

Print exam correction: Section C, Q12,
6th line of code, final bracket after
'wordLibrary' deleted

STUDENT NUMBER Letter

APPLIED COMPUTING: SOFTWARE DEVELOPMENT

Written examination

Thursday 9 November 2023

Reading time: 2.00 pm to 2.15 pm (15 minutes)

Writing time: 2.15 pm to 4.15 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	17	17	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 26 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.

Use the following information to answer Questions 1–3.

The following pseudocode describes a search algorithm.

```

Function search (list[], low, high, target)
1   While low <= high
2       mid ← (low + high)/2
3       If target = list[mid] Then
4           Return mid
5           End search
6       Else If target > list[mid] Then
7           low ← mid + 1
8       Else
9           high ← mid - 1
10      End If
11  End While
12  Return -1
End search

```

Part of a trace table for the algorithm is shown below.

Line	target	low	high	low <= high	mid	target = list[mid]	target > list[mid]
1	25	0	9	0 <= 9 ? True			
2	25	0	9		4		
3	25	0	9		4	25 = 17 ? False	
6	25	0	9		4		25 > 17 ? True
7	25	5	9		4		
10	25	5	9				
1	25	5	9	5 <= 9 ? True	4		
2	25	5	9		7		
3	25	5	9		7	25 = 23 ? False	

Question 1

The type of algorithm shown in the pseudocode is a

- A. binary search.
- B. insertion sort.
- C. linear search.
- D. quick sort.

Question 2

Which one of the following lists of numbers could have been used in this trace?

- A. 1, 8, 17, 23, 25, 27
- B. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- C. 8, 27, 1, 19, 17, 23, 21, 4, 13, 25
- D. 1, 4, 8, 13, 17, 19, 21, 23, 25, 27

Question 3

In the algorithm provided, the statement 'Else' relates to which one of the following control structures?

- A. iteration
- B. selection
- C. a method
- D. a function

Question 4

Within an application's code base, comments can be used to describe the function of particular sections of code and support future maintenance of the application.

How do programming languages differentiate between the code to be executed and comments that should be ignored?

- A. Comments are stored in a separate file to the code.
- B. Comments are only placed at the very start of the file containing the code.
- C. Comments commence with a symbol character or sequence of characters.
- D. Programming languages are intelligent enough to tell the difference between code and comments.

Question 5

The following lines of data need to be stored within a program.

A	leaf
B	enfix
B	guess
C	haunt
1	shell
1	program
2	frequency
3	consciousness

Considering the information above, which one of the following data structures would be most appropriate to use?

- A. a record
- B. an array of strings
- C. an array of integers
- D. an associative array

Question 6

In which stage of the problem-solving methodology does collecting data to determine requirements take place?

- A. design
- B. analysis
- C. evaluation
- D. development

Use the following information to answer Questions 7 and 8.

Poh is planning to introduce new software. When checking the customer satisfaction logs of the existing system, Poh identifies that the current software does not cater to the needs of users from diverse cultural backgrounds.

Question 7

In analysing the needs of the new software, which data collection technique is Poh using?

- A. logs presented in a report
- B. an interview
- C. observation
- D. a survey

Question 8

Given that Poh is looking to meet the needs of users from diverse cultural backgrounds, what type of constraint would this place on the development of the solution?

- A. legal
- B. social
- C. technical
- D. economic

Question 9

If the completion of an entire project is delayed because one particular task has taken longer to complete than expected, that task must be

- A. a milestone.
- B. a Gantt chart.
- C. on the critical path.
- D. the last task in the project.

Question 10

Under the *Privacy Act 1988*, organisations are required to

- A. de-identify all sensitive or personal information.
- B. notify individuals of the reasons for collecting their personal data.
- C. withhold an individual's personal data, despite the individual making a reasonable request for access.
- D. disclose the precise storage location of all personal and sensitive data related to an individual, including data stored locally and in the cloud.

Question 11

Moe regularly uploads large files (1–2 GB) to an online cloud storage provider and is concerned that his uploads are taking longer than he expected. He investigates a series of possible upgrades that he hopes will improve his upload speeds. The upgrades are shown in the following table.

