



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2022

Marking Scheme

Computer Science

Ordinary Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Marking Scheme – Section C

Structure of the marking scheme for Section C (Programming)

Candidate responses are marked according to different scales, depending on the types of response anticipated. Scales labelled A divide candidate responses into four categories (correct response, almost correct response, partially correct response, and response of no substantial merit), and so on. The scales and the marks that they generate are summarised in this table:

Scale Label	A
No. of categories	4
5 mark scale	0, 2, 3, 5
10 mark scale	0, 3, 7, 10

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the scheme, where necessary.

Marking scales – level descriptors

A-scales (4 categories)

- response of no substantial merit
- response with some merit
- almost correct response
- correct response

Answer any six questions.

Question 1

5 Marks

print statement	Result
<code>print(a+b)</code>	6
<code>print(b-a)</code>	2
<code>print(a*b)</code>	8
<code>print(a/b)</code>	0.5
<code>print(a==b)</code>	FALSE

Each correct item 1 mark

Note: $\frac{1}{2}$ is **not** a correct answer for `print(a/b)`

Question 2

5 marks

- Identifying traffic patterns.
- Help improve traffic flow at the junction.
- Change traffic light times at different times of the day.
- Get information on different modes of transportation being used.
- Save people time, stop delays

Any two of the above or similar:

First Correct:

Very good explanation – clear understanding demonstrated 3 marks

Fair explanation – limited understanding 1 mark

Second Correct:

Very good explanation – clear understanding demonstrated 2 marks

Fair explanation – limited understanding 1 mark

Question 3

3 + 2 marks

(a)

- **To see the changes of the LED turning on or off**
- **The code will run too quickly to see LEDs without the pauses**
- **To see if the code works correctly**

Any one of the above or similar:

Good explanation – clear understanding demonstrated 3 marks

Fair explanation – limited understanding 1 mark

(b) Describe the appearance of the LEDs when the program ends.

- **The red LED is on, the yellow and green LEDs are off**

Describing correctly all 3 of the LED's appearance 2 marks

Describing correctly 1 or 2 of the LED's appearance but not all 3 1 mark

Question 4

5 marks

- **Motherboard -> This is a circuit board that the other components can connect into.**
- **Central Processing Unit (CPU) -> Contains the Control unit and the Arithmetic Logic Unit. The CPU carries out all calculations and processes the instructions that come to it.**
- **Fan -> Used to keep the computer cool to avoid damage.**
- **Memory -> Contains data and programs while the computer is running. Splits into RAM (Random Access Memory) which is processing memory and is wiped when the computer is powered off and ROM (Read Only Memory) which contains essential instructions for the computer to start ('boot up').**
- **Hard Drive -> This component is used to store the computer's data and programs. As it is non-volatile its contents are not lost when the computer is switched off.**
- **Video Card -> Improves video and graphic quality on the computer or device.**

Best two responses marked out of 2 and third best response marked out of 1 as follows:

First and second correct:

Good description – clear understanding demonstrated 2 marks each

Fair description – limited understanding 1 mark each

Third correct:

Good description – clear understanding demonstrated 1 marks each

Fair description – limited understanding 1 mark each

Question 5

2 + 3 marks

(a)

- 3

Correct response 2 marks

(b)

- **Not an efficient way of searching.**
- **In big data sets it will take a long time to complete the search.**
- **Will only find the first number even if the number appears more than once.**

Good description – clear understanding demonstrated 3 marks

Fair description – limited understanding 1 mark

Question 6

3+2 marks

(a)

- **Guess < Number (Less than)**
- **Number greater than Guess (Greater than)**

Any one of the above or similar:

Very clear instruction– uses correct words or symbols and has correct logic 3 marks

Fair instruction – correct idea but small mistake with symbols or logic 1 mark

(b)

- **Give user a second chance to guess.**
- **Error checking to see that guess is between 1 and 10.**
- **Show the correct answer at the end.**
- **Ask the user do they want to play again.**
- **Any improvement of merit.**

Any one of the above or similar:

