BOSTES | BOARD OF STUDIES TEACHING & EDUCATIONAL STANDARDS NSW

2016 HSC Software Design and Development Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 21

Criteria	Marks
• Provides one advantage and one disadvantage	2
• Provides one advantage or disadvantage	1

Sample answer:

Networks allow access to common resources but they are more prone to hacking than stand-alone systems.

Question 22

Criteria	Marks
• Explains TWO relevant factors	3
• Explains ONE relevant factor OR identifies TWO relevant factors	2
• Identifies ONE relevant factor	1

Sample answer:

If there is insufficient RAM to store all relevant code and data, the need to access secondary storage repeatedly will slow response times.

If there are several concurrent users accessing a limited number of network pathways, there will be delays, increasing response times.

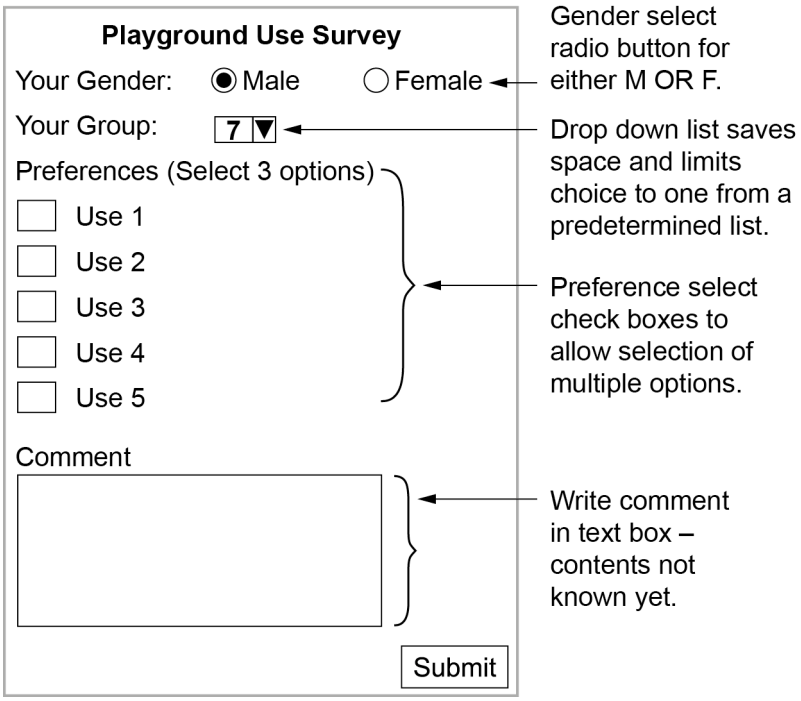
Answers could include:

Clock speed, number of tasks being attempted simultaneously, how data is being accessed (file type), the efficiency of the code, whether code has been compiled or is being interpreted.

Question 23

Criteria	Marks
• Shows appropriate uses of screen elements that fulfil the requirements for this interface, with justification of their use for this interface	4
• Shows appropriate uses of screen elements for this interface, with some justification OR shows appropriate use of screen elements that fulfil the requirements for this interface	3
• Shows appropriate use of screen elements	2
• Shows some understanding of screen design	1

Sample answer:



Question 24 (a)

Criteria	Marks
• Identifies and corrects all errors	3
• Identifies errors or corrects one error	2
• Identifies one error	1

Sample answer:

Line 4 should be UNTIL B <> A

Line 7 should be UNTIL C <> A AND C <> B

Question 24 (b)

Criteria	Marks
• Provides three correct lines	2
• Provides one correct line	1

Sample answer:

Line 3 : B

Line 6 : A

Line 8 : C

Question 25 (a)

Criteria	Marks
• Outlines how log books can be useful	2
• Shows some understanding of log books	1

Sample answer:

Log books are used to record the progress of the project, such as issues that arise, and changes that are made.

Question 25 (b)

Criteria	Marks
• Outlines one relevant technique	2
• Shows some understanding of project management other than the use of log books	1

Sample answer:

Time management using Gantt charts to schedule allocation of resources throughout the project and manage completion schedules.

Question 25 (c)

Criteria	Marks
• Provides a thorough explanation of why having good communication skills is important for a project manager	3
• Shows some understanding of why having good communication skills is important for a project manager	2
• Shows some understanding of communication skills	1

Sample answer:

A project manager needs to effectively interact with a diverse range of people. They need good conversation and listening skills to ensure that they effectively communicate with the clients or end users, and to correctly understand requirements. They need to manage their team, to clearly articulate project requirements to them and to resolve any conflict.