Option	Current setup	Upgrade option
1	Hard drive: read speed of 120 MBps	Solid state drive: read speed of 500 MBps
2	Wi-fi router on 802.11g: up to 54 Mbps	Wi-fi router on 802.11ac: up to 1.3 Gbps
3	NBN current plan: 50 Mbps download, 20 Mbps upload	NBN upgraded plan: 250 Mbps download, 50 Mbps upload
4	Laptop RAM: 8 GB	New laptop RAM: 32 GB

Considering the information above, which upgrade would be most likely to reduce the time to upload the files to the cloud storage provider?

- A. Option 1
- B. Option 2
- C. Option 3
- D. Option 4

Question 12

An online store is developing a software solution that will improve order tracking, including sending mobile phone notifications directly to customers as their order is processed, sent and delivered.

An objective of this software solution could be to

- A. improve service to customers.
- B. increase sales by 25 per cent over the next year.
- C. become one of the leading toy stores in Australia.
- D. reduce customer complaints regarding lost or delayed orders by half.

Question 13

In which stage of the problem-solving methodology is a strategy developed to determine whether a solution has met requirements?

- A. design
- B. analysis
- C. evaluation
- D. development

Question 14

Stephen is writing a block of code that will accept coordinates as parameters and return a Boolean value to indicate whether the given location is on land. This code will be called from multiple different parts of his program.

This block of code is most likely

- A. a control structure.
- B. an instruction.
- C. a function.
- D. a method.

Question 15

The following diagram represents a data structure that can be used to organise related data of a single data type. The index for the data structure uses integers.

0	1	2	3	4
5	10	22	6	

Which of the following data structures does the diagram represent?

- A. array
- B. record
- C. variable
- D. associative array

Question 16

John and Deepa are discussing characteristics of efficient and effective software solutions, in preparation for writing some evaluation criteria.

Which of the following is a characteristic of an effective software solution?

- A. authenticity
- B. completeness
- C. cost of data processing
- D. speed of processing instructions

Question 17

A finance officer at a school receives an invoice via email from the school's regular stationery supplier. He notices that the supplier's banking details on the invoice have changed.

The finance officer contacts the supplier, who confirms that they sent the invoice but their banking details have not changed.

This could suggest that the stationery supplier is a victim of

- A. a data breach.
- B. a phishing scam.
- C. social engineering.
- D. a man-in-the-middle attack.

Question 18

A website allows users to add product ratings or reviews without logging in or demonstrating that they have ever purchased the product they are reviewing.

The characteristic of data integrity that is most affected by this practice is

- A. accuracy.
- B. timeliness.
- C. authenticity.
- D. maintainability.

Question 19

Use case diagrams are used to outline and summarise how

- A. data is manipulated and flows through a system.
- B. actors interact with a system and its functions.
- C. external entities interact with a system.
- D. data is transmitted across a network.

Question 20

The *Health Records Act 2001* applies in which one of the following places?

- A. Victoria
- B. Queensland
- C. New South Wales
- D. All states of Australia

SECTION B – Short-answer questions

Instructions for Section B

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

Question 1 (2 marks)

Identify and describe one characteristic that a well-constructed software requirements specification (SRS) would have.

