

## YEAR 12 *Trial Exam Paper* 2021

### APPLIED COMPUTING: SOFTWARE DEVELOPMENT

#### Written examination

Reading time: 15 minutes

Writing time: 2 hours

**STUDENT NAME:**

### QUESTION AND ANSWER BOOK

#### Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	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 27 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 **name** in the space provided above on this page and on the multiple-choice answer sheet.
- All written responses must be in English.

#### At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.
- 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.**

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

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

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

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

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

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

**Question 1**

The most appropriate data type to store a client code such as EV118105 is

- A. string.
- B. integer.
- C. Boolean.
- D. floating point.

**Question 2**

Amal writes a software solution that automatically copies all modified data files to a network-attached storage (NAS) device at 11.59 pm every night.

This procedure for managing files would be considered as

- A. restoring.
- B. archiving.
- C. disposing.
- D. backing up.

**Question 3**

In order to fix problems with self-service supermarket registers, such as item barcodes not being recognised, an employee must swipe their ID pass over the barcode scanner.

This is an example of

- A. version control.
- B. software updates.
- C. user authentication.
- D. password encryption.

*Use the following information to answer Questions 4–6.*

Fatemeh has been asked by her coach to make a software solution to store and process the statistics for her basketball team. This would allow the coach to rotate players from the bench to appropriate positions so that all players get a fair amount of game time and sufficient rest breaks.

**Question 4**

Which one of the following would best document this need or opportunity?

- A. Gantt chart
- B. use case diagram
- C. data flow diagram
- D. problem statement

**Question 5**

Which one of the following is the least appropriate data gathering technique to determine the functional requirements of this solution?

- A. survey the players
- B. interview the coach
- C. read the coach's game notes
- D. observe the bench rotations at a game

**Question 6**

Which data structure would be most appropriate to contain the data about a player's time on and off the court and the position they played during that time?

- A. a class
- B. a record
- C. a function
- D. a one-dimensional array

Use the following information to answer Questions 7 and 8.

```
BEGIN  
x ← 0  
y ← 5  
WHILE y > 2 DO  
    answer ← x + 2 * y  
    x ← x + 2  
    y ← y - 1  
END WHILE  
RETURN answer  
END
```

### Question 7

Which one of the following statements is correct in regard to the pseudocode above?

- A. After the second loop of the pseudocode, the value of 'x' is 2.
- B. After the second loop of the pseudocode, the value of 'y' is 2.
- C. After the third loop of the pseudocode, the value of 'answer' is 10.
- D. After the fourth loop of the pseudocode, the value of 'answer' is 10.

### Question 8

The programmer using the pseudocode intends to modify it to allow users to enter their own numbers from 0 to 100 for the variables 'x' and 'y'.

Which form of validation would be applied to these variables to restrict the values to the numbers 0 to 100?

- A. type check
- B. check digit
- C. range check
- D. existence check

### Question 9

Phuong is a game developer who wants his latest game project to run on different gaming consoles, as well as on PCs and tablets.

This is an example of

- A. a usability constraint.
- B. an economic constraint.
- C. a technical requirement.
- D. a non-functional requirement.

**Question 10**

A software requirements specification (SRS) includes appendices.

Which one of the following would be in the appendices?

- A. scope
- B. context diagram
- C. user characteristics
- D. purpose and audience

**Question 11**

Which of the following are valid methods of expressing solution designs?

- A. mock-ups and brainstorming
- B. pseudocode and testing tables
- C. use case diagrams and algorithms
- D. data dictionaries and object descriptions

**Question 12**

A factor that influences the design of solutions is affordance.

Which one of the following best demonstrates the concept of strong affordance?

- A. using smaller buttons to save screen drawing time
- B. having buttons greyed out until all information is entered
- C. using fewer controls on a screen to increase user efficiency
- D. having underlined blue text that isn't a hyperlink in a web-based application

**Question 13**

Which one of the following actions would be considered a possible breach of the *Privacy Act 1988*?

- A. A social media site based in France sells its members list to advertisers.
- B. A fish and chip shop keeps a phone book with customer names and phone numbers.
- C. A government agency provides information about one of its clients to the police during an investigation.
- D. A large supermarket chain has its loyalty program member database in Melbourne hacked and the information stolen.

Use the following information to answer Questions 14–16.

