

BOARD OF STUDIES
NEW SOUTH WALES

2013 HSC Software Design and Development Marking Guidelines

Section I

Multiple-choice Answer Key

Question	Answer
1	C
2	D
3	B
4	B
5	C
6	A
7	A
8	D
9	A
10	C
11	B
12	D
13	B
14	A
15	B
16	D
17	B
18	A
19	C
20	C

Section II

Question 21

Criteria	Marks
• Describes how to achieve all data input features	3
• Describes how to achieve some data input features	2
• Shows a basic understanding of a data input feature	1

Sample answer:

Data validation – can be achieved using drop-down lists so the user can only enter an item from a specific list, such as days of the week.

Minimal mouse movements – ensure navigational elements are consistently placed eg, NEXT always bottom right of screen or use keyboard shortcuts so that accessing menu items does not require mouse movements.

Minimal keystrokes – auto fill fields with default data

Note: one strategy may be used to cover more than one feature. For example, drop down list may achieve data validation and minimum keystrokes.

Question 22 (a)

Criteria	Marks
• Provides a good discussion of two issues, clearly related to the scenario	4
• Provides a discussion of relevant issues with reference to the scenario	3
• Discusses a relevant issue OR	2
• Elaborates on two issues	
• Show some understanding of a relevant issue	1

Sample answer:

Privacy – the system has the potential to improve or reduce patient privacy. On one hand, if the data is transmitted securely from the phone to the doctor, the only people aware of the patient’s blood test are the patient and doctor. This improves the privacy of the patient. In a traditional system, the people who conduct the blood test, the drivers who transport the blood and the pathology staff are all involved. On the other hand, if the data is not securely transmitted and stored then others may have access to the patient’s blood test result, which would be a breach of their privacy.

Access – the system gives patients in rural areas, or patients who find it difficult to travel, access to blood tests. They don’t need to travel to a doctor’s surgery in order for a blood sample to be taken. On the other hand, patients need to have a smartphone and access to the internet, which may not be affordable for some patients or available in their area.

Answers may include:
Privacy issues

- Privacy of the patient must be ensured
- Data has to be securely transmitted to ensure it does not fall into the wrong hands or is modified by a third party
- Has to be no doubt about the ownership of the data and the rights of all parties as to how data may be used or distributed
- Data must be secured on the server and not accessible without appropriate permission
- Medical data stored on patients’ phones may be accessed by others (privacy issues)
- Which doctors has/have access to Pike’s database? Will the patient be asked (ethical) to give permission? Will the patient be notified of access?
- If the results/alerts are accidentally sent to the wrong person (privacy issue)

Accuracy issues

- Reliance on technology: relies on individual being able to use the technology correctly – a misuse could lead to a misdiagnosis
- Software has to be error free and high quality for the same reasons
- Patient should be able to check that the data held is correct and up-to-date

Technical issues

- Testing is based on data transmitted by phone – data may be distorted during transmission (lead to erroneous results)/diagnosis – technical/social issues