Characteristic _____

Description _____

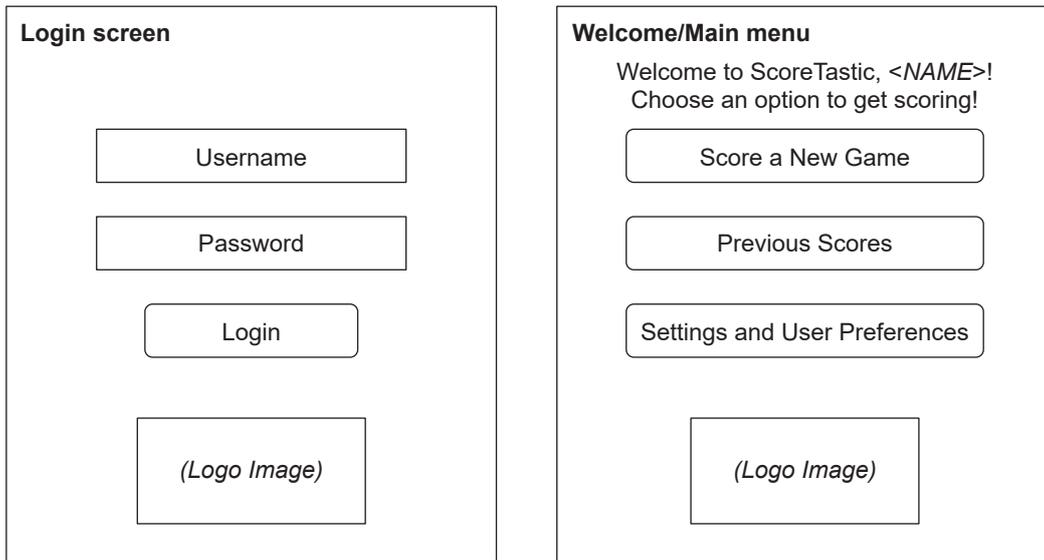
Question 2 (2 marks)

Explain why it is sometimes necessary to store numbers in a string data type variable. Provide an example of when numbers should be stored as a string, rather than as a numeric data type.

DO NOT WRITE IN THIS AREA

Question 3 (4 marks)

An app developer is creating a sports-scoring application for mobile devices that is currently in the design stage. Two of the solution designs are shown below.



- a. Identify the type of design tool used for the sports-scoring application. 1 mark

Other design tools, such as object descriptions and pseudocode, could be used to represent different aspects of the solution design.

- b. Explain how object descriptions and pseudocode represent different aspects of the solution design, in comparison to the design tool identified in **part a**. 3 marks

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Question 4 (5 marks)

Ananta is the team leader in a software development company that is creating a workflow management tool for a large marketing organisation. The clients are hoping that the new software will be capable of supporting their employees in monitoring the production of high-quality marketing and advertising materials.

As the project is nearing completion, Ananta is looking to conduct usability testing. She knows that members of the development team should not be participants in the usability tests.

- a. Identify who should participate in the usability test and explain why. 2 marks

To record the results of the usability tests, Ananta is considering two methods of collecting information.

Method 1: Recording a video of the tests.

Method 2: Observing the tests directly so she can ask clarifying questions.

- b. Identify which option Ananta should use. Justify your answer. 3 marks

Question 5 (5 marks)

- a. Describe why a risk-management strategy should be applied as part of an organisation’s software development practices. 1 mark

- b. Using the categories provided below, propose a risk-management strategy that could be used during the development of a software application. 3 marks

Technique _____

Responsibility _____

Timing _____

- c. Suggest **one** benefit of using the technique proposed in **part b.** 1 mark

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Question 6 (2 marks)

Compare how version control is different from backing up a file.

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**END OF SECTION B
TURN OVER**

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 (4 marks)

- a. Name the specific development model that Ness's team will use during the development of this application. 1 mark

- b. Complete the diagram to represent the development model that Ness has chosen to use for the development of this application.

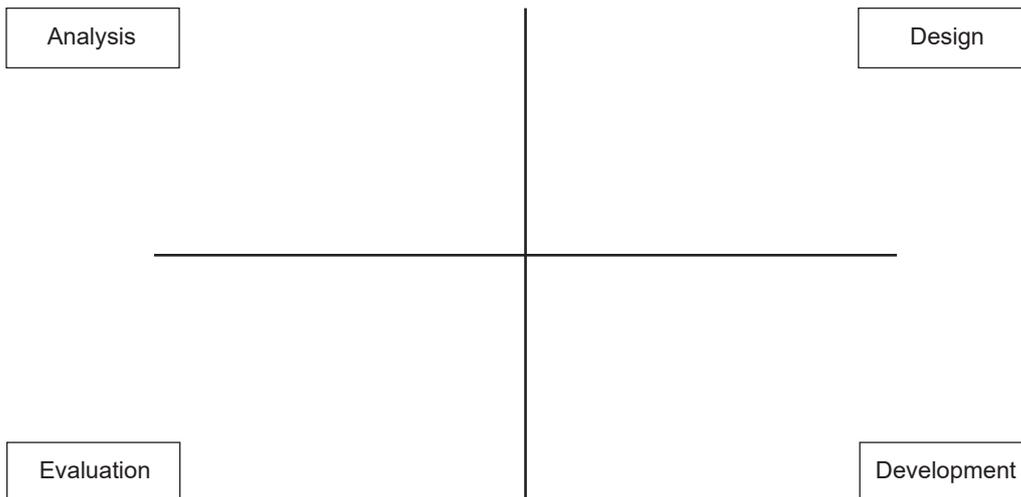
The start of each phase should be represented on the diagram after completing the key below. 3 marks