A university wishes to store the names and faculties of its tutors in a data structure for easy lookup. An associative array named ‘tutors’ is created with the following data.

GivenName	Faculty
Abel	Chemistry
Bella	Biology
Brianna	Physics
Chun	Chemistry
Daleyza	Biology

An algorithm to change this associative array is presented below.

```

ALGORITHM changeTutor
BEGIN
    INPUT nameToChange, newFaculty
    IF tutors[nameToChange] exists THEN
        tutors[nameToChange] ← newFaculty
        RETURN "Faculty member swapped to " + newFaculty
    ELSE
        RETURN "Faculty member not found"
    ENDIF
END

```

#### Question 14

When a lookup operation is performed on the associative array for the term ‘Chun’, which value is returned?

- A. Chemistry
- B. Abel Chun
- C. Chun Chemistry
- D. Abel Chemistry Chun Chemistry

#### Question 15

The algorithm is processed with ‘nameToChange’ as Brianna and ‘newFaculty’ as Biology.

This algorithm will return

- A. ‘Faculty member not found’.
- B. ‘Faculty member Brianna not found’.
- C. ‘Faculty member swapped to Biology’.
- D. ‘Faculty member Brianna swapped to Biology’.

**Question 16**

Which control structures are used in the algorithm?

- A. sequence only
- B. sequence and iteration only
- C. iteration and selection only
- D. sequence and selection only

**Question 17**

Ada downloads the latest superhero game to her tablet. The game has a file size of 900 megabytes. Her home wireless network has an average speed of 25 megabits per second.

The time taken to download this game is closest to

- A. 5 seconds.
- B. 30 seconds.
- C. 5 minutes.
- D. 30 minutes.

**Question 18**

A software module calculates the body mass index (BMI) of a patient to one decimal place and then returns a weight status of underweight, healthy or overweight according to the following values.

BMI	Weight status
below 18.5	underweight
18.5–24.9	healthy weight
25.0 and above	overweight

Which one of the following data sets would be most appropriate and efficient to test the software module?

- A. 18.5, 22.0, 25.1
- B. 18.0, 19.0, 24.0, 25.0
- C. 18.4, 18.5, 24.9, 25.0
- D. 18.4, 18.6, 22.0, 24.9, 25.0, 25.1

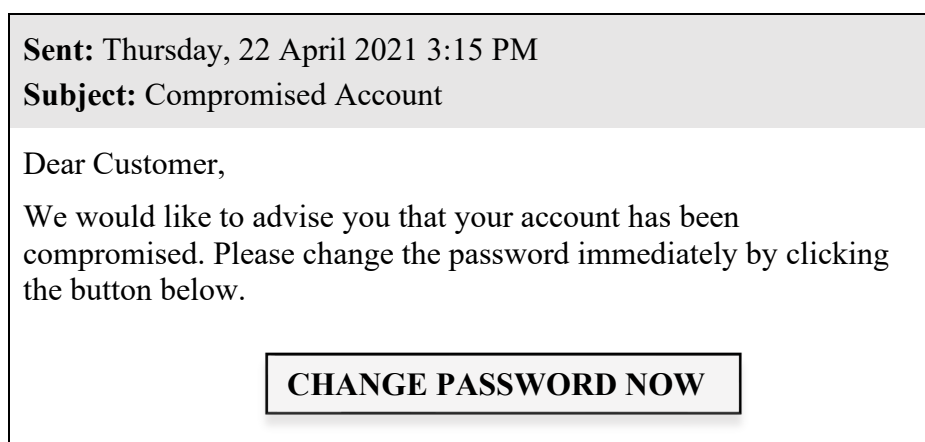
**Question 19**

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

- A. processing speed in seconds
- B. cost of file manipulation in dollars
- C. accuracy of output in decimal places
- D. hard drive space demands in terabytes

**Question 20**

Ken receives an email warning that his account with an online payment system has been compromised. The email advises Ken to 'click here' to go to his account and change the password.



This situation is an example of

- A. a worm.
- B. phishing.
- C. cross-site scripting.
- D. a man-in-the-middle attack.