Correct 2 marks

Question 7

5 marks

- **Ada Lovelace -> Considered the first computer programmer. Wrote and published the first algorithm.**
- **Dame Mary Cartwright -> Only woman to be president of the London Mathematical Society. Was one of the first to study Chaos Theory.**
- **Katherine Johnson -> Mathematician working for NASA. Carried out complex calculations for engineering department.**
- **Margaret Hamilton -> Considered one of the first computer programmers. Contributed to the programming that would be used on Apollo's spacecraft.**

Any one of the above or alternative:

Name of female who contributed to the field of computer science 2 Marks

Description of development:

Very good description – clear understanding demonstrated 3 marks

Fair description – limited understanding 1 mark

Question 8

3 + 2 marks

(a)

- **COVID Tracker App**
- **Online Video Calls.**
- **Entertainment online.**
- **Communicate with other people.**
- **Getting information to stay informed.**
- **Online working and schooling.**

Any one of the above or similar:

Very good description – clear understanding demonstrated 3 marks

Fair description – limited understanding 1 mark

(b)

- **Some people can afford or get access to technology and others cannot.**
- **The people who cannot afford or get access to technology can be left behind when a lot more is being done online.**

Any one of the above or similar:

Good explanation – clear understanding demonstrated 2 marks

Fair explanation – limited understanding 1 mark

c

Question 9

(a)

- **Four**
- **9.5**
- **10/10**
- **5 or 6**

Each Correct Item 1 mark

(b)

- Have a drop down menu so only numbers can be picked.
- Have a keypad with numbers 1 – 10
- Have an error message if the user enters an invalid score

Any one of the above or similar:

Good explanation – clear improvement described 2 marks
Fair explanation – improvement mentioned but not described 1 mark

Question 10

3 + 2 marks

(a)

Name	Component (write the letter)
Transistor	C
Capacitor	A
Resistor	B

Each Correct Item 1 mark

(b)

- Transistor -> Used to control current and voltage in a circuit.
- Capacitor -> Are used to store electrical charge
- Resistors -> Are used to slow down the flow of current in a circuit.

Any one of the above or similar:

Good explanation – clear understanding demonstrated 2 marks
Fair explanation – limited understanding 1 mark

Question 11

5 marks

INPUTS		OUTPUTS
A	B	A AND B
0	0	0 / False
0	1	0 / False
1	0	0 / False
1	1	1 / True

Full correct response 5 marks

Each Correct Item 1 mark



Question 12

3+2 marks

(a)

- 7

Correct answer 3 marks

Attempt work of merit 1 mark

(b)

- 1

Correct answer 2 marks

Attempt work of merit 1 mark



Section B	Long Questions	30 marks
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Question 13 **30 (12, 8, 10) marks**

(a) **12 (4, 8) Marks**

(i) **4 marks**

1 (smallest)	Bit
2	Kilobyte
3	Gigabyte
4 (largest)	Terabyte

Each correct item 1 mark



(ii) **8 marks**

- **20:59**

Each correct digit 2 marks

Work of merit for a digit 1 mark



(b) **8 (4,4) marks**

(i) **4 marks**

- **True**
- **False**
- **True**
- **True**

Each correct answer 1 mark

(ii) **4 marks**

- **128 extra characters**

Correct value 4 marks

Work of merit 2 mark



(c)

10 (5,5) marks

(i)

5 marks

- **Primary storage is contained within the device (RAM and ROM). It is often known as internal memory. Secondary storage can be connected to the device USB, hard-drive.**
- **Primary storage can be volatile and non-volatile. Secondary storage is always non-volatile storage.**
- **Secondary storage has slower access times than primary storage**
- **Primary storage is usually more expensive than secondary storage.**

Any two of the above or similar:

First Correct:

Good explanation – clear understanding of difference 3 marks

Fair explanation – limited understanding of difference 1 mark

Second Correct:

Good explanation – clear understanding of difference 2 marks

Fair explanation – limited understanding of difference 1 mark

(ii)

5 marks

- **Solid State drives can operate faster than Hard disk drives.**
- **Solid state drives are lighter than the Hard disk drive.**
- **Solid State Drives is smaller in size (takes up less space)**
- **Hard Disk Drives are cheaper than Solid State Drives**
- **Solid State drive doesn't produce noise whereas the Hard disk drive can create some noise.**

Best response marked out of 3 and second best response marked out of 2 as follows:

First Correct:

Good explanation – clear understanding of difference 3 marks

Fair explanation – limited understanding of difference 1 mark

Second Correct:

Good explanation – clear understanding of difference 2 marks

Fair explanation – limited understanding of difference 1 Mark

Question 14

30 (8, 12, 10) marks

(a)

8 (4, 4) marks

(i)

4 marks

- **There are 700 students in the school**
- **There are 120 students in 6th year**
- **The school is a mixed school**
- **The school has 40% males**
- **The school has 60% females.**
- **Lunch break is 1 hour long**
- **Any valid response**

Each correct statement 2 marks

(ii)

4 (1, 3) marks

- **Decomposition**
 - Description on how the problem can be broken down into manageable pieces.
- **Pattern Recognition**
 - Description on how the problem can be identified through patterns and how this can be used to solve it.
- **Algorithmic Thinking**
 - Description on how the problem can be solved using an algorithm.
- **Any other valid response**

Identifying computational technique as above or otherwise: 1 mark

Description of computational technique

Good description – clear understanding demonstrated 3 marks

Fair description – limited understanding 1 mark

(b)

12 (8, 4) Marks

(i)

8 marks

- Last Name (String)
- Year group (Int)
- Sibling in 6th Year (Boolean)
- Permission slip signed (Boolean)
- Parents Name (String)
- Number of Siblings (int)
- Any other valid piece of data relevant to the problem

Any variable created regarding the above with appropriate variable name:

Each fully correct row 2 marks
Each partially correct row 1 mark

(ii)

4 marks

Test case must mention:

- Person name
- Year group
- Permission
- Sibling (for person not in 6th year)

Pass test case:

All of above is included in test case 2 marks
Some of above are included in test case 1 mark

Fail test case:

All of above is included in test case 2 marks
Some of above are included in test case 1 mark

(No marks if example is repeated as a test case)

(c)

10 marks

Key decisions within algorithm and the outcomes correctly stated.

- Is student in 6th year -> Yes/ No
- Does the student have a sibling in 6th year? Yes/ No
- Does student have parental permission Yes/ No

Key decision and outcomes included

2 marks each (max 6)

Layout of pseudocode or flowchart

Good 2 marks

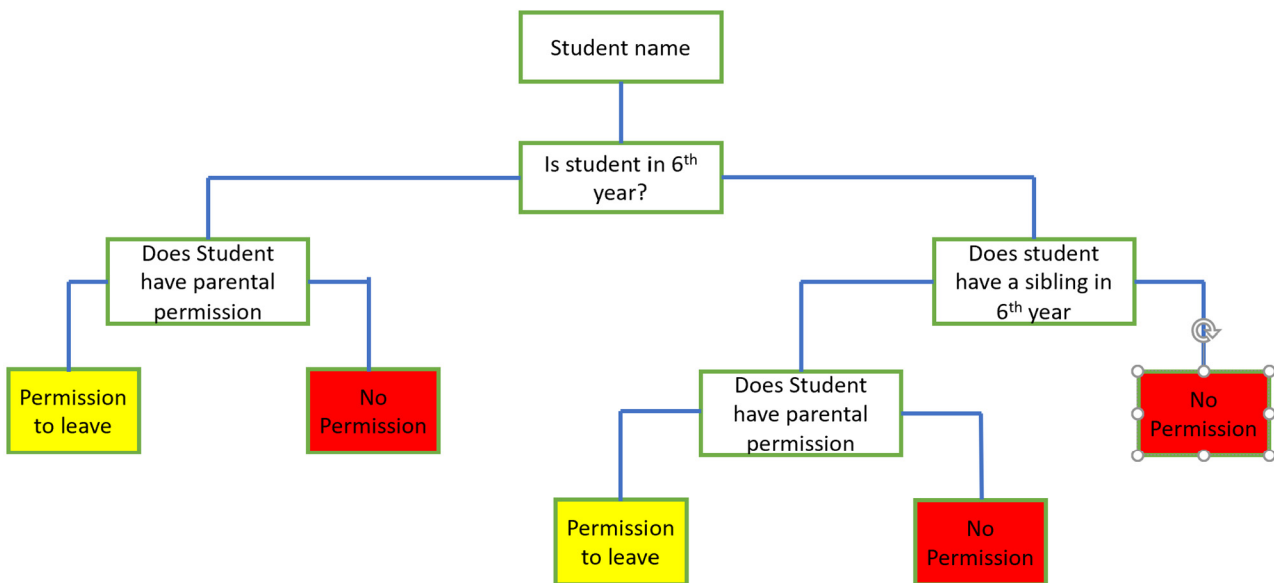
Fair 1 mark

Outcomes

All outcomes considered correctly 2 marks

Any outcomes considered correctly 1 mark

Example Solution



Question 15

30 (6, 6, 10, 6) marks

(a)

