# Anglo-Chinese School (Barker Road)

# PRELIMINARY EXAMINATION 2022 SECONDARY FOUR EXPRESS COMPUTING PAPER 1

ANSWER KEY

1 The diagram show four types of computer or network identifiers and eight examples that they could be represented on the right.

Draw one line between each identifier to its correct representation.

Identifiers		Example of Representation
	/•	2001:db8::20:17:bad:c0de
	•	55
IPv4	•	H4-7G-09-E0-D2-5Z (invalid due to G and Z characters)
MAC	•	129.126.67.97
Port number	•	3A (invalid as port number is only denary)
IPv6	•	108.F5.153.AF (invalid as IPv4 only has denary numbers)
	~	F4-7B-09-E0-D3-54
	•	2010:db8::20::b2d:134 (invalid as IPv6 should have no more than one set of double colons)
		[4]

2 (a) Convert the binary number 101 1011 into a denary and hexadecimal number.

Denary: 91

Hexadecimal: 5B [2]

(d) Convert the denary number 1698 into hexadecimal number. Show your working.

Divide by 16				
1698	2	2		
106	10	А		
6	6	6		
0				

- 6A2\_\_\_\_\_[2]
- (e) Explain why hexadecimal numbers are commonly used to represent binary numbers.

Hexadecimal format is quite **compact and thus much easier to read/understand** compared to the long binary strings of 1's and 0's

No marks for single point of short/compact or easy to read		
	[1	]

- 3 Computer memory is measured in terms of the number of bytes.
  - (c) (i) Explain what is meant by the term byte?

A byte is a unit of data made up of eight bits.

.....[1]

(ii) State the number of bytes in 5 mebibytes (MiB).

 $5 \times 1024^2 = 5,242,880$  bytes [1]

(d) (i) Optical and solid-state are two common types of storage media. Give two differences between these two types of storage media.

1 Data is stored as very small pits or indentations that can be read or written by a laser for optical media. For solid-state, data is stored in electronic circuits called "flash memory" that have no moving parts

.....

2 Optical media are vulnerable to scratches and fingerprints while solid-state media are not as vulnerable to drops, mechanical shocks, scratches or fingerprints.

.....[2]

(ii) State another type of storage media.

Magnetic [1] Cloud storage not accepted as cloud storage are also classified as magnetic or solidstate storage at server end.

- 4 Data collection is the first of four stages in the data life cycle.
  - (a) Describe any two data collection activities.

1 Any of the two activities: performing interviews, making observations, conducting surveys, collation and organising of data on spreadsheets etc.

2 ......[2]

(b) List any two other stages in the data life cycle.

1 Any of the two stages: Data processing, Data analysis or Data distribution \_\_\_\_\_\_
2 \_\_\_\_\_\_

- **5** Intellectual property are creations that have value. They can exist physically but also purely as data with no physical form.
- (a) The table shows three scenarios of Intellectual Property offences. Tick (✓) one or more boxes in each row to indicate if the offence is copyright infringement, plagiarism or both.

Scenario	Copyright Infringement	Plagiarism
Taking a friend's source code and submitting it for a coding competition without seeking his permission.		$\checkmark$
Downloading and installing a "cracked" version of a game without paying for it.	$\checkmark$	
Downloading research information from the internet and submitting it without any modification as your own for a homework assignment.	✓	$\checkmark$

(b) Draw **one or more** lines from each description on the left to the type of software it applied to on the right.



[3]

(c) Describe **one** way to avoid plagiarism when using public domain information in your research.

Acknowledge or cite the authors appropriately [1]

6 An alarm, Y, sends a signal (Y = 1) when certain fault conditions in a chemical process are detected. The inputs are:

Input	Binary	Condition
Α	0	Acidity <= 5
	1	Acidity > 5
Т	0	Temperature < 150 °C
	1	Temperature >= 150 °C
М	0	Mixer is off
	1	Mixer is on

The alarm, Y, returns a value of 1 if: either temperature >= 150 °C AND mixer is OFF or acidity > 5 AND temperature < 150 °C

(a) Draw a logic circuit for the system.