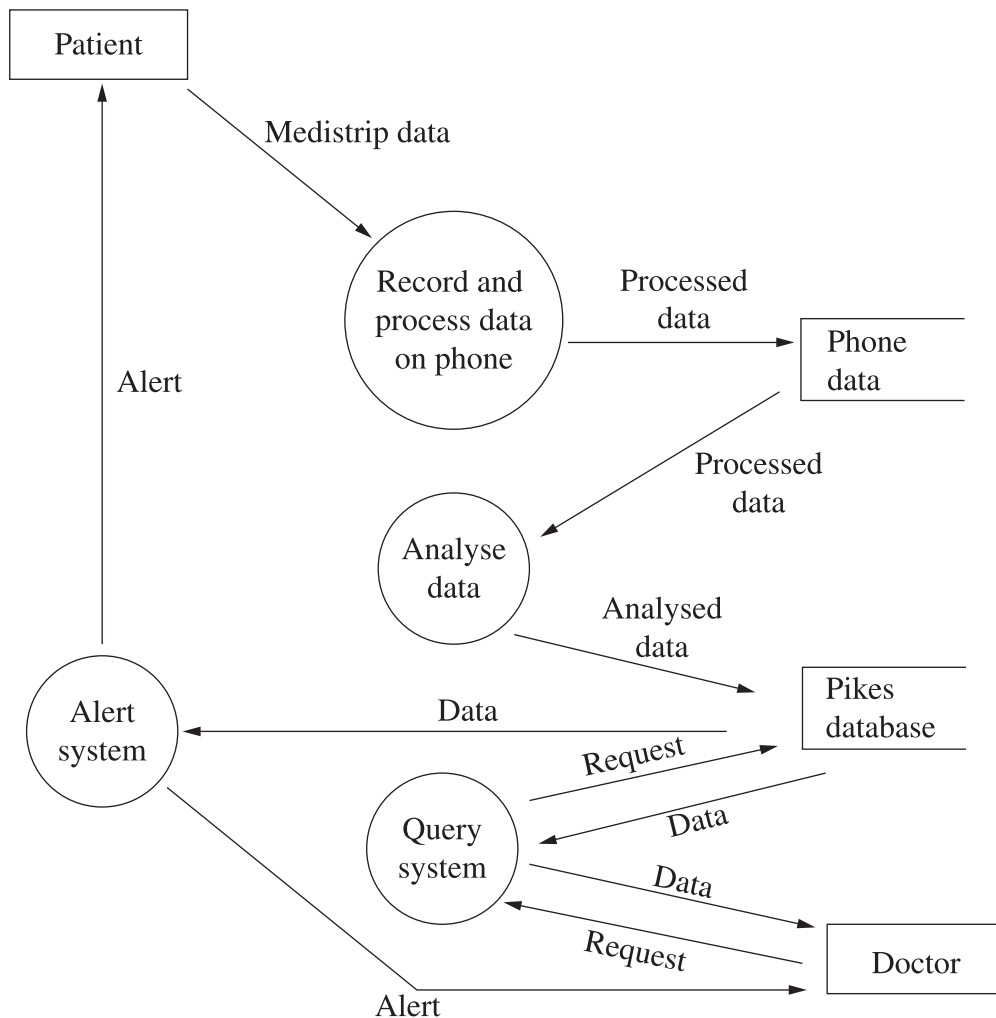
Access issues

- This service means patients in remote areas don’t have to visit a doctor’s surgery in order to have blood tests.
- Patients must have access to a smart phone to use the service.

Question 22 (b)

Criteria	Marks
<ul style="list-style-type: none"> Generates a substantially correct data flow diagram 	4
<ul style="list-style-type: none"> Shows an understanding of the system by drawing a data flow diagram with an external entity, a data store and more than one process 	3
<ul style="list-style-type: none"> Correctly uses a variety of data flow symbols OR <ul style="list-style-type: none"> Provides a diagram that shows a good understanding of the system 	2
<ul style="list-style-type: none"> Shows some understanding of the structure of a data flow diagram by the correct use of a data flow symbol OR <ul style="list-style-type: none"> Provides a diagram that shows some understanding of the system 	1

Sample answer:



Question 23

Criteria	Marks
<ul style="list-style-type: none">• Describes TWO ways in which a team of developers can make use of networks to support software development	3
<ul style="list-style-type: none">• Identifies TWO ways in which a team of developers can make use of networks to support software development OR <ul style="list-style-type: none">• Describes ONE way in which a team of developers can make use of networks to support software development	2
<ul style="list-style-type: none">• Identifies ONE way in which developers can use networks to support software development	1

Sample answer

Access to resources: developers can use the internet to access code libraries, search for solutions for problems that arise, try to find more efficient ways of solving problems etc. For example, a developer may not know how to use a specific function in a programming language, and searching for information on it will show examples of its use.

Ease of communication: developers can use messaging programs to communicate with other members of the programming team who may be located over a wide area. In addition to chat, they can exchange code fragments, screenshots of screen designs etc and gather feedback or ask for assistance.

Question 24 (a)

Criteria	Marks
• Draws a substantially correct IPO diagram	3
• Draws an IPO diagram indicating understanding of the problem	2
• Provides an understanding of IPO diagrams	1

