BOSTES | BOARD OF STUDIES TEACHING & EDUCATIONAL STANDARDS NSW

2014 HSC Software Design and Development Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 21

Criteria	Marks
• Clearly describes how legal action can result from software development • Uses specific examples	4
• Shows some understanding of legal action resulting from software development • Includes example(s)	3
• Shows a basic understanding of legal action relevant to software	2
• Identifies a feature of legal action relevant to software	1

Sample answer:

Software not performing as agreed by the developer and their client could lead to legal action by the client. If the developer refuses to modify the software to perform as expected or agreed, this could result in financial loss to the client.

Legal action can result from developers using copyrighted code from other sources without paying licensing fees or gaining permission for the use of the code. Where a developer uses source code without gaining proper permission from the copyright owner, then the copyright owner has the option of taking legal action against the developer.

In some instances, the copying of the "look and feel" of a competitor's application can also result in legal action being taken by the copyright owner. A recent example of this type of legal action was the law suit between Google and Apple over aspects of the design of the user interface in Android and Apple iPhone applications.

Question 22

Criteria	Marks
• Clearly shows the differences in the use of storyboards and IPO diagrams during software development	3
• Shows some understanding of storyboards and/or IPO diagrams	2
• Identifies an aspect of storyboards or IPO diagrams	1

Sample answer:

Storyboards are primarily used to diagrammatically show the various interfaces/screens in a system as well as the links between them. They are mainly focused on the interface design and the connection between the program/software and the user.

IPO diagrams are used to document a system by identifying the inputs into each major process. Variables and their interactions are the key elements of an IPO diagram and as such differ from storyboards which are user-interface focused.

Question 23

Criteria	Marks
• Clearly describes how the use of project management tools can ensure satisfactory completion of projects	4
• Shows a sound understanding of the link between project management tools and satisfactory completion of projects	3
• Identifies features of project management tools OR • Outlines a project management tool	2
• Identifies a feature of a project management tool	1

Sample answer:

A Gantt chart is an effective project management tool as it provides a text and graphical representation of the scheduling of all project tasks. This enables developers to know when each task is to be commenced and completed as well as indicating where tasks may overlap.

A logbook can provide more detailed information about the day to day progress of tasks and allows for developers to add additional information about project progress. This provides valuable information about current as well as future development.

Question 24

Criteria	Marks
• Explains why both sequential and event-driven approaches should be included • Relates features of these approaches to the design of the software	3
• Shows some understanding of the sequential and/or event-driven approach	2
• Identifies a feature of the sequential or event-driven approach	1

Sample answer:

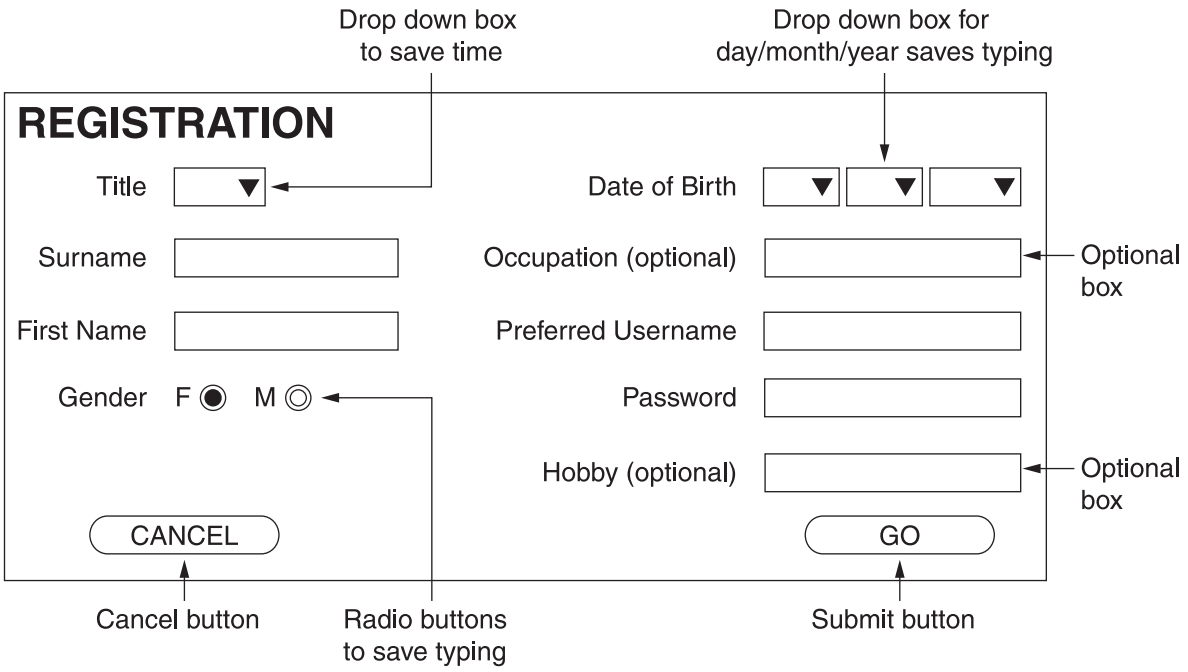
The normal operation of the robot vacuum cleaner can be programmed using a sequential approach as there will be a certain order of tasks that occur irrespective of the home situation such as startup, initial movement, brush and suction operation and recharging at set intervals.

