| Class/ Index Number | Centre Number/ 'O' Level Index Number | Name |
|------------------------|--|------|
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新加坡海星中学

MARIS STELLA HIGH SCHOOL PRELIMINARY EXAMINATION SECONDARY FOUR

COMPUTING

Paper 1 Written

7155/01 23 August 2022 2 hours

Candidates answer on the Question Paper. No Additional Materials are required.

MARKING SCHEME



This document consists of 16 printed pages.

1 Five data loss issues are shown on the left.

Six possible methods of data recovery or protection are shown on the right.

Draw one line to link each issue to its correct method .

| Data Loss Issues | Methods |
|---|-------------------------------|
| Data loss caused by hard disk head crash | Anti-virus software |
| Hacking into files and changing or deleting data | Encryption |
| A computer program that attaches itself to a harmless program and modifies it | Read policy privacy |
| An intruder with physical access to a storage device accessing files or folders | Anti-spyware software |
| Software that logs/records all key presses on your computer without you knowing | Create back-up files |
| | Use of passwords and firewall |

[5]

2 There are five stages in developing a program.

Identify three stages and elaborate the process of each stage.

1 mark to identify the stage, 1 mark for explaining what happens at that stage

- 1 Gather Requirements
 - Determine the nature of the problem by interviewing the intended audience of the program
 - Identifying a set of input necessary and how input will be collected
 - Identifying what outputs are required and how output will be given
- 2 Plan Solutions
 - Manually solving different simplified examples of the problem and generalising the steps needed to produce the required output (apply generalising to solve problem and plan solution)
 - Trying different ways to break down the problem into smaller parts such that the intended output of each part gets closer and closer to what is needed to solve the problem(apply decomposition to solve problem and plan solution)
 - Comparing the problem to other problems that have been solved before and identifying which algorithms can be used.
 - Estimating the amount of effort needed to write the code or the time needed to complete the algorithm before making a definite choice (plan logistics and project timeline)
 - Writing possible algorithms using either flowcharts or pseudo-code
- 3 Write code
 - Write code that performs the algorithm as planned in the previous stage as efficiently as possible.
- 4 Test and Refine Code
 - Running the code through one or more test cases to evaluate whether the written code adequately satisfies the gathered requirements and is ready to be used.
- 5 Deploy Code
 - To allow program to be used by intended audience by training users to use the program.
 - Transitioning from an old program or system to the new program.
 - Evaluating the effectiveness of the program in solving the problem and considering any changes that might increase its usability or effectiveness.

- 3 (a) Read the following section of a program code that inputs twenty numbers and then outputs the largest number input.
 - 1 highest = 0
 - 2 count = 0
 - 3 while count < 20:
 - 4 number = int (input ("Please enter a number: "))
 - 5 if number < highest:
 - 6 number = highest

7 $\operatorname{count} = \operatorname{count} + 1$

8 print ("The highest number is ", highest)

There are **three** errors in this code.

Locate these errors and suggest a corrected piece of code.

1 mark for each correct correction

Line 5 if number > highest:

Line 6 highest = number

```
Line 8
print ( "The highest number is ", highest ) (student needs to explain or show the
need to remove indentation or to bring the print statement outside the loop)
or
Remove indentation so the print statement is outside of the loop
```

```
(b) (i) Identify the type of errors found in part (a)
```

Logic error

[1]

[2]

[3]

(ii) Identify and describe another type of error not found in part (a)

1 mark for the type of error and 1 mark for the description

Syntax Errors – Errors that are due to incorrect source code that does not follow the rules of the language.

Run-time Errors – Errors that are detected while a program is running, usually causing the program to crash or hang.

4

(c) The program code is to be interpreted rather than compiled.

Give one difference between these two methods.

Any one of the following:

- Compiled code will not need the compiler program to run, but code to be interpreted will require the conversion program to run.
- Interpreter converts each line one at a time, while compiler converts the whole program into an executable file
- Interpreter locates errors as it runs while the compiler detects syntax errors before the program is even run.

[1]

4 The table contains statements about types of memory and secondary storage.

Tick (\checkmark) **one** or **more** boxes in each row to indicate if the statement is about RAM, ROM or Secondary Storage.

| Statement | Secondary Storage | RAM | ROM |
|---|-------------------|--------------|-----|
| Data is retained when electrical supply is cut off | <i>¥</i> | | ~ |
| Stores data that is currently being used by the processor | | \checkmark | |
| Data is lost when the power is switched off | | \checkmark | |
| Data can be stored in this device while the computer is running | \checkmark | \checkmark | |
| | | | [4] |

| 5 | (a) | Complete the truth table for the following logic circuit: | |
|---|-----|---|--|
|---|-----|---|--|



| | | | | | | | | _ |
|---|---|---|---|---|---|---|---|------|
| A | В | С | Р | Q | R | S | х | |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1m |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1m |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1111 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1m |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1111 |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1m |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1111 |

(b) What could replace the whole logic circuit?