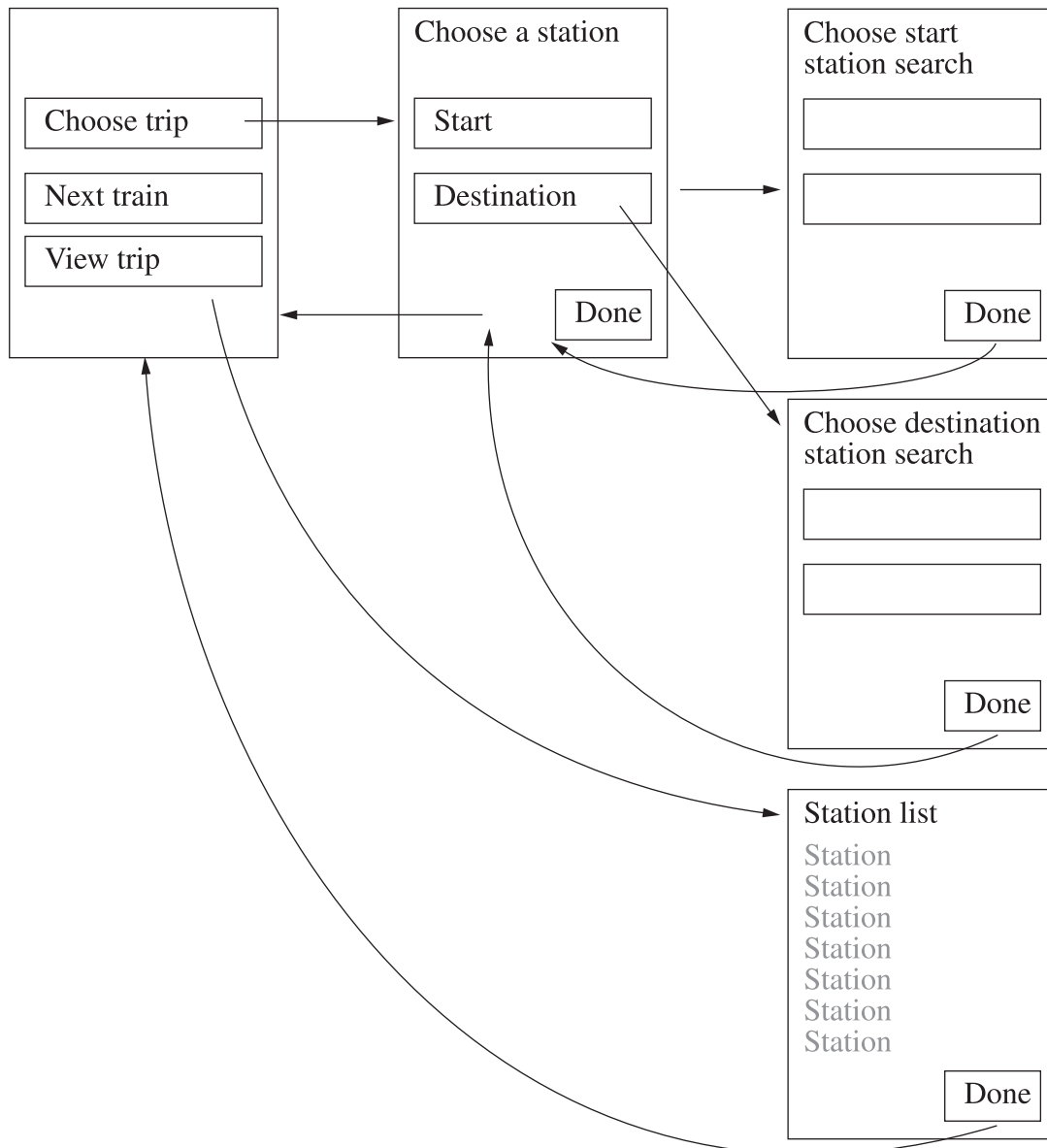
Sample answer:

<i>Inputs</i>	<i>Processes</i>	<i>Outputs</i>
<ul style="list-style-type: none">• Start station• Destination station• Request for list	<ul style="list-style-type: none">• Retrieve list of stations• Lookup timetable and find the details of the next train from the start station which is heading in the direction of the destination station• Find the departure time of the train from the timetable• Generate list of stations between start and destination	<ul style="list-style-type: none">• Information about the next train• List of stations

Question 24 (b)

Criteria	Marks
• Draws a substantially correct storyboard	4
• Draws a storyboard with relevant screens, navigation elements and data display areas	3
• Draws a storyboard with relevant screens and some elements	2
• Shows understanding of a storyboard	1

Sample answer:



Question 25 (a)

Criteria	Marks
<ul style="list-style-type: none">Provides a comparison of the suitability of the agile approach with an alternative approach, with specific reference to the feature of the approaches that make them suitable for this scenario	4
<ul style="list-style-type: none">Provides a description of the agile approach and an alternative approach, with reference to the suitability for this scenario	3
<ul style="list-style-type: none">Describes a development approach with reference to its suitability for this scenario OR <ul style="list-style-type: none">Describes the agile approach and identifies an alternative approach	2
<ul style="list-style-type: none">Describes a development approach OR <ul style="list-style-type: none">Identifies an alternative approach	1

Sample answer:

The agile approach typically involves frequent meetings between the client and developer to provide frequent feedback and improvement in the interface, with progressive release of features and functionality.