## SECTION B – Short-answer questions

### Instructions for Section B

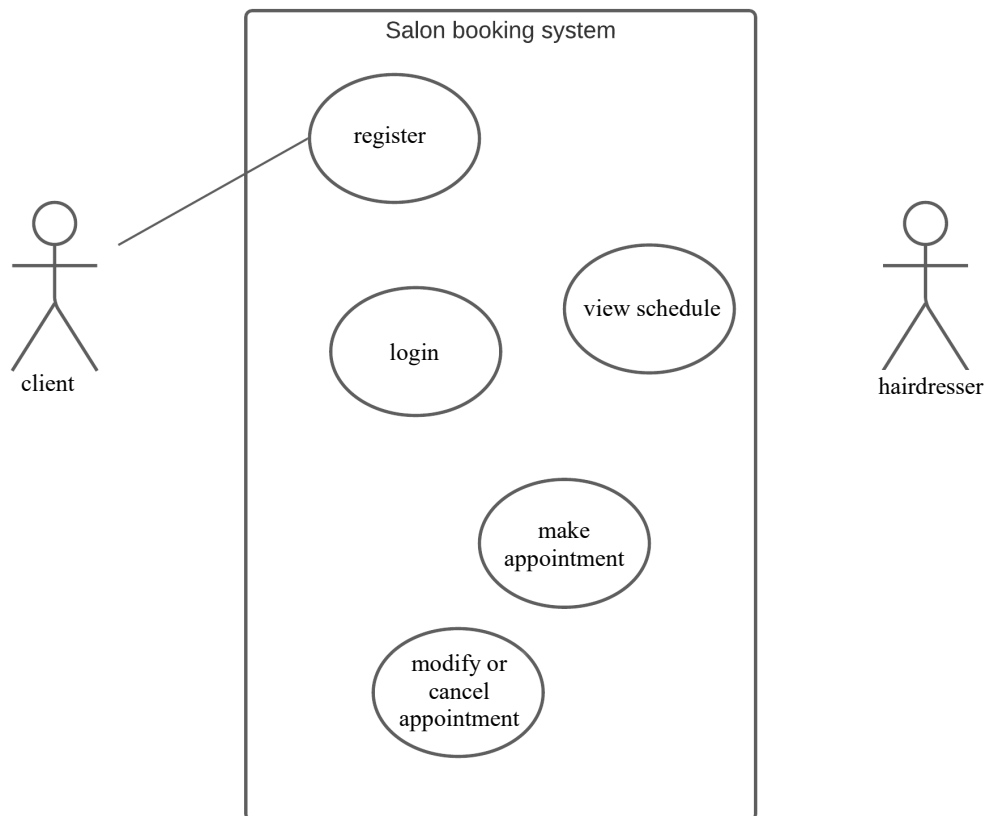
Answer **all** questions in the spaces provided.

#### Question 1 (4 marks)

The use case diagram below shows a simplified set of functional requirements for a hairdressing salon. In this use case diagram:

- Clients can register for an account.
- Once registered and logged in, clients can then make appointments.
- Hairdressers can view their schedule for the day.
- Both clients and hairdressers have the ability to modify and cancel appointments.

Complete the use case diagram below by showing all associations.



**Question 2** (9 marks)

Maya is developing an algorithm to control the function of an electric kettle. The kettle must function as follows:

- The kettle reads the desired temperature for the water from the base unit console (a series of push-buttons in five-degree increments from 80.0 to 99.9 degrees Celsius).
- The kettle reads the current temperature of the water from its internal temperature sensor.
- The kettle sets its internal timer to zero.
- Every second, the kettle checks the current temperature of the water. If the current temperature is less than the desired temperature, the base unit supplies power to the kettle; otherwise the power is turned off.
- When the timer reaches 600 seconds (10 minutes) or the kettle is removed from the base unit, the power is turned off.

The functions ‘Power(ON)’ and ‘Power(OFF)’ are used to represent power being supplied or not supplied to the kettle.

- a. Complete the data dictionary below by identifying the most appropriate data type for the named variables.

4 marks

Variable name	Data type	Description
desiredTemp		the desired temperature of the water, set by the user from the values 80.0, 85.0, 90.0, 95.0, 99.9
currentTemp		the current temperature of the water as measured by the internal temperature sensor, accurate to 0.1 degrees, e.g. 72.5
timer		the internal timer of the kettle, counting in seconds
kettleInContact		indicates whether or not the kettle is in contact with the base unit

- b. Complete the algorithm below by filling in the gaps with correct pseudocode.