Replace the logic circuit with input B only

(c) Draw the logic circuit for the following logic statement:

X = 1 if (A is NOT 1 AND B is 1) AND (B is NOT 1 OR C is 1)



- 6 A program has been written to process students' marks in a set of tests.
 - (a) Describe **two** validation checks that could be made on a student's name.

1 mark each

length check – to ensure up to 30 letters of alphabet only (number of letters can be any value reasonable for a long name) character/format check – to ensure name doesn't contain numeric characters

(b) Describe **two** validation checks that could be made on the test marks.

1 mark each range check – to ensure marks are within correct boundaries (e.g. between 0 and 100) length check – to ensure no more than 3 digits are input

[4]

[5]

7 An encryption system assigns a value to each letter of the alphabet:

A = 1, B = 2, C = 3,, Y = 25, Z = 26

Each letter is stored in a 12-bit binary register. The letters "S" (19th letter) is stored as:

| 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|------|------|-----|-----|-----|----|----|----|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |

A 4-bit register is used to store the encryption key. This register shows how many places the bits are shifted to the left in the 12-bit register when it is encrypted. For example,



means each bit in the 12-bit register is shifted 5 places to the left and the register now becomes:

| 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|------|------|-----|-----|-----|----|----|----|---|---|---|---|
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

Therefore, the letter "**S**" would be transmitted with the 4-bit register and the 12-bit register as a 16-bit register as follows:



(a) **"W**" is the 23rd letter of the alphabet.

(i) How is the letter "W" represented in the 12-bit register, before encryption?



(ii) The 4-bit register contains the following value:



How is the letter "W" stored in the 12-bit register, after encryption?



(b) A 4-bit register and a 12-bit register is shown below.

Which letter of the alphabet has been transmitted? (Explain how you got your answer.)



Letter "Y" or 25th letter (1mark)

1 mark for explanation

- Binary number 0000 1100 1000 has been shifted to the left by 3 places
- So the binary number becomes 0000 0001 1001
- 1+8+16 = 25

[2]

(c) (i) What is the largest encryption key that can be stored in the 4-bit register?

| 8 | 4 | 2 | 1 | |
|---|---|---|---|--|
| 1 | 1 | 1 | 1 | |

[1]

[1]

(ii) Convert this into denary (base 10).

| 15 (error carry forward from (i)) | |
|------------------------------------|--|
|------------------------------------|--|

(iii) If this encryption key were used, what problem would it cause?

1 mark from any of below:

- Try to move 15 places to the left which is not possible
- Only 12 bits in register to store letter; 15 is too large

You would end up with 12 0s in the register

8 Study the following flowchart very carefully.



(a) Complete the trace table for this flowchart using the following test data:

| 7, | З, | 2, | 4, | 9 |
|----|----|----|----|---|
|----|----|----|----|---|

| А | В | С | D | E | К | Х |
|---|---|----|---|---|----|----|
| 7 | 3 | 2 | 4 | 9 | | |
| | | | | | 0 | 0 |
| | | 4 | 2 | | 2 | 1 |
| | | | 9 | 2 | 2 | 1 |
| | | | | | | 0 |
| | 4 | 3 | | | 3 | 1 |
| | | 9 | 3 | | 3 | 1 |
| | | | | | | 0 |
| | 9 | 4 | | | 4 | 1 |
| | | | | | | 0 |
| 9 | 7 | | | | 7 | 1 |
| | | | | | | 0 |
| 1 | m | 1m | 1 | m | 1m | 1m |

[5]

[1]

[1]

(b) What values are output from the flowchart using the above test data?

9, 7, 4, 3, 2

-

(c) What is the purpose of the algorithm?

Sort in descending order.

- (d) What would happen if the value of X wasn't set to 0 in the return loop of the flowchart?
 - The program will continue looping round even when sorting is complete
 - The loop would never end/infinite loop

9 A spreadsheet was set up to calculate values of v based on the formula:

v = u + a * t

| | А | В | С | D |
|---|------------|------------|------------|----------|
| 1 | value of u | value of a | value of t | result v |
| 2 | 20 | 9.81 | 10 | |
| 3 | 30 | 9.81 | 30 | |
| 4 | 10 | 9.81 | 40 | |
| 5 | 40 | 9.81 | 20 | |
| 6 | 50 | 9.81 | 50 | |
| 7 | 20 | 9.81 | 20 | |
| 8 | | | | |

(a) A student typed in =(D2 + B2 * C2) into cell D2.

Why would this formula produce an error message?

1 mark

- Formula reference itself / circular reference
- Value in D2 is not known yet
- D2 is an empty cell

(b) What is the correct formula that should be in cell **D2**?

(c) If this formula was replicated down to cell **D7**, what formula would be in **D7**?