For this scenario, many of the stakeholders would not be available for frequent consultation, possibly only ever using the system once. Also, the features and functionality are unlikely to change much, apart from minor modifications to the user interface.

The structured approach typically involves a clear definition of all the requirements of a system, prior to any implementation. In this particular case, some of the requirements will be determined by the need to interface with an existing database. In conjunction with prototyping (for developing the user interface), the structured approach would be suitable here.

Question 25 (b)

Criteria	Marks
• Describes a variety of criteria, demonstrating an understanding of their relevance to this scenario	4
• Describes a variety of relevant criteria	3
• Identifies more than one relevant criterion with some elaboration	2
• Identifies one relevant criterion	1

Sample answer:

Some secure data, such as names of jurors, should not be available to all stakeholders. There needs to be a hack-proof log-in system, with layers of data access, and automatic logout after a period of inactivity.

The interface, and location of the touch screens, must allow access for the disabled and those of non-English speaking background. The legal system involves all kinds of people.

There must be adequate response times as there may be many users needing to find the appropriate courtroom promptly.

Accuracy is essential. The data must be updated regularly (and immediately if there's a change in a scheduled court appearance).

Question 26

Criteria	Marks
<ul style="list-style-type: none">• Recommends an installation method and provides justification related to the scenario OR <ul style="list-style-type: none">• Recognises that the suitability of a method depends on the importance placed on the criteria listed in the question	3
<ul style="list-style-type: none">• Describes an installation method	2
<ul style="list-style-type: none">• Demonstrates a limited understanding of installation method(s)	1

Sample answer:

Parallel installation would allow the data generated by both the old and new system to be compared, allowing reversion to the old if necessary, and would give users time to adjust and receive training. Direct cutover would not allow training time.

The most appropriate method depends on the importance of the criteria, eg if speed of introduction is considered most important, direct cutover should be used.

OR – Pilot schemes would allow evaluation and could encourage greater user acceptance.

OR – Phased would allow training in parts of the new system.

Question 27 (a)

Criteria	Marks
Provides an algorithm which correctly incorporates the following features: <ul style="list-style-type: none">• A loop• A counter being incremented• Data being stored in the array	2
<ul style="list-style-type: none">• Provides an algorithm with one of the above features	1

Sample answer:

```
FOR k = 1 to 52
    num(k) = k
NEXT k
```

Question 27 (b)

Criteria	Marks
<ul style="list-style-type: none">• Fully explains how the algorithm fulfils its purpose	3
<ul style="list-style-type: none">• Describes some features of the algorithm	2
<ul style="list-style-type: none">• Shows some understanding of the algorithm	1

Sample answer:

The purpose of the algorithm is to randomly place the numbers 1 to 52 in a new array, called newnum, such that there are no repeated elements.

The algorithm does this by moving through the new array one element at a time, selecting an element randomly from the old array and placing it into the new array. When the element has been moved to the new array, it is set to -1 in the original array. When choosing an element from the original array, the algorithm checks whether the element has already been set to -1, indicating it has already been used. If it has been used, it keeps generating random positions in the first array until it finds an unused element.

Question 28 (a)

Criteria	Marks
• Provides a substantially correct desk check	3
• Shows a good understanding of a desk check	2
• Shows limited understanding of a desk check	1

Sample answer:

Last	Swapped	K	Temp	Num			
				1	2	3	4
4	T	1		33	44	22	11
	F	2	44		22	44	11
	T	3	44			11	44
	T	4					

Question 28 (b)

Criteria	Marks
• Justifies the correct minimum and maximum number of passes	3
• Correctly identifies the minimum AND maximum number of passes OR	2
• Justifies a correct minimum or maximum number of passes	
• Shows some understanding of bubble sorts	1

Sample answer:

Minimum is 2

As the array is not sorted, at least one pass is needed to sort it, and one more pass is needed to confirm there are no more changes.

Maximum is 4

Once 4 elements are in the correct place in the array, the 5th element must also be correct.

Question 29 (a)

Criteria	Marks
• Describes appropriate strategies	3
• Describes an appropriate strategy	2
• Identifies a feature of testing	1

Sample answer:

The error may lie in the subroutines ‘Weigh suitcase’, ‘Add weight to plane total’ or ‘Print total weight’. To test if ‘weigh suitcase’ is working, a driver could be written to inspect the weight parameter being returned from ‘weigh suitcase’ and a suitcase of a known weight could be placed on the scales.