5 marks

**Begin**

desiredTemp ← input value from console

currentTemp ← input value from sensor

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**While** kettleInContact = true **And** \_\_\_\_\_

timer ← timer + 1

currentTemp ← input value from sensor

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**End While**

Power (OFF)

**End**

**Question 3** (2 marks)

Jessica and Jacinta are writing a program to teach young children simple word recognition and ordering. They intend to use binary searches to identify whether the word is in the program's word list. They start with a short sample word list, as shown below.

APE	BUN	CAR	CAT	DOG	FOX	HAT	JUG	NAP	PAT	SEA
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Jessica states that it will always take four iterations to show that a word is not in the word list, while Jacinta argues that the word EMU could be proven to not be in the list within three iterations.

Which programmer is correct? Explain your decision.

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**Question 4 (5 marks)**

Scott and Stephen are designing software that accesses files from local memory. They have independently designed their own naming conventions for files, functions and variables, as per the examples shown below.

Entity	Scott's naming convention	Stephen's naming convention
a variable to hold a password	strPwd	password_var
a function to read a record from a file	fReadRF()	read_Record_From_File()
a text file holding settings information	fileSet.txt	user-settings.txt
a table containing usernames and passwords	tblUnPwd	usernames_table

a. State **two** advantages of Scott's naming convention.

2 marks

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b. What is an advantage of Stephen's naming convention? Explain your answer.

1 mark

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c. Scott and Stephen realise that their program is large and they will need to bring in another programmer.

Based on this, recommend one of the two naming conventions to use. Justify your recommendation.

2 marks

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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** (1 mark)

Identify **one** information system goal of the LangLearnPlus lesson delivery system.

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**Question 2** (4 marks)

LangLearnPlus wants to develop forums and chat spaces for its registered members. Virat offers to take on this development. To develop the forums and chat spaces, Virat has a choice of a waterfall development model or an agile development model.

- a.** List an advantage of each model in regard to LangLearnPlus' development of the forums and chat spaces.

2 marks

Waterfall \_\_\_\_\_

\_\_\_\_\_

Agile \_\_\_\_\_

\_\_\_\_\_

- b.** Select **one** appropriate development model for the development of the forums and chat spaces. Justify your selection.

2 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Question 3** (3 marks)

Both teachers and students have requested that the homework related to a lesson be incorporated into the program, rather than needing to be emailed to the relevant teacher. The teachers would prefer to open a program to assess work rather than deal with numerous emails, while the students would rather click a submit button than have to attach a downloaded worksheet to an email.

Jodie has offered to take on the task of programming the homework module and has been given nine weeks. To plan her schedule, she has drafted the Gantt chart below, with Virat occasionally helping her with some of the tasks.

Task no.	Task	Duration	Dependencies	Days									
				1	2	3	4	5	6	7	8	9	
1	Develop SRS	1											
2	Design homework database	2	1										
3	Design screen formats	1	1										
4	Write evaluation criteria	1	2, 3										
5	Write homework module	2	4										
6	Test homework module	1	5										
7	Implement homework module in desktop program	1	6										
8	Implement homework module in app	1	6										
9	Train teachers	1	7, 8										
10	Completed and working homework module	0	9										◆

- a. Complete the Gantt chart by shading the missing task.

1 mark



- b. Complete the table below with the effect that the following events would have on the critical path of the project.

2 marks

Event	Effect on the critical path of the project
Design screen formats is delayed by one week.	
Implement homework module in app is delayed by one week.	

**Question 4** (4 marks)

The first task that Jodie has to complete for the programming of the homework module is to write the software requirements specification (SRS). This document contains functional and non-functional requirements, system and technical requirements, and constraints of the software being developed.

The following statements have been collected from the teachers and students.

- Teachers: ‘The program must allow us to mark the student’s work digitally.’
- Students: ‘The program must work equally well on devices like phones, tablets and desktop PCs.’

- a. Identify the relevant section of the SRS that would consider each statement.

2 marks

Teachers’ statement \_\_\_\_\_

Students’ statement \_\_\_\_\_

- b. The requirements and constraints are used to determine the scope of the SRS.

Describe the purpose of the scope in the SRS for the homework module.