The unique and unpredictable nature of most environments makes an Event Driven approach also applicable as “events”, such as encountering obstacles, walls or steps that cannot be predicted, can be programmed to trigger appropriate action by the robot that enables it to take alternate actions and continue its tasks.

Question 25

Criteria	Marks
• Shows a thorough understanding of the problem by providing an annotated webpage design that includes appropriate techniques to enhance efficiency effectively	4
• Shows a sound understanding of the problem by providing a webpage design that solves the majority of the efficiency issues	3
• Provides a design that demonstrates some understanding of the problem	2
• Identifies one way of improving efficiency	1

Sample answer:



Question 26 (a)

Criteria	Marks
• Clearly describes the responsibility of the developer in relation to the website and any related data stored in it	3
• Shows some understanding of the responsibility of the developer in relation to the website and/or the data stored in it	2
• Identifies a responsibility of a developer	1

Sample answer:

The developer must produce a quality website that adheres to the specifications set out by the bank. They should ensure that inclusivity issues have been addressed such as screen designs that incorporate options for those with visual impairment.

The data must be kept secure using encryption, levels of access (passwords) and not be accessible to any unauthorised people. Being banking data it is quite sensitive and therefore requires a high level of security.

Question 26 (b)

Criteria	Marks
• Clearly explains TWO communication issues that may have occurred between the bank and the developer	3
• Explains a communication issue that may have occurred between the bank and the developer OR • Outlines communication issues that may have occurred between the bank and the developer	2
• Identifies a potential communication issue between a client and a developer	1

Sample answer:

One communication issue could have been caused by time zone differences. This would make it difficult to give or receive feedback in a timely manner or set up meetings through video conferencing.

Another issue is that communicating online through emails would have been difficult to clearly express the requirements of the bank, or the feedback from the prototypes. This would have been further made difficult if the bank and developer did not speak the same language.

Question 27 (a)

Criteria	Marks
• Outlines TWO possible reasons	3
• Outlines ONE possible reason OR • Identifies TWO possible reasons	2
• Identifies a possible reason	1

Answers could include:

- The software has probably not been thoroughly tested. There could be a pathway in the software that has only recently been followed because its conditions have only recently occurred.
- Some capacity in the software has finally been reached, eg hard disk space or network bandwidth.
- Something may have changed in the environment, for example the operating system, some hardware, or other programs on the system. The new hardware or software may be incompatible with the custom software.
- Changes in the program's calculations due to external factors. For example, if the GST rate was raised from 10% to 15%, and the custom software was not updated, then all GST calculations would be wrong.

Question 27 (b)

Criteria	Marks
• Clearly outlines the actions that should be taken by the business and by the developer	3
• Outlines the action(s) that should be taken AND/OR the role of the business AND/OR the role of the developer in resolving the situation	2
• Shows a basic understanding of the process required to resolve the situation OR the role of the business OR the role of the developer in the situation	1

Sample answer:

The business should inform the developer that errors have been occurring and provide them with the data from the times when errors occurred, or provide relevant screenshots. The developer should locate the source of the error, fix the error and update the software for the business.