Key

1 _____

2 _____

3 _____



Question 2 (3 marks)

Ness has explained her expectations about secure development practices to her team. These expectations are outlined in the case study.

Suggest three criteria that Ness could use to evaluate the effectiveness of the secure development practices she will be putting in place.

Criterion 1 _____

Criterion 2 _____

Criterion 3 _____

Question 3 (2 marks)

To ensure that the team can work efficiently and effectively throughout the development of the platform, Ness and her team need to select a naming convention. It will be used by all team members throughout the project when naming variables, functions and other components of their code base.

Describe **one** characteristic that their naming convention should incorporate. Provide an example of what this characteristic would look like when implemented in this solution.

Question 4 (4 marks)

Part of the project plan is shown below.

Task ID	Task name	Predecessors	Days											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Interview and appoint new developers	–	█	█	█	█								
2	Complete project plan	–	█	█	█	█	█							
3	Purchase and set up developer equipment	1					█	█						
4	Assign budget	2						█	█	█	█			
5	Agree on development practices	3, 4										█	█	█
6	Milestone: Ready for Phase 1	5												◆

Once Ness has completed the initial project plan, there are likely to be changes.

- a. Describe a technique she could use for recording the progress of the project to identify any changes made to the project plan. 2 marks

A member of the development team fears that Task 3 (‘Purchase and set up developer equipment’) could take up to six days instead of the planned two days.

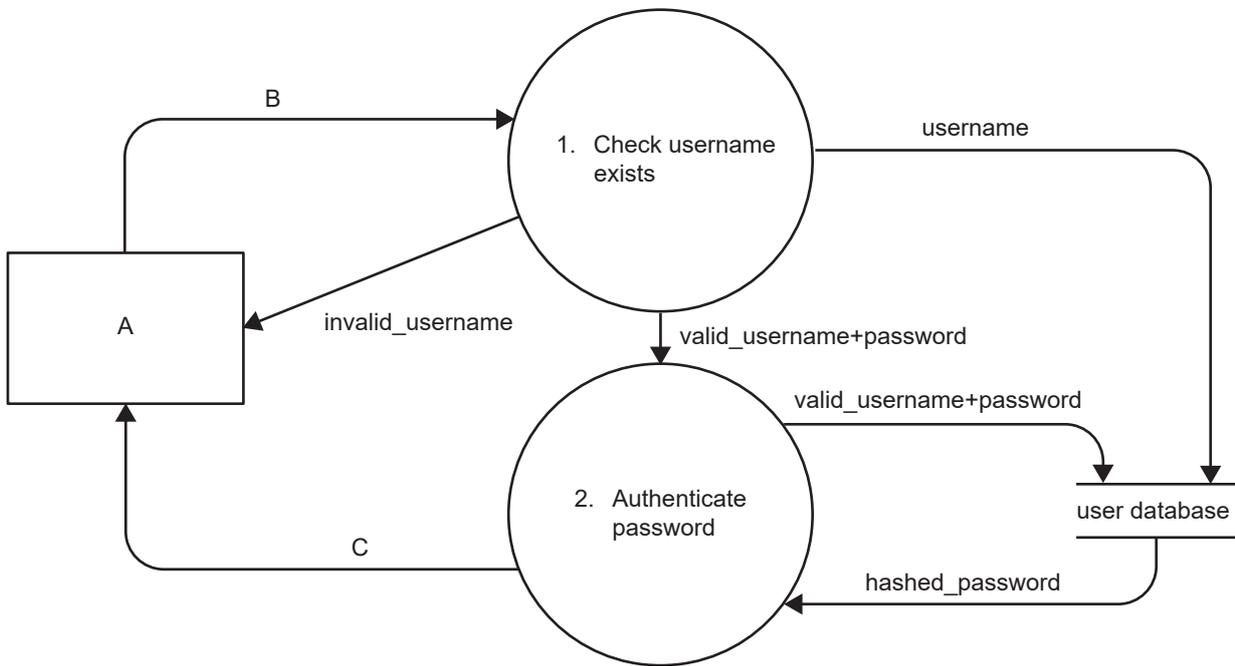
- b. Describe the likely impact this will have on the timing of the milestone ‘Ready for Phase 1’. 2 marks