2 marks

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**Question 5** (4 marks)

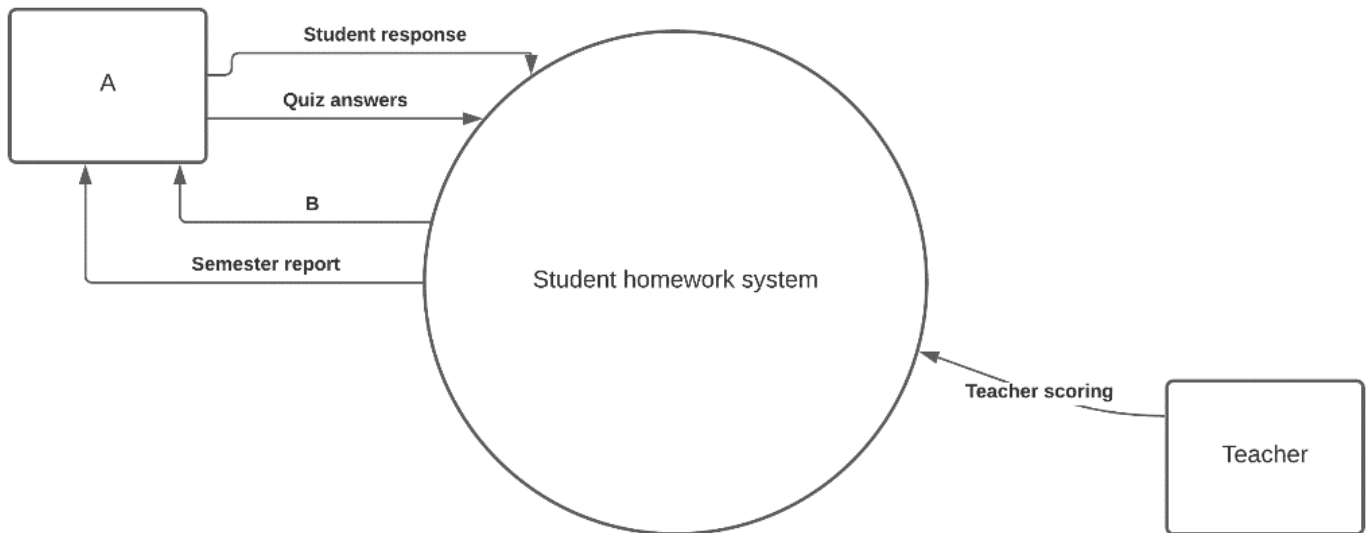
The data flow diagram in the case study (Figure 1) shows the process for students submitting homework and answers to multiple-choice quizzes using the new homework module.

- a. Identify the classification for each of the two items named as entities, data flows, data stores or processes.

2 marks

Name	Classification
Assess homework	
Student records	

The data flow diagram in the case study (Figure 1) represents the student homework system shown in the context diagram below.



- b. Complete the context diagram by writing the correct labels for A and B in the spaces provided below.

2 marks

A \_\_\_\_\_

B \_\_\_\_\_

**Question 6** (4 marks)

As part of the data-gathering process for the development of the chat spaces and forums, Virat has to gather information from students and teachers. The data-gathering techniques he has available are surveys, interviews, observation and reports.

Suggest and justify the most suitable technique to gather data from the teachers, and the most suitable technique to gather data from the students.

Teachers \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Students \_\_\_\_\_

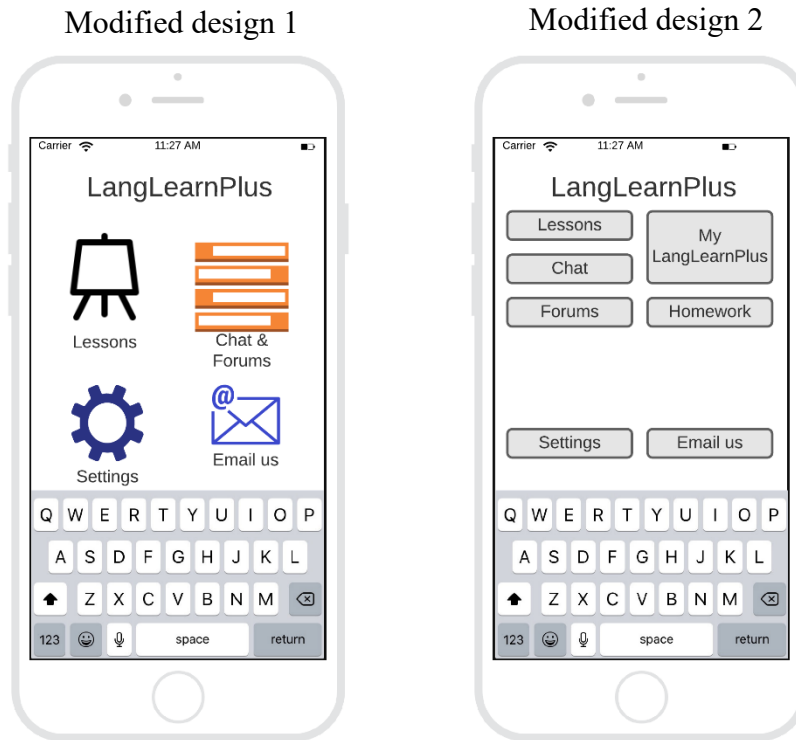
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\_\_\_\_\_

