocado to be ordered.

Outline **one** ethical concern regarding John's suggestion for the constant voice monitoring feature. 2 marks

Question 13 (7 marks)

John has employed a security expert to help ensure the security of the FRIDGESMART app. John has concerns about the software and data security of the app as well as about potential consequences for FRIDGESMART if it does not identify the risks.

a. John is concerned about a man-in-the-middle attack.

Describe a man-in-the-middle attack and how such an attack could affect FRIDGESMART. 3 marks

b. State **two** potential risks if the security vulnerability described in **part a.** is not fixed. 2 marks

c. Explain **one** way in which FRIDGESMART could ensure that all customers using the app employ appropriate software security controls to protect the software and the company's data. 2 marks

Question 14 (4 marks)

John has suggested to FRIDGESMART that it develop a risk management plan that includes strategies to minimise security vulnerabilities in its software development practices for any future projects.

Recommend two key risk management strategies, as part of a risk management plan, and outline how each strategy would minimise security vulnerabilities.

Risk management strategy 1 _____

Risk management strategy 2 _____

END OF QUESTION AND ANSWER BOOK

Insert for Section C – Case study

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

The FRIDGESMART company

FRIDGESMART is a small, family-owned electrical appliance company that specialises in refrigerators. FRIDGESMART wants to expand its business and has been investigating the inclusion of touchscreen technology for its new refrigerator range. The touchscreen technology will identify food items in the refrigerator that need to be ordered and send the order to HOMEMADE, a large food product supplier.

FRIDGESMART recognises the value of partnering with HOMEMADE, who will be its sole provider of food products and who will manage deliveries ordered through an app.

FRIDGESMART has employed John Jones to manage and develop the software solution for the touchscreen technology. John has been developing software solutions for several years and specialises in secure online transactions.

John has already developed Version 1.0 of the FRIDGESMART app as a prototype. This is an initial version of the app, from which later versions can be developed.

The FRIDGESMART app

The touchscreen technology will utilise an app that runs on the refrigerator and on desktop computers and mobile devices.

The app provides customer authentication through voice and face recognition, and through a username and password. It allows customers to set up an account with HOMEMADE. Customers will provide details such as their first name, surname, address, credit card details and mobile phone number, and will be able to allow or block notifications (on/off) and set customer permissions (including voice and photo access). These details will be sent to HOMEMADE.

Within the refrigerator is a camera that will record and track the items' barcodes and the times the items are taken from or placed in the refrigerator. The app will check each item's barcode against the order file at HOMEMADE. All goods sent by HOMEMADE, including fresh produce, will come with barcodes. If an item's barcode is not present in HOMEMADE's order file, an error notification will be sent to the app for the customer to take action. If an item's barcode is present, the item will be added to the order.

The app will automatically add items to a weekly order based on parameters set by the customer. For example, when only one 2 L milk container remains in the refrigerator, the app will add one 2 L milk container to the order, if the customer has set this as a parameter.

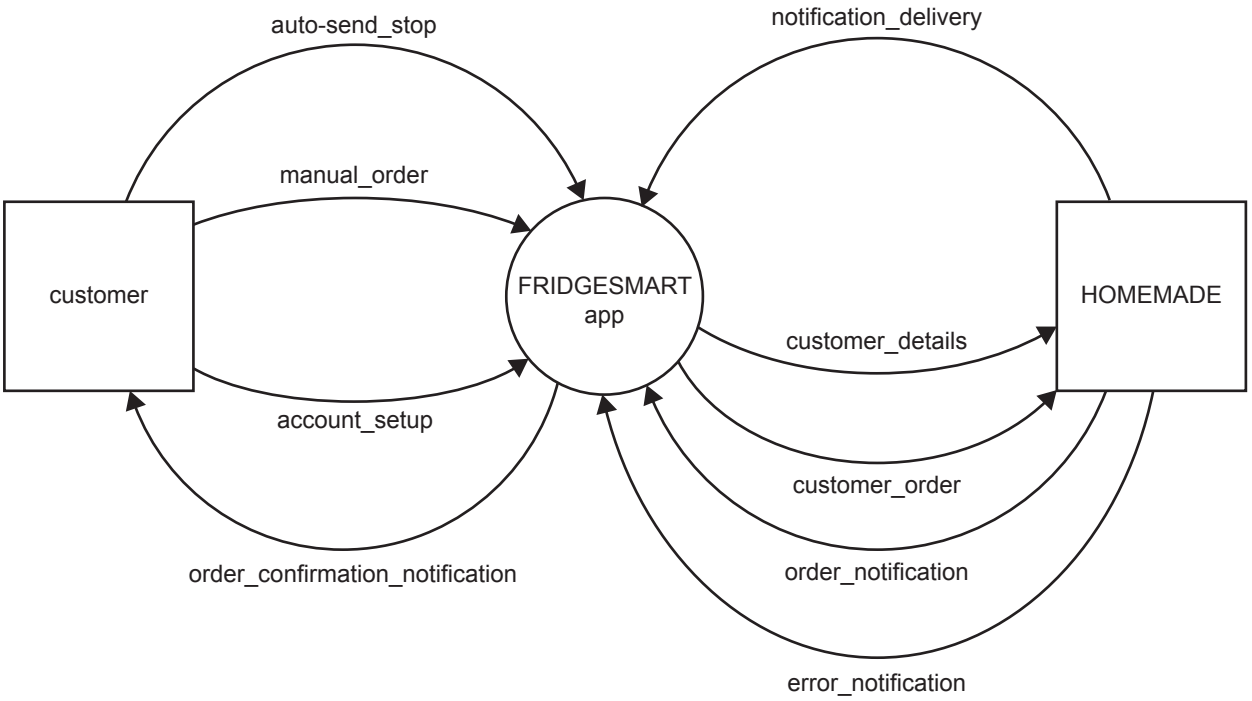
When an order reaches a default value of $100, HOMEMADE will organise next-day delivery to the customer. Otherwise, at 9 am each Friday, the order will be automatically sent to HOMEMADE for delivery the following Saturday. However, a customer can stop the auto-send prior to 9 am on the previous Friday through the app. Once the full system is developed, customers will be able to change the default value.

A customer can also add to their HOMEMADE order through the app and HOMEMADE will confirm the order through the app. The app will then send an order confirmation notification to the customer.

Once HOMEMADE has delivered the items, the app will receive a notification that the items have been delivered, even if the items have not yet been placed in the refrigerator.

John Jones has created a draft context diagram, as shown on page 3 of this insert.

Context diagram



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