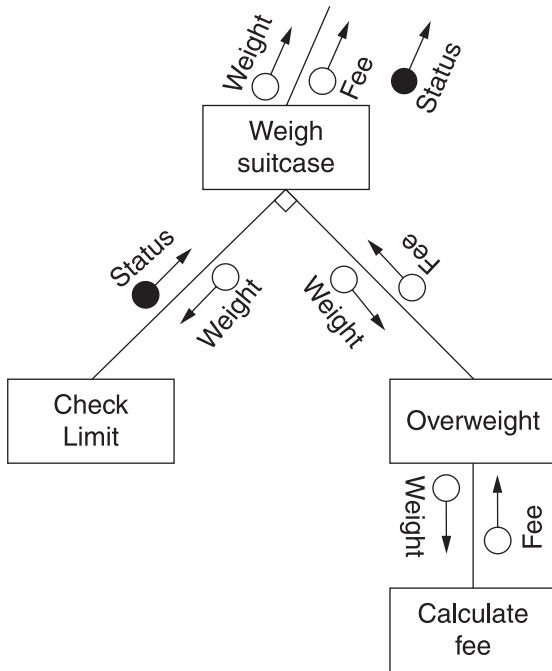
To test if ‘add weight to plane total’ is working, a driver could be written to pass weight values to the subroutine and the total weight value returned could be inspected. For example, weights of 10, 15, 10 and 5 could be passed in and the total weights returned should be 10, 25, 35 and 40.

To test if ‘Print total weight’ is working a debugging output statement could be used at the start of the subroutine to ensure that the total weight parameter has been correctly received.

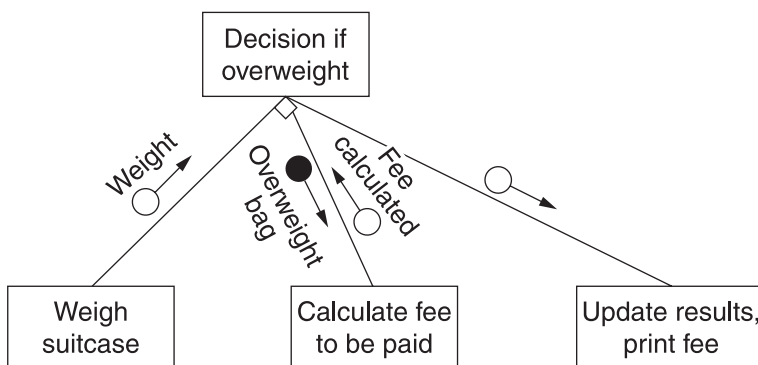
Question 29 (b)

Criteria	Marks
• Produces a substantially correct structure chart segment	3
• Produces a structure chart segment showing some new features	2
• Shows a limited understanding of structure charts	1

Sample answers:



Alternate sample answer:



Question 30 (a)

Criteria	Marks
<ul style="list-style-type: none"> Correctly identifies the logic error and produces substantially correct pseudocode 	3
<ul style="list-style-type: none"> Correctly identifies the logic error and produces partially correct pseudocode 	2
<ul style="list-style-type: none"> Correctly identifies the logic error OR <ul style="list-style-type: none"> Produces partially correct pseudocode 	1

Sample answer:

The logic error: if the first record read is also the last record (ie file is empty), that record will still be processed. (What effect that has depends on what else is stored in that record.) In fact this will always process the 'dummy' last record.

BEGIN

 Read record

 WHILE NOT Last record

 IF payment overdue THEN

add customer account record to overdue

 ENDIF

 Read record

 ENDIF

Print overdue list

END

Question 30 (b)

Criteria	Marks
<ul style="list-style-type: none"> Shows a good understanding of the requirements of the module by providing relevant specifications and assumptions 	3
<ul style="list-style-type: none"> Demonstrates some understanding of the requirements of the module 	2
<ul style="list-style-type: none"> Identifies a relevant feature of the module 	1

Sample answer:

'Overdue' is an array of records with the same record structure as customer's account.

'Overdue' is dimensioned appropriately (many possible elements).

Customer account record is passed as a parameter to the module.

The customer's account record is appended to the end of the existing array.