\_\_\_\_\_

**Question 7** (4 marks)

Virat and Jodie have each sketched a modified design for the user interface screen on a phone, as shown below.



- a.** For each design, describe **one** element that would increase the effectiveness or efficiency of the LangLearnPlus app.

2 marks

Modified design 1 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Modified design 2 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- b.** Select the design that would best meet the needs of the students using the LangLearnPlus interface screen. Justify your selection.

2 marks

Modified design selected: \_\_\_\_\_  
 Justification: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Question 8 (6 marks)**

Rather than using external software, the LangLearnPlus teachers have requested that the multiple-choice quizzes also run inside the program so that they have a consistent format. Jodie has written an XML file to store the data for a multiple-choice-quiz question, of which an example is below.

```
<?xml version="1.0" encoding="UTF-8"?>
<question>
<qCode>FRQ001</qCode>
<qDetails>
  <prompt>Which of these is French for hello?</prompt>
  <marks>1</marks>
  <response key="A">bonjour</response>
  <response key="B">au revoir</response>
  <response key="C">comment alles vous</response>
  <response key="D">a bientôt</response>
  <correctResponse>A</correctResponse>
</qDetails>
</question>
```

Jodie also writes the data as a record in a CSV file, as shown below.

```
"FRQ001","Which of these is French for hello?",1,"bonjour","au
revoir","comment alles vous","a bientôt","A"
```

- a.** For the purpose of efficient data storage, which file type would be more appropriate? Justify your response.

3 marks

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- b.** For the purpose of interoperability, which file type would be more appropriate? Justify your response.

3 marks

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**Question 9** (7 marks)

Jodie has been provided with the rules LangLearnPlus uses for determining completion of a topic. Students must score an overall average of at least 70.0% on the multiple-choice quizzes or complete at least eight homework tasks to achieve a completed grade (C), otherwise they receive a not completed (NC). Jodie has produced the pseudocode below. The function calcScore calculates the average score of the multiple-choice quizzes, while the function sumHomework totals the number of homework tasks completed.

**Begin**

```

avgMCScore ← calcScore(student.MCscores)
hwTasksCompleted ← sumHomework(student.HomeworkTasks)
If avgMCScore ≤ 70.0 Or hwTasksCompleted < 8 Then
    overallGrade ← "NC" // not completed
    generateNCemail(student.email)
Else
    overallGrade ← "C" // completed
    generateCemail(student.email)
End If

```

**End**

- a. Complete the test table provided below using appropriate test data.

4 marks

Test	Expected result	Actual result
avgMCScore = 69.9 hwTasksCompleted = 7	overallGrade ← "NC"	overallGrade ← "NC" should fail and does

- b. Identify the line of pseudocode that produces an error.

1 mark

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

2 marks

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**Question 10** (3 marks)

Jodie has produced test data to show a list of students by surname, their average multiple-choice quiz score, the number of homework tasks completed and their overall grade. This is stored in a set of records named 'StudentData', which is shown below.

surname	avgMCscore	hwTasksCompleted	overallGrade
Adams	62.2	4	NC
Lambert	93.2	2	C
Zhang	49.2	10	C
Lau	81.4	5	C
Thompson	72.3	8	C

Jodie can sort the data by using a selection sort or a quick sort and search the data by using a linear search or a binary search.

- a. Jodie has been asked to write a software function that will sort the data by the variable 'hwTasksCompleted' in ascending order. She decides to use a selection sort on the data shown above and count the number of times records are swapped.