Question 28

Criteria	Marks
• Provides a correct algorithm that fixes the logic errors	3
• Provides a substantially correct algorithm that fixes the logic error(s)	2
• Shows an understanding of a logic error	1

Sample answer:

```
BEGIN
    row = 1
    WHILE row ≤ 6
        FOR column = 1 to 6
            product (row, column) = column * row
        NEXT column
        row = row + 1
    ENDWHILE
END
```

Question 29

Criteria	Marks
• Recommends appropriate level(s) of testing with justification and reference to the scenario	3
• Recommends a level of testing with appropriate justification	2
• Shows a basic understanding of levels of testing	1

Sample answer:

As the clients are being charged too much rent, it is likely that the error is in the rent program. Within the rent program, leasing information is said to be error free, which leaves the calculate rent module to be tested to ensure the calculation is free of logic errors. When this has been completed, program testing should be performed on the rent program to ensure that the data passed between the modules is error free and that the rent calculations are correct when compared against test data and expected output.

Question 30

Criteria	Marks
• Provides a substantially correct algorithm	4
• Provides an algorithm that addresses the majority of the requirements	3
• Provides an algorithm that addresses some requirements	2
• Provides some relevant information that shows a basic understanding of the problem	1

Sample answer:

```
BEGIN Login
    attempts = 0
    correctLogin = false
    WHILE attempts <  5 AND correctLogin = false
        input username
        input password
        IF Check_details(username, password) = true THEN
            correctLogin = true
        ELSE
            attempts = attempts + 1
        ENDIF
    ENDWHILE
    IF correctLogin = false THEN
        Lock_account(username)
    ENDIF
END Login
```

Question 31 (a)

Criteria	Marks
• Clearly outlines how arrays of records could be used in the program	2
• Shows a basic understanding of an array of records	1

Sample answer:

Two arrays of records may be used in this scenario.
Cabins(1-20): has a record for each cabin, with fields for: Group names, Number in cabin.
Students(…) : has a record for each student, with fields for: Student's name, group name, cabin number.

Question 31 (b)

Criteria	Marks
• Clearly outlines the steps required	3
• Shows some understanding of the process	2
• Identifies a feature of the process	1