Question 31 (a)

Criteria	Marks
<ul style="list-style-type: none"> All lines correct 	2
<ul style="list-style-type: none"> At least one line correct OR <ul style="list-style-type: none"> Shows some understanding of the algorithm 	1

Sample answer:

```

BEGIN get_Max_Position
    Let MaxPos = 1
    Let position = 2;
    REPEAT
        IF Element(position) > Element(maxPos) THEN
            Let maxPos = position
        ENDIF
        Let position = position + 1
    UNTIL position > NumElementsInArray
END get_Max_Position
    
```

Question 31 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides a correct algorithm 	3
<ul style="list-style-type: none"> Provides a substantially correct algorithm 	2
<ul style="list-style-type: none"> Provides a partially correct algorithm 	1

Sample answer:

```

get_Max_Value(elements, 20, max)
FOR Counter = 1 to 20
    IF Element (Counter) = max THEN
        Display Counter
    END
NEXT Counter
    
```


Section III

Question 32 (a) (i)

Criteria	Marks
• Correctly identifies ONE attribute AND ONE method for the FICTION sub-class	2
• Correctly identifies ONE attribute OR ONE method for the FICTION sub-class	1

Sample answer:

copyNumber is an attribute
Borrow is a method

Question 32 (a) (ii)

Criteria	Marks
• Addition of a sub-class and an appropriate attribute	2
• Addition of an appropriate attribute to an existing class OR • Addition of a sub-class without an appropriate attribute	1

Sample answer:

```
sub-class NONFICTION is a BOOK {  
    public –  
        subjectArea: string  
}
```

Question 32 (a) (iii)

Criteria	Marks
• Justifies the use of encapsulation for the Book class indicating good understanding of encapsulation	3
• Shows some understanding of encapsulation	2
• Identifies a feature of encapsulation	1

Sample answer:

The methods borrow and return ensure that there are only two legal values for status, which must be set by one of these methods. Status is encapsulated within the class.
The method borrow ensures that a book can only be borrowed if its status is “available”.

Question 32 (b) (i)

Criteria	Marks
• Provides TWO limitations of using the imperative paradigm for developing the database software indicating a good understanding	3
• Identifies TWO limitations of the imperative paradigm OR • Identifies ONE limitation of the imperative paradigm with reference to the scenario	2
• Identifies ONE limitation of the imperative paradigm	1

Sample answer:

- Need to specify code for every individual process
- Difficulty of coding for variability
- Difficulty in adding more features of the dinosaurs such as skin colour or length of neck

Question 32 (b) (ii)

Criteria	Marks
• Shows a good understanding of the role of an inference engine with reference to the scenario	3
• Shows a good understanding of an inference engine	2
• Shows some understanding of an inference engine	1

Sample answer:

The inference engine would make use of forward or backward chaining to reach a conclusion about the characteristics of a particular dinosaur based on a set of established facts, derived from the database, and a set of rules derived from the code.

Question 32 (b) (iii)

Criteria	Marks
<ul style="list-style-type: none"> Provides substantially correct code for TWO facts and TWO rules 	4
<ul style="list-style-type: none"> Provides substantially correct code for TWO facts and ONE rule OR <ul style="list-style-type: none"> Provides substantially correct code for ONE fact and TWO rules 	3
<ul style="list-style-type: none"> Provides substantially correct code for TWO facts or TWO rules OR <ul style="list-style-type: none"> Provides substantially correct code for a fact and a rule 	2
<ul style="list-style-type: none"> Provides a fact or a rule 	1

Sample answer:

```

dinosaur(allosaurus)
period(allosaurus, jurassic)
could_run(X):- dinosaur(X), legs(X, two)
could_eat(X, Y):- dinosaur(X), dinosaur(Y), type(X, carnivore), period(X, Z), period (Y, Z)
    
```

Question 32 (c)

Criteria	Marks
<ul style="list-style-type: none"> Shows how the paradigms could be applied to different parts of the system 	3
<ul style="list-style-type: none"> Identifies a characteristic of each paradigm OR <ul style="list-style-type: none"> Shows how one paradigm applies to the scenario 	2
<ul style="list-style-type: none"> Identifies a characteristic of either paradigm 	1

Sample answer:

Using OO: there would be a class of computer with sub-classes desktop, laptop and tablet, which would share attributes.

Using logic: the customer requirements would be facts, while rules could be used to match a product to these requirements.

Question 33 (a)

Criteria	Marks
• Provides differences between ASCII and Unicode	3
• Provides a difference between ASCII and Unicode	2
• Identifies a feature of ASCII or Unicode	1

Sample answer:

Differences:

- Unicode can represent many more characters than ASCII (more than 1 million compared with 128)
- The characters of most languages can be represented using Unicode, however the letters represented by ASCII are in English only.