DO NOT WRITE IN THIS AREA

Phase 1: User profile (including authentication) module

Question 5 (3 marks)

Below is a partial data flow diagram (DFD) representing the authentication process.



Referring to the context diagram in the case study insert, identify the correct names for the following labels.

A: _____

B: _____

C: _____

Question 6 (1 mark)

Users will be asked to provide a billing address, including postcode and state (for example, Victoria), when creating a profile on the platform.

They will enter which state they are from, and then their postcode. The postcode will then be checked to ensure that it matches the state that was entered.

Identify a feature of a user interface that could be used to facilitate effective and efficient entry of the user's state.

Feature _____

Question 7 (5 marks)

Ness originally planned to purchase high-quality test data as part of the testing of the user profile and authentication module.

Unfortunately, she found that purchasing this data would cost significantly more than she had budgeted for, which would make it almost impossible to finish the project.

The finance manager has told Ness that she must either reduce the size of her team by eliminating two members' roles from the organisation, or purchase lower-quality test data.

- a.** Identify **two** possible consequences that might arise from this ethical issue. 2 marks

- b.** Suggest a possible method of resolving **one** of the consequences identified in **part a.** and describe an advantage and a disadvantage of taking this approach. 3 marks

Method _____

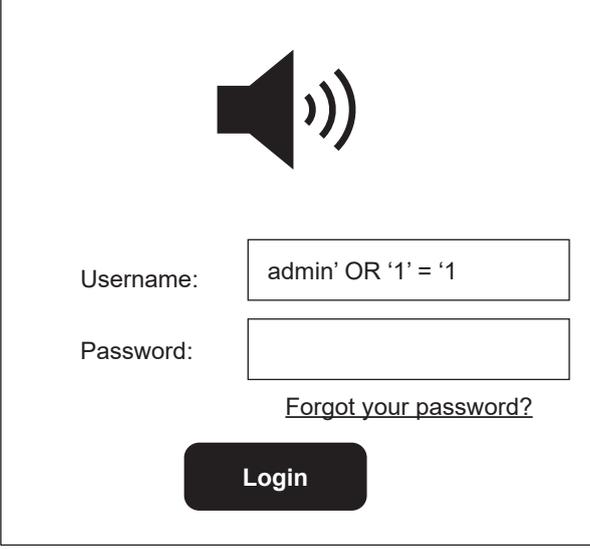
Advantage _____

Disadvantage _____

Question 8 (4 marks)

As part of the security testing for the platform, *admin' OR '1' = '1* is entered into the username field on the 'user log in' section of the platform.

The diagram below shows a screenshot provided for clarity.



The screenshot shows a login interface. At the top center is a speaker icon. Below it are two input fields: 'Username:' containing the text 'admin' OR '1' = '1' and 'Password:' which is empty. Below the password field is a link that says 'Forgot your password?'. At the bottom center is a black button with the text 'Login' in white.

- a. Identify the type of risk posed to the platform. 1 mark

- b. Provide **two** reasons why malicious individuals might use the risk identified in **part a.** on the platform. 2 marks

- c. Suggest how the risk identified in **part a.** could be mitigated. 1 mark

Phase 2: Transcription module**Question 9** (3 marks)

Ness's team has developed some designs for the transcription module's interface (Figure 3 in the case study insert), as well as three evaluation criteria that will be used to evaluate the designs they have come up with (Figure 4 in the case study insert).