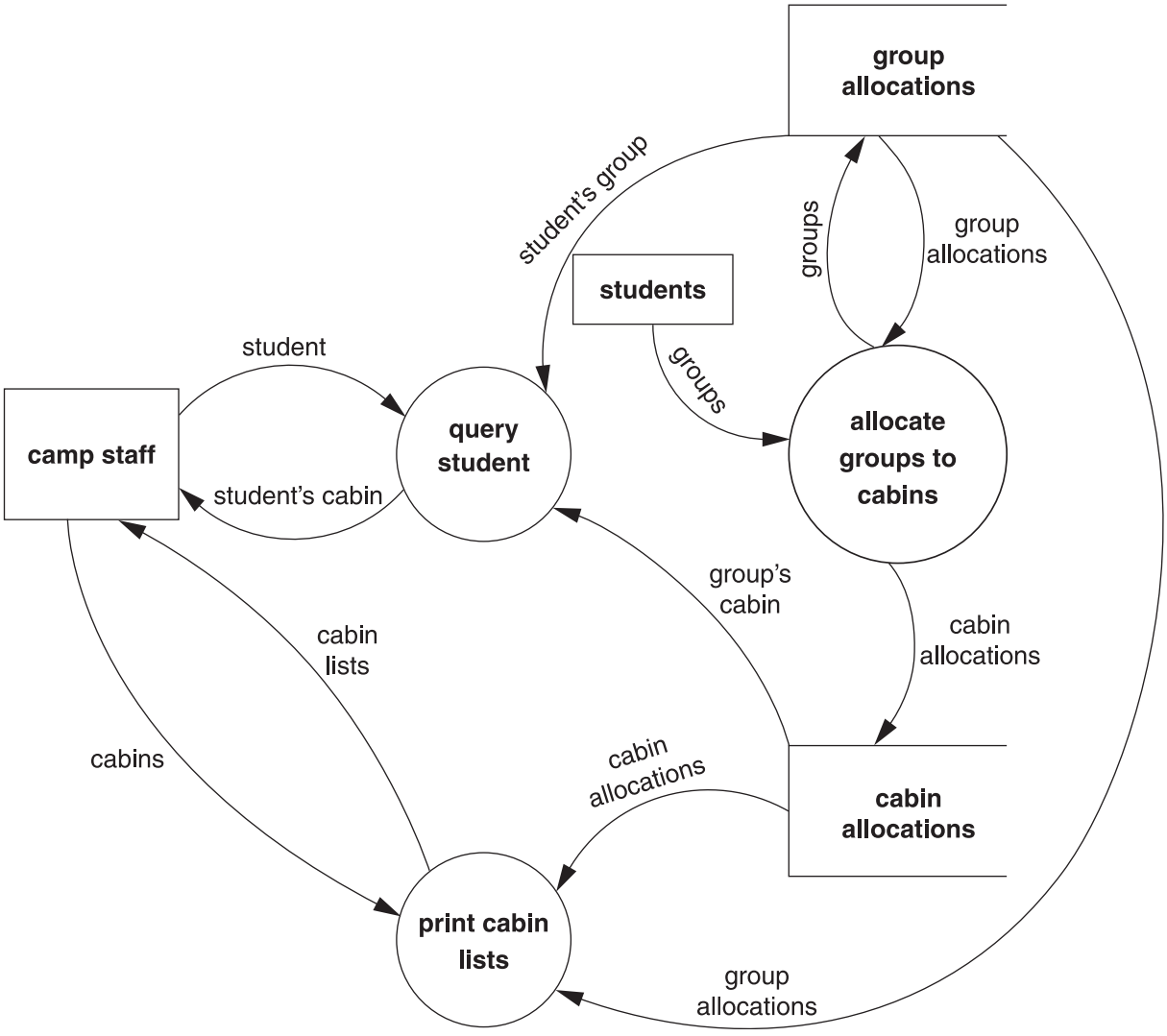
Sample answer:

Get all the group sizes. Allocate groups of 10 or 9 to cabins. For groups of 8, see if there's a group of 2 to combine with, else just allocate. Then follow a similar procedure for groups of 7 (match with 3 or 2) 6 and 5 to fill cabins to 10 (preferred) or 9. With the remainder, find combinations that add up to 10 or 9.

Question 31 (c)

Criteria	Marks
• Provides a substantially correct data flow diagram	4
• Shows a sound understanding of the system by drawing a data flow diagram with an external entity, a data store and more than one process	3
• Correctly uses a variety of data flow symbols OR • Provides a diagram that shows a sound understanding of the system	2
• Correctly uses a data flow symbol OR • Provides a diagram that shows some understanding of the system	1

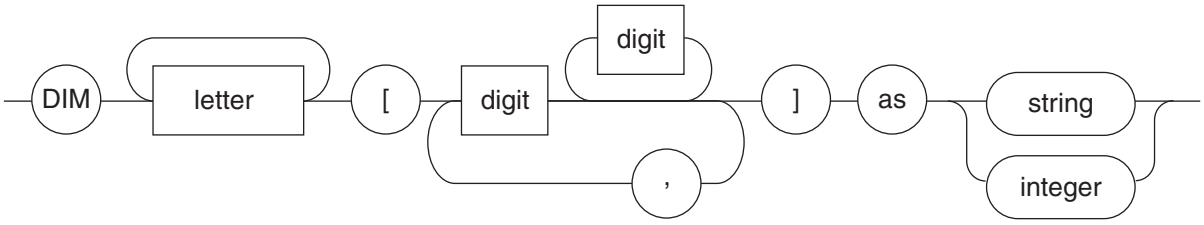
Sample answer:



Question 32

Criteria	Marks
• Provides a substantially correct railroad diagram incorporating all components	3
• Provides a railroad diagram that illustrates some features of the DIM statement	2
• Shows a basic understanding of railroad diagrams	1

Sample answer:



Question 33

Criteria	Marks
• Provides a substantially correct algorithm that incorporates the following features: – A suitable data structure – A suitable loop – Output of chapter text – Output of options – Input of user choice – Suitable determination of next chapter based on user choice	4
• Provides a partially correct algorithm that addresses the main aspects of the problem	3
• Provides a solution that attempts to solve some aspects of the problem	2
• Attempts a solution that shows some understanding of the problem	1