How many swaps will the selection sort produce by the end of the sorting process?

1 mark

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- b. Jodie has been asked to write a software function that will search for any students who have an 'avgMCscore' of less than 7.0.

Explain why a linear search would be more suitable for this process than a binary search.

2 marks

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**Question 11** (3 marks)

Once the homework module has been programmed, the teachers are asked to be involved in usability testing.

Explain specifically how the four teachers can provide valuable feedback during usability testing for the following principles.

Ease of use \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Accessibility \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Flexibility \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



**Question 12** (6 marks)

LangLearnPlus advertises for content creators. One of the applicants is Christos, who teaches Greek, Classical Greek and Latin. Christos has taught for 20 years at three different schools and offers the interviewing panel access to the entire curriculum he has developed at each school, ready-made and just needing to be digitised. At the end of the interview, Christos leaves a USB flash drive with samples of the curriculum. LangLearnPlus is concerned about the legal and ethical issues of Christos' offer.

- a.** Identify the relevant legislation that applies to this situation.

1 mark

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- b.** Describe how this situation could be considered a breach of the legislation identified in **part a.**

3 mark

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- c.** The database/network administrator, Maria, is concerned that Christos could have potentially breached LangLearnPlus' security.

Identify how this breach could have occurred and explain what consequences could result from this breach.

2 marks

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**Question 13** (7 marks)

Virat, Jodie and Maria decide to look at the security of the entire LangLearnPlus program. One of their concerns is malicious outsiders using an SQL injection to bypass the login process.

- a.** Describe how an SQL injection could be used to bypass the login process.

2 marks

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- b.** State **two** potential risks if this security vulnerability is not fixed.

2 marks

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- c.** Explain how the login process could be made secure against SQL injections.

3 marks

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**Question 14** (4 marks)

Virat, Jodie and Maria have been asked to develop a risk management plan that includes strategies to minimise security vulnerabilities for LangLearnPlus' current and future practices. In the risk management plan, they will review the hardware, software and procedures they currently have and identify areas for improvement.

Recommend two key risk management strategies in regard to the following areas of risk, and outline how each strategy would minimise security vulnerabilities.

Risk 1: loss of files and data

Risk management strategy 1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Risk 2: hacker accessing files and data

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.

LangLearnPlus is a small business start-up that offers computer-based lessons and activities to secondary school languages students across Victoria. The organisation was set up in 2018 by four former language teachers who were concerned that the popular language apps and programs did not cater for the specific needs of VCE students. During the remote learning period of 2020, LangLearnPlus saw increased interest in its business and demand for its program.

Initially, the teachers conducted remote lessons via an online video-calling program, but they found that scheduling meetings was inconvenient and it was too difficult to organise payments for lessons and refunds for missing lessons or technological issues. Instead, they decided to create a desktop program and a phone app that would provide access to regular twice-weekly lessons from a web server. Students can buy one-off lessons or subscribe for a school year. Information about the process of interacting with LangLearnPlus is as follows.

- Students download the app (from the relevant app store) or desktop version (from the LangLearnPlus website). They then register an account with an email address and password. The program suggests a password of between six and ten characters, with at least one number and at least one capital letter or symbol. Registered accounts are kept in a database.
- Once registered, students can view a short description of all lessons and a small sample of selected full lessons for free.
- In order to complete a lesson, students must purchase the lesson or a long-term subscription via a credit card transfer or PayPal. The credit card transfers are encrypted via HTTPS with Secure Sockets Layer (SSL).
- Lessons consist of at least one video, a multiple-choice quiz using a third-party application and a section of homework that students email to the relevant teacher.
- Both the teachers and students have provided feedback that they would like the homework to be fully incorporated into the program/app so that they don't need to use email. There have also been a small number of situations where students have received the wrong content for what they have ordered, such as the wrong lesson or a different multiple-choice quiz or homework task.
- During 2019, LangLearnPlus had 2500 subscriptions (each priced at \$200) and sold approximately 15 000 individual lessons at an average cost of \$10 each.
- LangLearnPlus is also considering looking at having chat spaces and forums for its registered members. These would be accessible from either the app/desktop program or the website.

## **The employees**

The current teachers are listed below.