Use the provided criteria to select a preferred design, Design A or Design B. Justify your choice.

Preferred design _____

Justification _____

DO NOT WRITE IN THIS AREA

Question 10 (4 marks)

The process for uploading a file for transcription will involve checking that the selected file can be processed by the platform's artificial intelligence (AI).

Users select a file from their device and the platform will check the file extension. If the check determines that a valid audio (.m4a, .mp3, .flac, .ogg or .wav) or video (.mp4, .avi, .ogv or .mov) file has been selected, it will upload the file for transcription and the process will continue.

If any other file type (including audio and video file types other than those listed) has been selected, a message will be displayed to the user indicating that the file is incompatible with the platform and then asking the user to upload a different file.

- a. Construct a set of tests to fully test the checking of files uploaded to the platform. 2 marks

Proposed test	Example file name	Expected result
Compatible/valid extensions		
Incompatible/invalid extensions		

- b. Explain how the use of an error message when an attempt is made to upload an incompatible file would increase the effectiveness of the user interface of the platform. 2 marks

Question 11 (5 marks)

George and Regina, two members of the team, are discussing the processing features to use in the development of the transcription module.

One discussion is about the code required for uploading audio recordings, which results in the text transcription of the file. George is saying that a function is the best structure to use, while Regina is suggesting that a method should suffice.

- a. Justify why a function should be used within the platform’s code. 3 marks

- b. George and Regina start considering how classes could be used within the module. Describe how the development team could use a class within the transcription module. 2 marks

DO NOT WRITE IN THIS AREA

Question 12 (6 marks)

The team knows that the accuracy of transcriptions will be an important non-functional requirement for the platform.

They have generated an algorithm that will compare each word in the transcription (generated by the AI), with a library of words from previously transcribed audio. The transcribed word will then be checked against the matched audio from the uploaded recording. Where an inaccurately transcribed word is detected, the word will be re-transcribed and the transcription updated with the new text. The new text will then be re-checked by the algorithm.

This algorithm is outlined below.

```

Begin
  For i ← 0 to transc_text.length - 1
    Set error to -1
    Set matched to true
    If compare(transc_text[i],
      wordLibrary[]) is false Then
      Set matched to false
    End If
    If matched is true Then
      Set matched to result of
        audio_Check(rec[i])
    End If
    If matched is false Then
      Set error to i
      reTranscribe(rec[error])
      Subtract 1 from i
    End If
  Next i
End

```

Using the information and algorithm provided, complete the data dictionary below.

Name	Data type/structure	Description
error	integer	Used to determine the position of an error within the transcription
transc_text[]		Collection of words that have been transcribed from the uploaded audio
rec[]	array (audio)	
i		
	Boolean	Used to determine whether an issue with the transcription has been detected
wordLibrary[]		Collection of words from previously transcribed audio

Phase 3: Translation module**Question 13** (3 marks)

The development of the platform was delayed during the testing of the transcription component of the solution. The business's management insists that Ness must ensure that the new product is released on time. One suggestion is to integrate a third-party AI-based translation service into their platform to help launch the platform on time. Ness's team has identified a particular product that could be integrated into their product; however, she is worried that this approach could present some issues in the medium- and long-term future.

Propose how Ness and her team could manage each of the following risks that she has identified.

Risk 1: Loss of access to the AI-based translation service during server maintenance conducted by the third party.

Proposal _____

Risk 2: Security vulnerabilities could be introduced into the platform.

Proposal _____

Risk 3: User data could be transferred internationally without their knowledge.

Proposal _____

Question 14 (4 marks)

The translation module takes the source document and splits it into paragraphs, resulting in an XML file being generated. The module then sends each paragraph to the API (application programming interface) as separate requests/calls, working through each paragraph node in the file. As each paragraph is translated, the API adds the translated data to the end of the original XML file.

One of the junior developers recommends using a CSV file to send the data to the API; however, Ness disagrees.