Question 26 (a)

Criteria	Marks
• Identifies the variables and specifies their data types	3
• Shows some understanding of variables and appropriate data types	2
• Identifies a variable or data type	1

Sample answer:

Variable	*Type*
TC	real
N	integer
C	string
D	real

Question 26 (b)

Criteria	Marks
• Shows a thorough understanding of how the algorithm can be improved	3
• Shows a substantial understanding of program documentation and/or maintenance	2
• Shows some understanding of program documentation or maintenance	1

Sample answer:

Include internal documentation such as comments to explain the code. Use meaningful identifiers (such as Total_Cost instead of TC) to illustrate the purpose of variables. Indent code to show the block structure in binary decisions.

Answers could include:

- Define the cost of each ticket at the start, rather than having 30 appear several times.
- Restructure so that the calculation and display only need to appear once, possibly in a separate module.

Question 27

Criteria	Marks
• Describes how relevant debugging techniques can be used to find the cause of the error	4
• Describes how a relevant debugging technique can be used to find the cause of the error OR outlines multiple debugging techniques	3
• Outlines one debugging technique OR identifies debugging techniques	2
• Shows some understanding of debugging or program errors	1

Sample answer:

The problem could be an infinite loop. Running the program with a program trace would indicate which loop is not being terminated.

Single line stepping executes a program one line at a time and allows the programmer to observe the effect of the line's execution. An unexpected value of a variable may be identified.

Question 28

Criteria	Marks
• Shows how the data can be stored in one data structure with the required example	3
• Shows how a data structure can be used to store the data	2
• Identifies a relevant data structure OR shows how John's data could be stored	1

Sample answer:

Use an array of records, with each person's data held in a different record allowing multiple data types to be stored. For example John's data could be stored as:

Student(4).Height = 1.98

Student(4).Gender = 'M'

Student(4).Birth Year = 1998

Student(4).Name = 'John'

Question 29 (a)

Criteria	Marks
• Recommends a suitable development approach with good justification	3
• Recommends a development approach with some justification	2
• Recommends a development approach	1

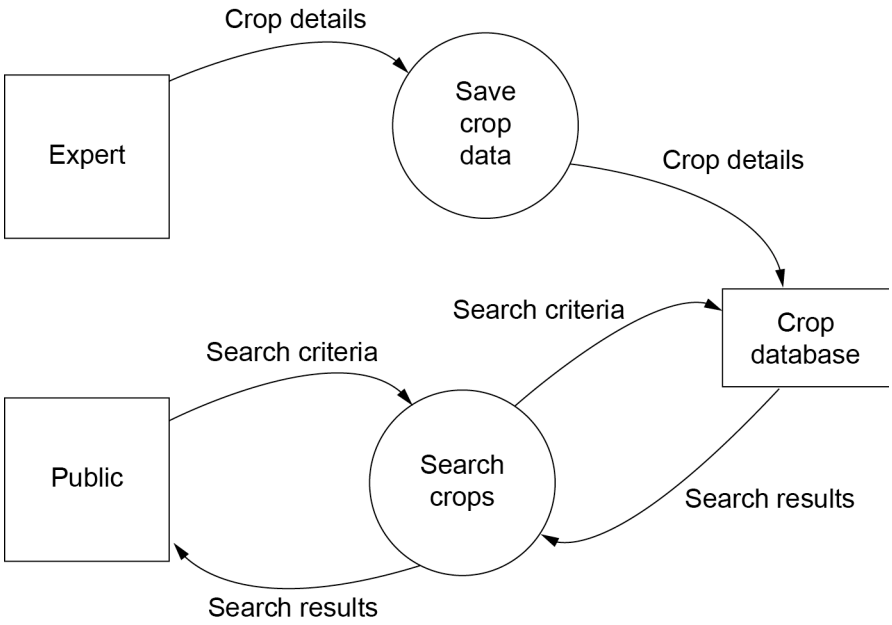
Sample answer:

Agile
Since it is uncertain what the website should look like, the project team works with the developers to quickly create an initial version of the website. This could be made live on the internet to collect feedback from users to be discussed at regular meetings. Changes can be made to the website based on this feedback so that the website is constantly changing to reflect the needs of the users.