- Wei is 34 and teaches Chinese. He has good computer skills and is comfortable with technology.
- Stephanie is 37 and teaches French and Italian. She can use basic applications and Internet, but she admits she is not overly comfortable with computers.
- Doug is 58 and teaches Indonesian. His computer skills are reasonable, but his eyesight is quite poor.
- Yuki is 27 and teaches Japanese. She describes herself as a digital native and is very active on social media across multiple devices.

LangLearnPlus would like to expand the number of subjects it offers and would therefore need to hire more content creators (each new employee would have to offer a different language). It has two programmers (Virat and Jodie), a database/network administrator (Maria) and an office administrator (Neville) in its employ as well.

### The offices and server room

The LangLearnPlus offices are in a converted three-bedroom house in Carlton. The offices are in a reasonably busy street and have rear access to a staff carpark. LangLearnPlus has some security measures in place, such as an alarm system and lockable gates at all entrances. The server room has a gaseous fire suppression system while the rest of the building has water sprinklers. The servers are connected to an uninterruptible power supply and have a separate proxy server with a software firewall. All computers have anti-malware software installed. The servers are backed up nightly on a RAID 10 network-attached storage device.

### The program

The LangLearnPlus program was written primarily by Jodie, with help from Virat. Jodie aims to write an update for each platform every two months, containing bug fixes and patches, with the desktop version being updated one month and the app version being updated the other month. Lesson content (compiled primarily by Virat) is pushed to the program every week on Monday and Thursday. With every patch, Jodie manually makes a copy of the current version of the program and saves it to the backup RAID 10 device. She also makes a copy on her staff laptop (which she takes home at night) in the event of a disaster occurring at the LangLearnPlus offices, such as a fire or electrical storm. Jodie has had to roll back the app version of the program twice, both times due to incompatibilities with phone operating system upgrades.

### Data flow diagram for student homework and quiz module

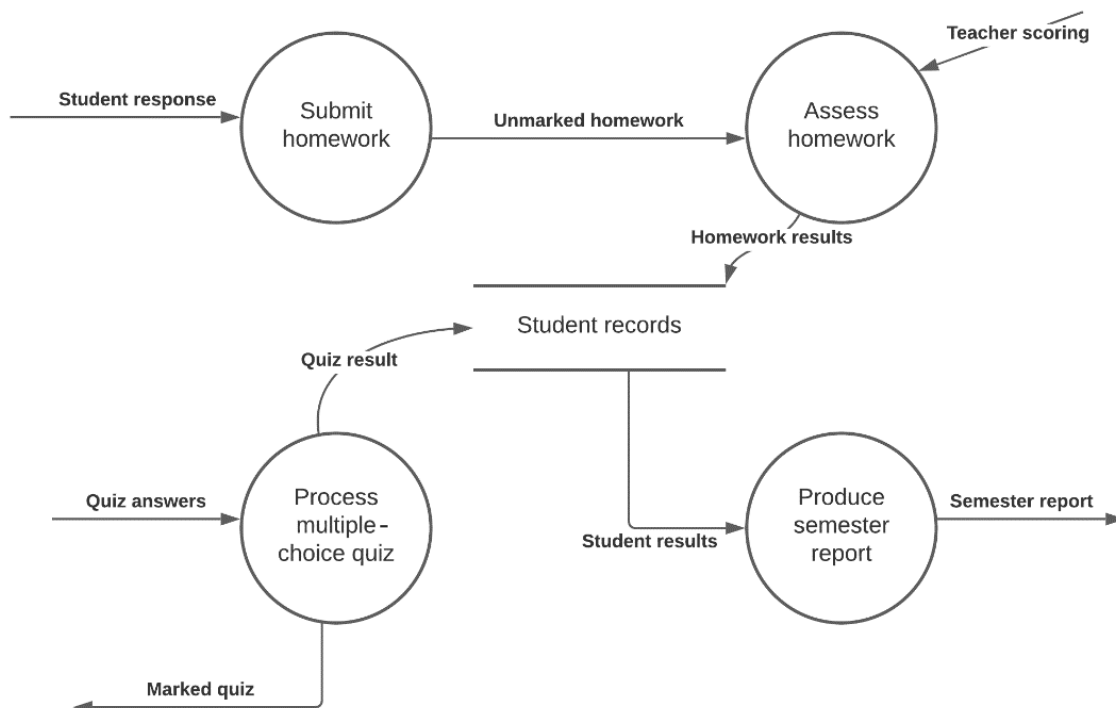


Figure 1

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