- a. Justify why it is better to use an XML file in this scenario, rather than a CSV file. 3 marks

- b. From the options below, circle **one** factor that would influence the decision to use an XML file when designing the module. 1 mark

affordance interoperability marketability security

Question 15 (3 marks)

Describe a suitable backup procedure that Ness could use while working on the project.

Question 16 (2 marks)

As development of the platform is nearing completion, Ness is preparing to review the platform for maintainability, security and legal compliance purposes.

Suggest two areas of investigation that Ness could include in reviewing these aspects of the platform.

Suggestion 1 _____

Suggestion 2 _____

Question 17 (4 marks)

At the conclusion of the development of the translation module, and overall project, Ness will assess the effectiveness of her project plan.

- a. Propose how the project plan could be assessed for its effectiveness. 2 marks

- b. Explain why it is important for Ness to assess how the project plan has assisted in monitoring the progress of the project. 2 marks

DO NOT WRITE IN THIS AREA

Insert for Section C – Case study

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

A software-as-a-service (SaaS)¹ development business currently provides productivity and project-management software to clients. The business has decided to offer translation² and transcription³ services using artificial intelligence (AI). The business is based in Melbourne, and has offices around the world. Ness is the development leader on the project. Her team will predominantly be based in Melbourne although some staff will be working remotely in offices overseas.

In her preliminary planning and work on the project, Ness has decided on using an iterative approach, where three complete phases of the problem-solving methodology will take place. Each phase will take place as follows:

Phase 1: User profile (including authentication) module

Phase 2: Transcription module

Phase 3: Translation module

She has also drawn a sketch of the intended workflows for the application when it is complete.

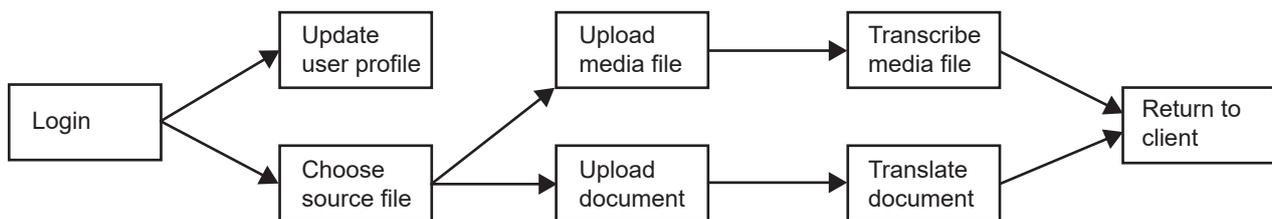


Figure 1: General workflow of the platform

Establishing expectations for secure development

Ness wants secure development practices at the forefront of her team's thinking when they are developing the platform. The following secure development practices will be implemented:

- two-factor authentication (password and swipe card) to access office spaces and devices working on the project for everyone involved
- logs that record user access to office spaces and the development environment, including failed attempts at access
- ongoing professional learning about secure development practices
- ongoing code auditing for security vulnerabilities
- ongoing code auditing to meet industry standards and legal requirements around security.

These practices will be evaluated for their effectiveness once the project has been completed.

¹**Software-as-a-Service (SaaS)** – Application hosted online. Users typically have a subscription to the service and access the application through a web browser, rather than installing the application on their device.

²**Translation** – The process of converting written or spoken words from one language into another, while maintaining the meaning of the original text.

³**Transcription** – The process of converting speech or audio into a written or typed text document.

Application development

Phase 1: User profile (including authentication) module

The user profile and authentication procedures are outlined below.

- When users sign up to the platform, they provide personal details, including name, email address and billing information (including address). Users are then asked to verify their email address by clicking a link in a confirmation email.
- Once verified, users are able to log in using their email address and password combination.
- Once authenticated, users can access their user profile and the translation and transcription services offered (when the solution is fully developed).

A context diagram representing this is shown below.