Question 29 (b)

Criteria	Marks
• Provides a data flow diagram that includes suitable external entities, processes and data store, with suitable data flow indicated, with some differentiation between expert users and the general public	4
• Provides a substantially correct data flow diagram in the context of the scenario	3
• Provides a diagram with some correct data flow symbols	2
• Provides a diagram that shows some understanding of the scenario	1

Sample answer:



Question 29 (c)

Criteria	Marks
• Explains relevant social issues	3
• Identifies relevant social issues or explains ONE relevant social issue	2
• Identifies a social issue	1

Sample answer:

Inclusivity: The website must be accessible to all intended users. This may require interface features that allow for disabilities – for example text to speech for the visually impaired.

As not all users should have the right to add or edit data, there must be suitable levels of security, with protection of user passwords and personal information.

Question 30

Criteria	Marks
• Outlines factors to be considered, providing relevant justification	3
• Identifies factors to be considered OR • Identifies a factor providing relevant justification	2
• Shows an understanding of the problem	1

Sample answer:

The number of elements in the array and how often the array needs to be searched and updated are factors to be considered. If the number of elements is small or the array needs to be updated often, then the decision to not sort and use a linear search might be made, rather than sorting and using a binary search.

Question 31

Criteria	Marks
• Provides a substantially correct algorithm that incorporates the following features: – Correctly referencing elements of the array – Checking whether each individual row adds to 10 – Checking whether all rows add to 10 – Outputting an appropriate message	4
• Provides an algorithm that attempts to address the main features of the problem	3
• Provides an algorithm that attempts to solve some features of the problem	2
• Shows some understanding of the problem	1

Sample answer:

```
BEGIN CheckPuzzle
        correct = true
        row = 1
        WHILE row <= 4 AND correct = true
            rowtotal = 0
            FOR column = 1 TO 4
                rowtotal = rowtotal + cell(row, column)
            NEXT column
            IF rowtotal <> 10 THEN
                correct = false
            END IF
            increment row
        END WHILE
        IF correct THEN
            Display “Puzzle is correct!”
        ELSE
            Display “Sorry, puzzle is incorrect”
        END IF
END CheckPuzzle
```

Question 32

Criteria	Marks
• Provides a single, substantially correct EBNF statement that covers most situations given	4
• Provides a substantially correct metalanguage statement that covers more than one given situation	3
• Provides a metalanguage statement that describes a partially correct binary selection statement	2
• Shows some understanding of a metalanguage	1

Sample answer:

Binary selection = IF <condition> { (OR | AND) <condition>) } THEN { <statement> } [ELSE { <statement> }] ENDIF

Question 33

Criteria	Marks
• Provides a correct algorithm that incorporates the following features: – OPEN / CLOSE file – Looping through the file, reading data – Terminating the loop at end of file – Correctly constructing and displaying the output	5
• Provides an algorithm that attempts to address the main features of the problem	4
• Provides an algorithm that shows understanding of file handling OR processing of data	3
• Provides an algorithm that shows understanding of the problem	2
• Shows some understanding of the problem	1

Sample answer:

```
BEGIN
    Open FoodData for Input
    Read name
    WHILE NOT EOF
        Read food
        Display name “likes” food
        Read name
    ENDWHILE
    Close FoodData
END
```

Section III

Question 34 (a)

Criteria	Marks
• Identifies the essential features of an expert system	2
• Identifies a feature of an expert system	1

Sample answer:

An expert system is able to emulate the decision-making processes used by humans. They are often designed to solve complex problems by reasoning using a set of facts and rules rather than conventional procedural code.

Question 34 (b)

Criteria	Marks
• Explains the appropriateness of both paradigms to the scenario	4
• Shows a substantial understanding of both paradigms	3
• Shows some understanding of one of the paradigms with reference to the scenario OR shows some understanding of both paradigms	2
• Shows some understanding of paradigms	1

Sample answer:

The logic paradigm provides facts and rules where the developer is not required to design how they are met. Facts would be suitable in this scenario for stating symptoms and descriptions of the patient's condition, while rules could be used to determine which of the company's products would be suitable for the patient to use.

The control of the inventory would be taken care of using OO. Product would be a class with attributes (such as productId and numberInStock) and methods eg addToOrder(). There would also be a class for current orders. The grouping of attributes and methods using classes and encapsulation would make the code easier to maintain.