[4]

(b) Complete the truth table for this alarm system.

Α	Т	Μ	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0
mark for correct outputs in each 2 consecutive rows			

1 mark for correct outputs in each 2 consecutive rows

[4]

7 A programmer is creating a new computer game.

In the game, the user's avatar (a game character) moves through the virtual world trying to catch and rear cute monsters.

- The game will display a menu that will let the user create a new player or login as a returning player.
- If the user chooses a new player, an avatar is created with name, gender and costume.
- If the user chooses returning player, the game accesses the saved file and starts from where it was last saved.
- The user makes the avatar move within a virtual world.
- The game is auto-saved.
- The user can click on cute monsters roaming in the virtual world and encounter them to catch them
- The user can also access his/her collection of cute monsters and interacts with individual monsters via hugging, playing and/or feeding candies.
- (c) The decomposition technique can be used to create smaller, more manageable modules of the program. One of these modules is the **menu**.

Identify and describe **five** other modules that can be decomposed from the problem.

Module 1 new player / avatar creation module – create an avatar with name, gender and costume

Module 2 returning player module – load saved game and start game from saved point

Module 3 game save module – auto saving of game

Module 4 movement module – movement of avatar within the virtual world

Module 5 encounter module – catching of cute monsters

#### Other possible modules include:

interaction module – interaction with individual monsters via hugging, playing etc. collection module – list collection of cute monsters in inventory map module – chart virtual world with roaming cute monsters

Do not assume beyond information provided beyond the question.

.....[5]

(d) State two other problem-solving techniques.

1 Pattern recognition	
2 Generalisation	[2]

- 8 Technology has enabled rapid healthcare changes all around the world.
  - (a) Describe two economic benefits to healthcare using technology.

Any two of the benefits:

• Technology has created new areas of growth in the healthcare industry, such as the provision of **telemedicine** solutions to existing healthcare businesses. In particular, many of these solutions provide a way for patients to securely transfer potentially sensitive medical information over the Internet.

• There is also an increased focus in automating healthcare processes through the use of **robots to dispense medicine and other more menial tasks**. This may in turn cause such jobs to disappear from the job market and free up manpower for other economic activites.

• The rise of **3D-printing technology** has also opened up new opportunities in the building and customisation of **prosthetic limbs**, hearing aids and dental fixtures, prolonging human's quality of living in the long run.

.....[2]

(b) Describe one ethical issue of using technology in healthcare.

### Any one of the ethical issues:

• Is it acceptable for robots to replace humans (in the field of human touch) in providing certain kinds of healthcare?

• Is it acceptable to transfer private medical information over the Internet?

.....[1]

- (c) Public and private medical institutions need to implement proper controls in handling online medical records to prevent unauthorised access.
  - (i) State and describe **one** authentication method to prevent unauthorised access.

Any one of the authentication method:

• Use of **strong passwords** that only allowed authorised personnel to access confidential medical records

• Implement **2 Factor authentication**, e.g. tokens, OTPs that only allowed authorised personnel to access confidential medical records

• Use of **biometric** systems – they are more secure and only allowed authorised personnel to access confidential medical records

.....[2]

(ii) State and describe **one** access control method to prevent unauthorised access.

Any one of the access control method:

• Setting proper **file permissions** in the system so that only authorised personnel can access confidential medical files

• Implementation of **Firewall** to block traffic between any unauthorised senders and/or receivers and/or certain well-known harmful programs.

• Encryption of data so that they are encoded and can't be accessed without a secret key

.....[2]

- **9** A healthcare organisation has one hospital, two specialist centres and three clinics at various locations within a city. A computer network is implemented to enable communication between the six entities to share medical information of patients.
  - (e) State the most appropriate network based on geographical size.