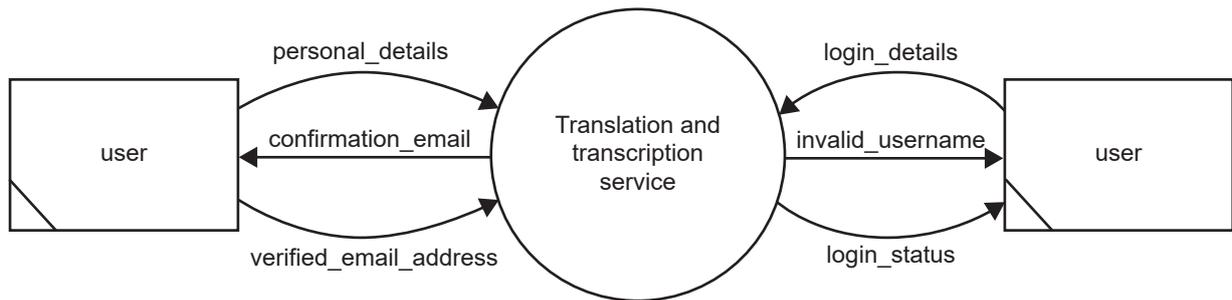


Figure 2: Context diagram for this module

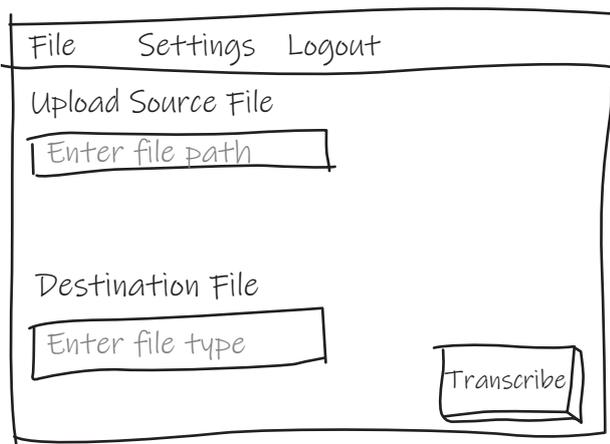
Due to the size of the business, the development team is required under the *Privacy Act 1988* to ensure that the personal details of users, and their data, are protected from unauthorised access and misuse.

Phase 2: Transcription module

Once the user profile module is completed, an analysis of requirements for the transcription module will be conducted. The team is now working on the design of the transcription module.

Two alternative designs for the transcription module user interface have been developed.

Design A



Design B

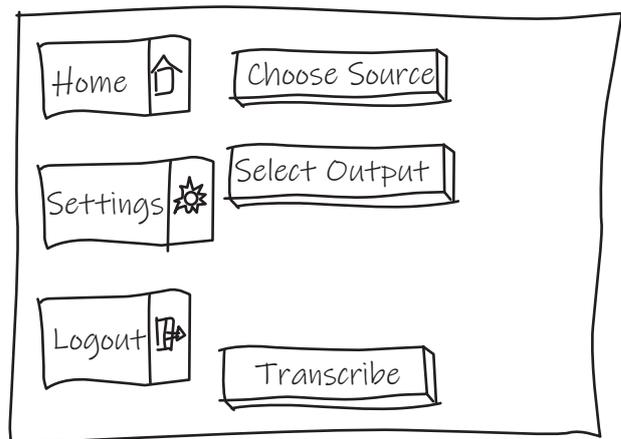


Figure 3: Designs for the transcription module's user interface

Ness's team has also designed the three evaluation criteria below to use when evaluating the designs for this module.

- Criterion 1:** Design follows common layout conventions for easy navigation.
- Criterion 2:** Design uses standard symbols to communicate functions.
- Criterion 3:** Design minimises typing to be more efficient across a range of devices.

Figure 4: Evaluation criteria for the transcription module's user interface

Phase 3: Translation module

Initially the translation module will accept documents in one of five languages (Chinese, English, French, Arabic and Spanish) and be able to translate between languages (for example, English to French, French to English, French to Arabic). It is intended that eventually 50 languages will be supported by the platform.

Due to a delay in the development of the solution, it has been recommended that a third-party translation service be used to ensure that the platform can be released on time. This third-party service will be accessed by the module, using API (application programming interface) requests/calls.