Question 34 (c) (i)

Criteria	Marks
• Correctly extends the code for both the facts and the rule	3
• Correctly extends the code for the facts or the rule	2
• Shows an understanding of facts or rules in the logic paradigm	1

Sample answer:

The first dot point would require:

```
teacher(Mrs Baker, Music)
in_class(Maha, Music)
```

The second dot point would require:

```
classmate(X, Y):- in_class(X, Z), in_class(Y, Z)
```

Question 34 (c) (ii)

Criteria	Marks
• Provides a description of how this rule is evaluated with reference to the chaining method used	3
• Shows some understanding of forward or backward chaining	2
• Shows some understanding of the problem	1

Sample answer:

Using Backward Chaining: It will find the rule taught(X,Y) and break it down as teacher(Mr Seale, Z), in-class(Sharon, Z). The program would find the facts teacher(Mr Seale, Drama) and teacher(Mr Seale, Dance). The fact in_class(Sharon, Dance) would then be found.
So Z = Dance. As both facts are found then taught(Mr Seale, Sharon) will return True.

Question 34 (d) (i)

Criteria	Marks
• Provides a valid suggestion	2
• Shows some understanding of attributes	1

Sample answer:

Move the attribute "Colour" for the Fruit and Vegetable classes to the Plant class.

Question 34 (d) (ii)

Criteria	Marks
• Provides an answer that demonstrates inheritance, instantiation and assignment of appropriate values	4
• Provides an answer that attempts to instantiate and that assigns values to attributes	3
• Shows some understanding of instantiation or assigning values to attributes	2
• Shows a basic understanding of instantiation	1

Sample answer:

```
v = new Vegetable()
v.Colour = "Brown"
v.Name = "Potato"
v.Description = "Grows in the ground"
v.GrowsAboveGround = False
```

Question 34 (d) (iii)

Criteria	Marks
• Provides a suitable method that can be used during instantiation to set the id value	2
• Provides a method that can be used to set the id value	1

Sample answer:

```
Plant(value : integer)
        id = value
END Plant
```

Question 35 (a)

Criteria	Marks
• Provides differences	2
• Provides a difference	1

Sample answer:

7-bit ASCII is limited to 128 characters – the characters found on a standard keyboard. Unicode uses more bits (16) and allows many other scripts and symbols to be represented.

Question 35 (b)

Criteria	Marks
• Performs a correct division in binary	3
• Shows understanding of shifting and subtraction	2
• Shows some understanding of the process of division	1

Sample answer:

```
     0001111
110)1011101
      110
      1011
       110
       1010
        110
        1001
         110
          11   ← Remainder
```

Question 35 (c) (i)

Criteria	Marks
• Provides convincing evidence	3
• Provides some evidence	2
• Shows some understanding of the relevant logic gates	1

Sample answer:

With a NOR gate, the output is 1 only if both inputs are 0, so the output here will be 0 (as 1 of the inputs is 1).

With a NAND gate, the output is 0 only if both the inputs are 1. In this case one of the inputs is 0, so the output Z is 1.

Answers could include:

A	B	C	A NOR B	Z = C NAND (A NOR B)
0	0	0	1	1
0	0	1	1	0
0	1	0	0	1
0	1	1	0	1
1	0	0	0	1
1	0	1	0	1
1	1	0	0	1
1	1	1	0	1

Whenever A is 1, Z is 1.

$$\overline{\overline{\overline{A+B}}.C}$$

$$= \overline{\overline{\overline{A+B}}+\overline{C}}$$

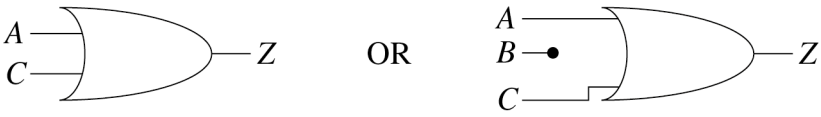
$$= A+B+C$$

$$= 1 \text{ if } A = 1$$

Question 35 (c) (ii)

Criteria	Marks
• Provides a correct circuit using fewer than three logic gates	3
• Provides a substantially correct circuit OR describes the circuit	2
• Shows some understanding of the problem	1

Sample answer:



Answers could include:

$A + \overline{A}C + A\overline{B} + AC.$

Rearrange to $A + A\overline{B} + \overline{A}C + AC.$

Simplify to $A + \overline{A}C + AC.$

Simplify to $A + C.$

OR

A	B	C	Z
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

The value of B is irrelevant. The circuit simplifies to ‘A OR C’.

Question 35 (d) (i)

Criteria	Marks
• Shows understanding of the contents of both the header and trailer for this data stream	3
• Provides some relevant contents	2
• Shows some understanding of data streams	1

Sample answer:

The header must contain some start-of-transmission code and maybe the length of the data block, error detection bits and the identity of the source and destination of the data.

The trailer could include end-of-transmission codes.

Question 35 (d) (ii)

Criteria	Marks
• Provides a substantially correct description of the text	3
• Provides a partial description of the text, including at least two features	2
• Shows some understanding of the problem	1

Sample answer:

The font is `courier`, the style is boldface and italic.