Question 33 (b) (i)

Criteria	Marks
• Shows a good understanding of the shifting of bits, for the given example	3
• Provides a substantially correct binary multiplication showing the shifting of bits OR shows a good understanding of the shifting of bits	2
• Shows some understanding of the binary multiplication process OR shows some understanding of the bit shifting process	1

Sample answer:

$$\begin{array}{r} 10110 \\ 101 \times \\ \hline 10110 \\ 10110 \\ \hline 1101110 \end{array}$$

In 101, the left most bit represents a four, so 10110 is shifted left twice (2×2), before being added.

Question 33 (b) (ii)

Criteria	Marks
<ul style="list-style-type: none"> Provides a correct assessment of the statement and a justification showing good understanding of single precision floating point representation 	3
<ul style="list-style-type: none"> Shows some understanding of two components of the single precision floating point representation 	2
<ul style="list-style-type: none"> Identifies a feature of floating point representation 	1

Sample answer:

The sign bit is 1, which means the decimal value is negative.

The stored exponent is 01111111, which is 127. The actual exponent is 127 less than the stored exponent, so the actual exponent is 0.

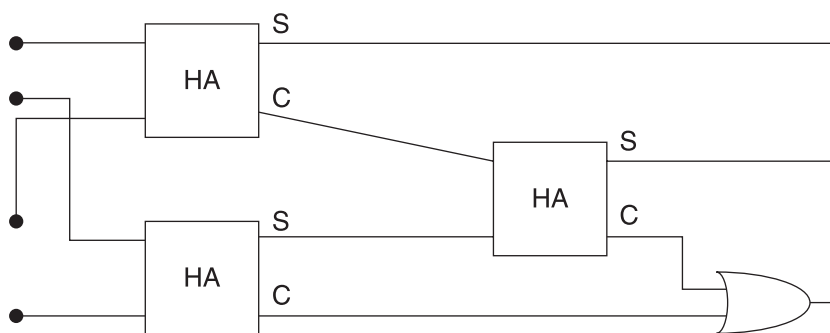
The stored mantissa is 0.

So the stored number is $-1 \times 2^0 = -1$.

So the student is correct.

Question 33 (c) (i)

Criteria	Marks
<ul style="list-style-type: none"> Provides a correct circuit 	3
<ul style="list-style-type: none"> Provides a substantially correct circuit, showing understanding of the problem 	2
<ul style="list-style-type: none"> Combines circuit components showing some understanding of the problem 	1

Sample answer:


Question 33 (c) (ii)

Criteria	Marks
• Provides a substantially correct truth table	2
• Shows some understanding of representing Boolean expressions using a truth table	1

Sample answer:

A	B	$A \cdot B$	\bar{A}	$\bar{A} \cdot B$	$A \cdot B + \bar{A} \cdot B$	$(A \cdot B + \bar{A} \cdot B) \oplus \bar{A}$
0	0	0	1	0	0	1
0	1	0	1	1	1	0
1	0	0	0	0	0	0
1	1	1	0	0	1	1

Question 33 (c) (iii)

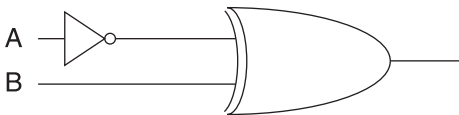
Criteria	Marks
• Provides a correct circuit, either for the Boolean expression OR for the truth table OR for a simplified Boolean expression	2
• Shows some understanding of representing Boolean expressions using a circuit OR simplification of Boolean expressions	1

Answers may include:

Note: a wide variety of circuits may be provided.

The Boolean expression may be simplified:

$$\begin{aligned}
 & (A \cdot B + \bar{A} \cdot B) \oplus \bar{A} \\
 & = B \cdot (A + \bar{A}) \oplus \bar{A} \\
 & = B \cdot 1 \oplus \bar{A} \\
 & = B \oplus \bar{A}
 \end{aligned}$$

Sample answer:


Question 33 (d) (i)

Criteria	Marks
• Provides the correct data stream	2
• Provides a data stream showing some understanding of the problem	1

Sample answer:

11100100

Question 33 (d) (ii)

Criteria	Marks
• Provides the correct path and obstacles	2
• Provides a path and/or obstacles showing some understanding of the problem	1

Sample answer:

				↑					
				X					
				X					
X	X	X	X	X					
X									
X									
X									
S									

Software Design and Development

2013 HSC Examination Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	9.2.2 — Planning and designing software solutions	H1.3
2	1	9.2.1 — Defining and understanding of the problem	H5.2
3	1	9.3 — Developing a solution package	H5.2
4	1	9.1.1 — Social and ethical issues	H2.2
5	1	9.1.1 — Social and ethical issues	H2.2
6	1	9.2.2 — Planning and designing software solutions	H4.3
7	1	9.2.1 — Defining and understanding of the problem	H5.2
8	1	9.2.5 — Maintaining software solutions	H5.2
9	1	9.2.1 — Defining and understanding of the problem 9.3 — Developing a solution package	H5.2
10	1	9.2.3 — Implementation of software solutions	H4.2
11	1	9.1.1 — Social and ethical issues	H3.1
12	1	9.2.2 — Planning and designing software solutions	H1.3
13	1	9.2.2 — Planning and designing software solutions	H4.3
14	1	9.2.5 — Maintaining software solutions	H5.2
15	1	9.2.3 — Implementation of software solution	H1.2
16	1	9.2.4 — Testing and evaluating of software solutions	H4.2, H4.3
17	1	9.2.2 — Planning and designing software solutions	H5.2
18	1	9.2.4 — Testing and evaluating of software solutions	H4.3
19	1	9.2.4 — Testing and evaluating of software solutions	H4.3
20	1	9.2.3 — Implementation of software solutions	H1.3, H1.1

Section II

Question	Marks	Content	Syllabus outcomes
21	3	9.2.2 — Planning and designing software solutions	H6.4
22 (a)	4	9.1.1 — Social and ethical issues	H2.2, H3.1
22 (b)	4	9.3 — Developing a solution package	H4.2
23	3	9.1.1 — Social and ethical issues	H2.2
24 (a)	3	9.2.1 — Defining and understanding of the problem	H4.2
24 (b)	4	9.2.2 — Planning and designing software solutions	H6.4
25 (a)	4	9.1.2 — Application of software developments	H4.2, H6.2
25 (b)	4	9.3 — Developing a solution package	H1.3, H6.4
26	3	9.1.2 — Application of software development approaches	H4.2
27 (a)	2	9.2.2 — Planning and designing software solutions	H4.2
27 (b)	3	9.2.2 — Planning and designing software solutions	H1.3

Question	Marks	Content	Syllabus outcomes
28 (a)	3	9.2.2 — Planning and designing of software solutions	H1.3, H4.2
28 (b)	3	9.2.2 — Planning and designing of software solutions	H4.3
29 (a)	3	9.2.4 — Testing and evaluating of software solutions	H4.3
29 (b)	3	9.2.2 — Planning and designing software solutions	H4.3
30 (a)	3	9.2.1 — Defining and understanding of the problem	H4.2
30 (b)	3	9.2.1 — Defining and understanding of the problem 9.2.3 — Implementation of software solutions	H5.2 H4.3
31 (a)	2	9.2.2 — Planning and designing software solutions	H4.2
31 (b)	3	9.2.2 — Planning and designing software solutions	H4.3

Section III

Question	Marks	Content	Syllabus outcomes
32 (a) (i)	2	9.4.1 — Programming paradigms	H1.2
32 (a) (ii)	2	9.4.1 — Programming paradigms	H1.2
32 (a) (iii)	3	9.4.1 — Programming paradigms	H4.1, H4.2
32 (b) (i)	3	9.4.1 — Programming paradigms	H1.2
32 (b) (ii)	3	9.4.1 — Programming paradigms	H4.2
32 (b) (iii)	4	9.4.1 — Programming paradigms	H1.2
32 (c)	3	9.4.1 — Programming paradigms	H5.3
33 (a)	3	9.4.2 — The interrelationship between software and hardware	H1.3
33 (b) (i)	3	9.4.2 — The interrelationship between software and hardware	H1.3
33 (b) (ii)	3	9.4.2 — The interrelationship between software and hardware	H1.3
33 (c) (i)	3	9.4.2 — The interrelationship between software and hardware	H1.3
33 (c) (ii)	2	9.4.2 — The interrelationship between software and hardware	H1.3
33 (c) (iii)	2	9.4.2 — The interrelationship between software and hardware	H1.3
33 (d) (i)	2	9.4.2 — The interrelationship between software and hardware	H2.2, H1.3
33 (d) (ii)	2	9.4.2 — The interrelationship between software and hardware	H1.3, H2.2