Sample answer:

```
BEGIN
    Display book(1,1).chapter
    FOR chapterCount = 2 to 20
        FOR versionCount = 1 to 3
            Display book(ChapterCount, VersionCount).description
        NEXT versionCount
        Get versionChoice                    '1, 2 or 3
        Display book(chapterCount,versionChoice).chapter
    NEXT chapterCount
END
```

Question 34 (a)

Criteria	Marks
• Shows a good understanding of why this algorithm runs slowly	2
• Identifies a feature of the algorithm that results in slowness OR • Shows some general understanding of inefficiency in algorithms	1

Sample answer:

Key identifies the record to be changed, there is no need for the loop. The program runs unnecessarily slowly because it is stepping through elements of the array when it could replace the element directly.

Question 34 (b)

Criteria	Marks
• Provides a substantially correct algorithm that is equivalent to the original and would run faster	2
• Provides an algorithm that addresses an aspect of the inefficiency	1

Sample answer:

```
BEGIN find_and_replace (recordlist, key, record)
    IF key ≤ size of recordlist THEN
        recordlist[key]=record
        output 'record replaced at', key
    END IF
END find_and_replace
```

Section III

Question 35 (a) (i)

Criteria	Marks
• Clearly describes the strengths of the logic paradigm in relation to a specific type of problem	3
• Shows some understanding of the strengths of the logic paradigm	2
• Identifies a feature of the logic paradigm	1

Sample answer:

The logic paradigm is useful where a game has rules, especially when the combination of rules is large and complex. The logic paradigm allows the developer to not have to consider all combinations.

Question 35 (a) (ii)

Criteria	Marks
• Clearly describes the strengths of the object-oriented paradigm in relation to a specific type of problem	3
• Shows some understanding of the strengths of the object-oriented paradigm	2
• Identifies a feature of the object-oriented paradigm	1

Sample answer:

The object-oriented paradigm, through polymorphism and inheritance, allows special cases in a game to be easily handled without affecting the rest of the software. Common and tedious subroutines can be extracted to super classes to allow the specific parts of each class to be more prominent.

Question 35 (b)

Criteria	Marks
• Shows a clear understanding of what a method is	2
• Identifies a feature of a method OR • Gives an example of a method	1

Sample answer:

A method is a subroutine associated with an object, and which has access to its data.

Question 35 (c) (i)

Criteria	Marks
• Outlines one way to solve the problem	2
• Shows some understanding of the problem	1

Sample answer:

Using polymorphism, an empty `open_account` method can be added to the `FastCash` class but put in the private section so that it cannot be accessed.

Question 35 (c) (ii)

Criteria	Marks
• Fully explains the results of ALL the instructions	3
• Shows some understanding of why an account will be opened and/or why an account will not be opened	2
• Shows a basic understanding of the code	1

Sample answer:

`chris.open_account` will succeed because chris's current teller is a normal teller and always opens an account.

`kim.open_account` will succeed because kim is a VIP customer and can have any teller open an account, and kim's current teller is a normal teller and always opens an account anyway.

`sam.open_account` will not succeed because sam's current teller is a `FastCash` teller and sam is a normal customer, not a VIP customer.

`lyndon.open_account` will not succeed because lyndon does not have a current teller.

Question 35 (d) (i)

Criteria	Marks
• Provides a correct extension of code that includes the required facts and rule	3
• Provides an extension of code that includes some of the required fact(s) and/or rule	2
• Shows a basic understanding of the logic paradigm facts or rules	1

Sample answer:

```
child(steven,kristy)
child(joan,kristy)
parent(P):– child(P,X)
```

Question 35 (d) (ii)

Criteria	Marks
• Identifies a type of chaining and clearly explains how it evaluates the query using the facts and rules	4
• Identifies a type of chaining and outlines how it evaluates a query and/or how it uses facts and/or rules	3
• Shows some understanding of chaining	2
• Identifies a type or a feature of chaining	1

Sample answer.