The letter `C` appears without flashing, the letter `A` is flashing 50 ms on, 50 ms off, the letter `T` is not flashing.

Question 35 (d) (iii)

Criteria	Marks
• Provides an explanation of the effect, with specific reference to relevant codes or characters being printed	3
• Shows some understanding of what will now appear on the display	2
• Recognises that the flash rate won't change OR displays a limited understanding of the purpose of the `1B` in relation to the data that follows	1

Sample answer:

If `1B` is omitted, the flash rate won't be changed. The letter `F` will be printed, followed by the letters `PP`.

2016 HSC Software Design and Development Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	9.1.1 Software piracy	H3.1
2	1	9.1.1 Reverse engineering	H3.1
3	1	9.1.2 Outsourcing	H1.2
4	1	9.1.2 Installation methods	H5.1
5	1	9.1.2 Use of CASE tools	H1.2
6	1	9.2.1 Developer vs user perspective	H4.1
7	1	9.2.2 System documentation	H5.2
8	1	9.2.4 Quality assurance criteria	H3.2, H5.1
9	1	9.2.3 Purpose of DLL	H4.3
10	1	9.2.1 Data types	H4.2
11	1	9.2.2 Flowchart vs pseudocode	H4.2
12	1	9.2.4 Test data design	H4.2
13	1	9.2.2 Identifying a sort	H1.3
14	1	9.2.3 Compiler vs interpreter	H1.2, H4.2
15	1	9.2.2 Analysis of algorithm	H4.2
16	1	9.2.2 Subroutine calls	H4.3
17	1	9.2.3 Metalanguages	H2.1
18	1	9.2.2 Insertion algorithm	H4.3
19	1	9.2.3 Machine code fragment – interpretation	H1.1, H1.3
20	1	9.2.3 Machine code fragment – use of register	H1.1, H1.3

Section II

Question	Marks	Content	Syllabus outcomes
21	2	9.1.1 Use of networks in software development	H2.2
22	3	9.1.1, 9.2.4 Response times	H2.2
23	4	9.2.2 Interface design – screen elements	H6.4
24 (a)	3	9.2.2 Errors in algorithm	H4.2
24 (b)	2	9.2.2 Complete an algorithm	H4.2
25 (a)	2	9.3 Purpose(s) of logbooks	H5.1
25 (b)	2	9.3 Project Management techniques	H5.1
25 (c)	3	9.2.1, 9.3 Communication skills	H6.1
26 (a)	3	9.2.2 Data types	H6.3, H6.4
26 (b)	3	9.2.2, 9.2.5 Maintenance	H5.1
27	4	9.2.3 Debugging tools	H5.3
28	3	9.2.2 Data structures	H4.2
29 (a)	3	9.1.2 Scenario – development approach	H1.2

Question	Marks	Content	Syllabus outcomes
29 (b)	4	9.2.2 Scenario – system documentation	H6.3, H6.4
29 (c)	3	9.1.2 Scenario – social/ethical issues	H3.1
30	3	9.2.2 Search and sort	H1.3
31	4	9.2.2 Algorithm design	H4.2
32	4	9.2.3 Metalanguages – design for a control structure	H2.1
33	5	9.2.2 Algorithm design	H4.2

Section III

Question	Marks	Content	Syllabus outcomes
34 (a)	2	9.4.1 Definition of an expert system	H1.2
34 (b)	4	9.4.1 Comparing paradigms	H1.2, H2.1
34 (c) (i)	3	9.4.1 Extending LOGIC code	H1.2
34 (c) (ii)	3	9.4.1 Evaluating a LOGIC rule	H1.2, H2.1
34 (d) (i)	2	9.4.1 Modifying some OOP code	H1.2
34 (d) (ii)	4	9.4.1 Producing some OOP code (instantiation)	H1.2
34 (d) (iii)	2	9.4.1 Producing some OOP code (method)	H1.2
35 (a)	2	9.4.2 Character representation	H1.3
35 (b)	3	9.4.2 Binary arithmetic – division	H1.3
35 (c) (i)	3	9.4.2 Analysing a circuit	H1.1
35 (c) (ii)	3	9.4.2 Designing a circuit	H1.1
35 (d) (i)	3	9.4.2 Data stream – contents of header / trailer	H1.1
35 (d) (ii)	3	9.4.2 Data stream – interpretation	H1.1
35 (d) (iii)	3	9.4.2 Data stream – control code	H1.1