6 (2, 4) marks

(i)

2 marks

- **Any important development in computing and technology**

Good description - clear understanding demonstrated

2 marks

(ii)

4 marks

For each reason:

- Detailed reason why the development was important **2 marks**
- Brief reason why the development was important **1 mark**

(b)

6 marks

The World Wide Web and the Internet are often thought to be the same thing but they are different. Explain how the World Wide Web and Internet differ?

- **The internet is the connections between networks and devices around the world. Devices are able to communicate with each other through these connections.**
- **The world wide web is a collection of websites. Each website is a collection of web pages. Websites and the pages they are made up of are identified and can be accessed via URLs. Websites are hosted on computers called web servers. These web servers are connected to the internet.**
- **The internet is the connections between networks. The world wide web is the content that can be accessed on the internet.**

Very good explanation - clear understanding demonstrated

6 marks

Good explanation - clear information, lacking demonstration of full understanding

3 marks

Fair explanation - limited understanding

1 mark

(c)

12 marks (6, 6)

(i)

6 marks

Good features:

- **Clear visual of Ireland**
- **Menu neatly laid out**
- **Clear title**

Any one of the above or similar 3 marks

Poor features:

- **Not good colour combinations**
- **Some text very small**
- **No navigation bar**
- **Poor structure to the page**

Any one of the above or similar 3 marks

(ii)

6 marks

- **Spread content across all the webpage**
- **Be more consistent with text size.**
- **Use more colours that complement each other.**
- **Make the website more accessible.**
- **Add in a navigation bar with links**
- **Place search bar in more prominent place on the site.**

Any three of the above or similar 2 marks each

(d)

6 marks

- **Use plain English**
- **Use large fonts, buttons**
- **Use good colour combinations**
- **Embedded use of screen reader**
- **Closed captions on videos**
- **Allow keyboard navigation**
- **Don't clutter the website with links**
- **Use heading correctly and organise the content.**
- **National Language Support.**

Any three of the above or similar 2 marks each

Question 16

50 marks

(a)

50 (5, 10, 5, 5, 5, 10, 10) marks

Possible solution:

```
1 # Question 16 (a)
2 # Examination Number:
3 # user enters first name
4 firstName = input("What is your first name? ")
5 surname = input("What is your surname? ")
6
7 print("Hello", firstName, surname, "please select from the list
of items.\n")
8 # \n creates a new line
9
10 # List of items in shop
11 print("\tItems Available") # \t creates a tab
12 print("-----")
13 print("1 = Book")
14 print("2 = Ruler")
15 print("3 = Pen")
16 print("-----")
17
18 shoppingItem = int(input("\nEnter the number of the item would
you like: "))
19
20 if shoppingItem == 1:
21     print("You bought a book")
22 elif shoppingItem == 2:
23     print("You bought a ruler")
24 elif shoppingItem == 3:
25     print("You bought a pen")
26 else:
27     print("Invalid choice. Goodbye")
```

(i)

5 marks (A-5 scale)

5 marks	Correct response Correct implementation using solution above or similar.
3 marks	Almost correct response Comment in inappropriate location.
2 mark	Response with some merit Any reasonable attempt at inserting a comment.

(ii)

10 marks (A-10 scale)

10 marks	Correct response Correct implementation using solution above or similar (using input only or print and input commands).
7 marks	Almost correct response Almost correct implementation using solution above or similar but with minor syntax error. Correct solution but variable is not called surname
3 mark	Response with some merit Attempted use of <code>input</code> to attempt to take in the users surname.

(iii)

5 marks (A-5 scale)

5 marks	Correct response Correct implementation using solution above or similar.
3 marks	Almost correct response Correct implementation using solution above or similar but with minor syntax or semantic error.
2 mark	Response with some merit Attempt that shows some limited knowledge of print statements.