Forward chaining applies the facts and rules by starting with the goal of looking for matching rules or facts. When a rule is found, the process is then repeated (ie chained) until all rules (ie intermediate goals) have had all matching facts found.

For `descendant(mary,D)`, the engine looks for matching facts and rules, and finds the fact `child(mary,wilma)`, for the first result. The engine continues and finds the second descendant rule, which looks for any child of Mary and then looks for descendants of each of those children, and eventually finds the facts `child(mary,wilma)` and `child(wilma,joan)`.

Question 36 (a)

Criteria	Marks
• Provides an explanation of how 2's complement can be used in the binary subtraction given	3
• Shows some understanding of how 2's complement can be used in binary subtraction	2
• Identifies a feature of 2's complement or binary subtraction	1

Sample answer:

In the CPU, numbers can only be added, so the 01001010 is converted to its 2's complement (effectively multiplying by –1) and is added to 00110011.

```
00110011 +          01001010
01101001   1's comp 10110101 +       00110011+
10011110            ________        ________
           2's comp 10110110        11101001
```

Question 36 (b)

Criteria	Marks
• Provides a correct Boolean representation of the circuit	2
• Shows some understanding of Boolean representation	1

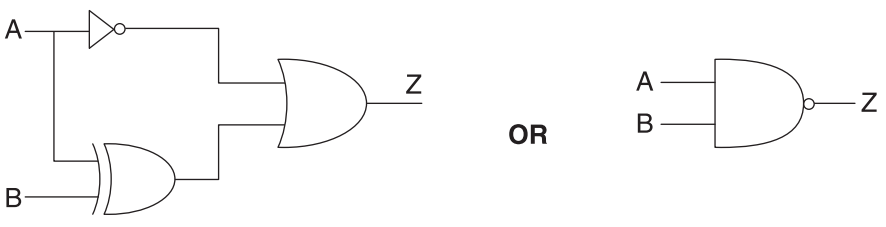
Sample answer:

$A\overline{B} + AB + \overline{A}B$

Question 36 (c)

Criteria	Marks
• Provides a correct circuit	3
• Shows a substantial understanding of the logic circuit	2
• Shows some understanding of the logic circuit	1

Sample answer:



Question 36 (d)

Criteria	Marks
• Clearly explains how flip-flop circuits are used to store and shift bits	3
• Shows some understanding of how flip-flop circuits store and/or shift bits	2
• Identifies a feature of flip-flop circuits	1

Sample answer:

The feedback loop in a flip-flop circuit makes it a bistable device capable of storing one bit. Several flip-flops together can store several bits. By linking the output from one flip-flop to the input of another, bits can be shifted from one flip-flop to another (effectively multiplying or dividing by two).

Question 36 (e)

Criteria	Marks
• Clearly shows the similarities and differences between floating point numbers and integer representation	3
• Shows some understanding of integer and/or floating point representation	2
• Shows a basic understanding of integer or floating point representation	1

Sample answer:

Similarity:
Both use the first bit as the sign (0 for positive)

Difference:
For integers, the remaining 31bits represent powers of 2 ($2^{30} \rightarrow 2^{0}$) and can only represent whole numbers.

For floating point numbers, the next 8 bits represent the exponent (+127) and the last 23 bits the mantissa (ignore the 1 before the radix) and can represent real numbers.

Question 36 (f) (i)

Criteria	Marks
• Explains the need for control characters in the scenario	2
• Demonstrates some understanding of control characters	1

Sample answer:

Text is sent as ASCII codes. It is necessary to distinguish between bytes that represent ASCII codes and those that represent graphics or formatting.

Question 36 (f) (ii)

Criteria	Marks
• Clearly shows how the data streams are similar or different with specific reference to the header, data block and trailer	4
• Shows a sound understanding of both data streams	3
• Shows some understanding of the data stream sent from the workstation and/or the data stream sent from the printer	2
• Identifies a feature of one of the data streams	1

Sample answer:

The header for both streams must include the source and destination of the data (ie the workstation and printer ID). The print job will require a much larger data block than the status of that print job. This in turn implies the need for more sophisticated error checking. The print job will be of various sizes, so the header must include the size of the data stream, or the trailer must include an end-of-transmission code. The status of the print job may be a standard size.