(d) Cell **D8** needs to display the highest value of v.
 Identify the most appropriate function that will need to be entered in cell **D8**.
 MAX

(e) Column B has the same value throughout.If column B was removed, explain the changes in cell **D2**?

(A2 + B2 * Error) / (A2 + Error * B2) / (A2 + B2 * 9.81) / (A2 + 9.81 * B2)

Formula must show that cells C2 changed to B2, and original B2 turn to error.

[1]

[1]

- 10 State the security issue as described by each of the descriptions below.
 - (a) Using a software that gathers information by monitoring key presses on a user's computer and relays the information back to the person who sent the software.

Spyware

(b) Using a malicious code installed on the hard drive of a user's computer or on the web server; this code will re-direct user to a fake web site without their consent.

pharming

(c) Using a normally harmless program that has a program or code that is attached to itself and is designed to amend, delete or copy data and files on a user's computer without their consent.

Virus

(d) The act of gaining illegal access to a computer system without the owner's consent.

hacking

(e) The creator of code sends out a legitimate-looking email in the hope of gathering personal and financial data; it requires the recipient to follow a link in the email or open an attachment.

phishing

[5]

- 11 An office building has many companies. Each company has its own computer network that connects to the main building's LAN.
 - (a) Give one reason why the office building's network is a LAN.

Local area network (LAN) consists of a network which covers a small geographical area. Since the network of the office building only consist of the companies within the same building it is considered a small geographical area and thus labelled a LAN.

[1]

(b) Some companies use wired networks while other use wireless networks.

Describe the difference between a wired and wireless network.

1 mark for description under each header. Student needs to show a comparison between the same aspect of reasoning.

Max 1 mark if student attempts to give 2 reasons

| Wired | Wireless |
|---|---|
| Use of cables provides faster and higher bandwidth. | Due to the transfer of data through radio waves, interference is possible thus making data transfer happen at a slower rate. |
| Data transmission is unaffected by interference. | Data transmission can be affected due to physical obstructions. |
| Range of connection is limited to the length of the cable. | Range of connection is limited to a small area. |
| Security is higher as its hard to tap into the data transmission. | The data transmission can be tapped into more easily. |
| Adding new devices is limited to the number of cable connection possible. | Easier to add new device and not limited by physical means. |
| Running cables post a safety hazard to tripping. | No physical cables to post hazard of tripping. |

(c) One company uses a ring topology. The company consists of a small setup of three computers. The diagram shows the layout in the office.

Complete the diagram by drawing the ring topology that connects the three computers shown.



[3]

1 mark per connection between computers. Students need to show a circular connection from computer 3 to computer 1 despite the computers being place in a straight line.

(d) Another company uses a bus topology setup in the office.

Describe the bus topology.

In bus topology, a common cable or backbone (1 mark) connects all the devices. The bus is a medium that allows the transmission of data. During communication, only one computer can transmit data at any one time (1 mark).

[2]

(e) One company uses a peer to peer network to connect their devices.

Describe two positive features of peer to peer network.

1 mark for each reason

_

- No need for **dedicated** servers to setup up network.
- No need for **special** software and operating system features

Each computer acts as both a client and a server.

[2]

(f) The office building uses a range of network devices.

Complete the table by writing the missing function or name of each network device.

Network Hub (1 mark)

Router – It forwards packets between separate networks. (1 mark) It keeps the connected networks, which may use fundamentally different protocols (1 mark), separate and forwards packets between them.

Network Switch (1 mark)

[4]

12 A greenhouse is being monitored by a computer using two sensors. SENSOR1 measures the temperature and SENSOR2 measures the humidity levels.

If the temperature exceeds 32°C or the humidity levels fall below 0.55%, then an error message is output by the computer.

Write an algorithm, using pseudocode only, which

- inputs both sensor readings
- checks the sensor input values and outputs a warning message if either input values is out of range
- continues monitoring until the <ESCAPE> key is pressed

(You may assume that INPUT SENSORn will take a reading from SENSORn for example INPUT SENSOR1 means that readings will be taken from SENSOR1. You may also assume INPUT KEY inputs a key press from the keyboard for example when the <ESCAPE> key is pressed, "ESCAPE" is stored into KEY).

| KEY = 0 | (1 mark initial key) |
|-------------------------|--|
| WHILE KEY != ESCAPE | (1 mark correct loop) |
| INPUT SENSOR1 | |
| INPUT SENSOR2 | (1 mark input sensor) |
| IF SENSOR1 > 32 | |
| OUTPUT "Warning tempe | rature too high!" (1 mark to check temp) |
| ENDIF | |
| IF SENSOR2 < 0.55 | |
| OUTPUT "Warning humilit | y too low!" (1 mark to check humility) |
| ENDIF | |
| INPUT KEY | (1 mark to read keyboard) |
| ENDWHILE | |

Negative marking will be done here

-End of Paper-