(iv)

5 marks (A-5 scale)

5 marks	Correct response Correct implementation using solution above or similar.
3 marks	Almost correct response Correct implementation using solution above or similar but with minor syntax or semantic error.
2 mark	Response with some merit Attempt at adding print statements to the appropriate place.

(v)

5 marks (A-5 scale)

5 marks	Correct response Correct implementation using solution above or similar.
3 marks	Almost correct response Correct implementation using solution above or similar but with minor syntax or semantic error.
2 mark	Response with some merit Attempt at adding in the dividers to the list.

(vi)

10 marks (A-10 scale)

10 marks	Correct response Correct implementation using solution above or similar.
7 marks	Almost correct response Correct implementation using solution above or similar but with minor syntax or semantic error. Attempt at adding 2 if or elif statements to complete the task.
3 mark	Response with some merit Attempt at adding 1 if statement or elif statement to complete the task

(vii)

10 marks (A-10 scale)

10 marks	Correct response Correct implementation using solution above or similar.
7 marks	Almost correct response Correct implementation using solution above or similar but with minor syntax or semantic error.
3 mark	Response with some merit Attempt at using an else statement or equivalent to error check.

Coursework (90 marks in total)	
1. Investigation and Plan	Marks
<ul style="list-style-type: none"> Initial research into the context of the brief and existing solutions. Planning and outlining potential solutions to the brief; identifying the potential stakeholders and end-users; consider social implications and how the artefact can be inclusive for all users; refine, list and describe the objectives for the artefact that you will develop. Deeper research on the chosen solution and potential technical solutions that will achieve the artefact objectives. 	20
2. Design	
<ul style="list-style-type: none"> Clearly describes how the requirements of the system are met. Description of the key aspects of how the artefact will be structured; an overview of how different parts of the system will interact which may include a system architecture diagram or system flowchart, data flow diagram(s), algorithms or flowcharts, data model, wireframes, hardware selection and similar. 	20
3. Implementation and Testing	
<ul style="list-style-type: none"> A brief timeline of key dates and milestones achieved in the development of the artefact. Clearly describes the development of the artefact and any problems that were encountered during the process Clearly demonstrates the operation of the system. This should be demonstrated through the use of the video and supporting text if required. Fundamental programming skills are demonstrated, such as using a modular approach, using high level data structures, algorithms, programming constructs, minimal duplication of code, readability, effective use of commenting and similar. A description of the type and extent of testing that took place which may include test cases/table and test data; an explanation of the impact of testing on the development of the artefact. 	40
4. Evaluation	
<ul style="list-style-type: none"> Explains the extent to which your artefact meets your design objectives; how well the needs of the envisaged end-user are met. Describes with justification how your artefact could be modified and improved. 	10
References and Summary word count	
<ul style="list-style-type: none"> You must also include references and/or a bibliography. Include a summary of the word count of the report, including the total word count. 	0

Higher grade	Ordinary grade	Reference Mark	Higher Mark	Ordinary Mark
1		81 – 90	81 – 90	90
2		72 – 80	72 – 80	90
3		63 – 71	63 – 71	90
4		54 – 62	54 – 62	90
5	1	45 – 53	45 – 53	81 – 90
6	2	36 – 44	36 – 44	72 – 80
7	3	27 – 35	27 – 35	63 – 71
8	4	23 – 26	23 – 26	54 – 62
	5	18 – 22	18 – 22	45 – 53
	6	14 – 17	14 – 17	36 – 44
	7	9 – 13	9 – 13	27 – 35
	8	0 – 8	0 – 8	0 – 26

COURSEWORK – conversion from reference mark to Ordinary-level mark

For Ordinary-level candidates, the final mark is found from the reference mark as follows:

- If the reference mark is 54 or more the final mark is 90.
- If the reference mark is at least 27 but less than 54, then add 36 to the reference mark to get the final mark.
- If the reference is at least 1 but less than 27, then double the reference mark and add 9 to get the final mark.
- If the reference mark is 0 the final mark is 0

Reference Mark	Conversion
54 or more	Award 90 marks
27 – 53	Add 36 marks
1 - 26	Multiply the reference mark by 2 and add 9 marks
0	0

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