Software Design and Development

2014 HSC Examination Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	9.1.1 Social and Ethical Issues	H3.1
2	1	9.1.1 Social and Ethical Issues	H3.2
3	1	9.2.3 Implementation of software solutions	H5.2, H6.2
4	1	9.2.2 Planning and designing software solutions	H1.3
5	1	9.2.2 Planning and designing software solutions	H4.2, H4.3
6	1	9.2.4 Testing and evaluating software	H5.2, H5.3
7	1	9.2.3 Implementation of software solutions	H4.2
8	1	9.2.3 Implementation of software solutions	H1.2, H1.3
9	1	9.1.2 Application of software development approaches	H1.2, H4.2
10	1	9.2.2 Planning and designing software solutions	H1.3, H4.3
11	1	9.2.2 Defining and understanding the problem	H5.2
12	1	9.1.1 Social and ethical issues	H3.1
13	1	9.2.3 Implementation of software solutions	H4.2, H5.3
14	1	9.2.3 Implementation of software solutions	H1.2, H1.3
15	1	9.2.2 Planning and designing software solutions	H4.2, H1.2
16	1	9.2.3 Implementation of software solutions	H1.3
17	1	9.2.2 Planning and designing software solutions	H1.3, H4.2
18	1	9.2.1 Defining and understanding the problem	H1.3, H4.3
19	1	9.2.2 Planning and designing software solutions	H1.3
20	1	9.2.3 Implementation of software solutions	H1.1, H1.3

Section II

Question	Marks	Content	Syllabus outcomes
21	4	9.1.1 Social and Ethical Issues	H3.1
22	3	9.2.1 Defining and understanding the problem	H5.2
23	4	9.3 Developing a solution package	H5.1, H2.1
24	3	9.2.2 Planning and designing software solutions	H4.2
25	4	9.2.5 Maintaining software solutions	H4.2
26 (a)	3	9.1.2 Application of software development approaches & 9.1.1 Social and Ethical Issues	H2.2
26 (b)	3	9.2.1 Defining and understanding the problem	H5.2, H6.3
27 (a)	3	9.2.3 Implementation of software solution	H4.3
27 (b)	3	9.2.5 Maintaining software solutions	H3.1
28	3	9.2.5 Maintaining software solutions	H3.1
29	3	9.2.4 Testing and evaluating software solutions	H4.2, H4.3
30	4	9.2.2 Planning and designing software solutions	H4.3
31 (a)	2	9.2.2 Planning and designing software solutions	H1.3
31 (b)	3	9.2.2 Planning and designing software solutions	H4.2
31 (c)	4	9.2.1 Defining and understanding the problem	H5.2
32	3	9.2.3 Implementation of software solution	H4.2
33	4	9.2.3 Implementation of software solution	H4.2, H4.3
34 (a)	2	9.2.2 Planning and designing software solutions	H4.3
34 (b)	2	9.2.2 Planning and designing software solutions	H4.3

Section III

Question	Marks	Content	Syllabus outcomes
35 (a) (i)	3	9.4.1 Programming paradigms	H2.1
35 (a) (ii)	3	9.4.1 Programming paradigms	H2.1
35 (b)	2	9.4.1 Programming paradigms	H2.1, H4.2
35 (c) (i)	2	9.4.1 Programming paradigms	H2.1, H4.2
35 (c) (ii)	3	9.4.1 Programming paradigms	H2.1, H4.2
35 (d) (i)	3	9.4.1 Programming paradigms	H2.1, H4.2
35 (d) (ii)	4	9.4.1 Programming paradigms	H2.1, H4.2
36 (a)	3	9.4.2 The interrelationship between software and hardware	H1.1, H1.3
36 (b)	2	9.4.2 The interrelationship between software and hardware	H1.3
36 (c)	3	9.4.2 The interrelationship between software and hardware	H1.3
36 (d)	3	9.4.2 The interrelationship between software and hardware	H1.3
36 (e)	3	9.4.2 The interrelationship between software and hardware	H1.1, H1.3
36 (f) (i)	2	9.4.2 The interrelationship between software and hardware	H1.1, H1.3
36 (f) (ii)	4	9.4.2 The interrelationship between software and hardware	H1.1, H1.3