Metropolitan area network [1]

- (f) The network is primarily connected via wires.
  - (i) State the most commonly used wired protocol.

Ethernet\_\_\_\_\_[1]

(ii) Explain why it is more advantageous to use a wired network.

Data transfer is typically **more secure** in a wired network as medical information is confidential

.....[1]

(g) State the network model (client-server or peer-to-peer) that is most appropriate for the network used by the organisation. Explain why.

Client-server [1 mark] is more appropriate. The medical information is confidential and required **tight access control** that can be **controlled centrally at a server**. In addition, storage and backup is centralised and can be carried out at the server. [1 mark for reason]

.....[2]

(h) Identify and describe the function of two network devices that could be used in the network.

Any two of the following network components

Network Interface Card	A network interface card (NIC) provides the hardware interface to enable the transfer of data between a device and a network. NIC also has a unique 48-bit MAC address that can be used to identify the particular computer or device with that NIC.
Network Hub	Connects multiple devices to the same network. A hub acts like a loudspeaker as it broadcasts the data to all its connected devices without limiting the data to only the specific device it was intended for.
Switch (Bridge not accepted)	A network switch constructs a single network by connecting two similar networks together. A switch uses MAC addresses to keep track of the devices that are connected to each side of the switch.

Router	A router keeps the connected networks (which may use fundamentally different protocols) separate and forwards packets between them using Internet protocols (IP addresses that may change dynamically)
Modem	Modem sets up a long-distance connection to the ISP's network by converting digital to analog data and vice-versa.

```
.....[4]
```

**10** The following pseudo-code represents an algorithm that allows the user to generate usernames for a nation-wide learning portal. The username is created via the generate function.

```
user = []
repeat = TRUE
WHILE repeat == TRUE
OUTPUT "Enter a student's name: "
INPUT name
OUTPUT "Enter the school: "
INPUT school
username = generate(name, school)
user = user + [username]
OUTPUT username
OUTPUT username
OUTPUT "Next student? (Y/N): "
INPUT option
IF option == "N" THEN
repeat = FALSE
```

ENDIF

ENDWHILE

OUTPUT user

**Note**: the function generate(name, school) returns a username in capital letters by prepending the school input, followed by a "-" character and then appending the first 5 alphabets of name.

Example:

generate("John Tan", "acsbr") would return the string "ACSBR-JOHNT".

(b) The algorithm needs to validate the school, immediately after it is input.

(i) The school input must be more than 2 letters, but less than 6 letters. Identify an appropriate data validation technique that can be used to validate this input.

Length check
[1]

(ii) Write pseudo-code for the algorithm to restrict the input of school to more than 2 letters, but less than 6 letters. The algorithm should continually ask for a new input until a valid one is entered.

You only need to write the pseudo-code to validate the input. You may use the length() function that accepts one argument of type string and returns its length as an integer.

```
INPUT school
# 1 mark for while
# 1 mark for correct condition
WHILE length(school) <= 2 OR length(school) >= 6
OUTPUT "Invalid!"
INPUT school # 1 mark for re-input
ENDWHILE
```

[3]

(iii) For each test case condition in the following table, give an example of test data for school.

Test case condition	Test data
Normal	"acs1"
Error	"anglochineseschool"
Boundary	"Acs"
	"Ac "
	"Acsbr1"
	"acsbr"
	[3]

(c) The table below shows some of the variables in the algorithm.

State the data type for each variable.

Variable	Data Type
repeat	Boolean
user	List
username	String

[3]

**11** Consider the following pseudocode algorithm.

```
Flag = 1
WHILE Flag == 1
Flag = 0
FOR Count = 0 TO 3
IF Num[Count] < Num[Count + 1] THEN
Store = Num[Count]
Num[Count] = Num[Count + 1]
Num[Count + 1] = Store
Flag = 1
ENDIF
NEXT Count
ENDWHILE</pre>
```

The contents of the Num[Count] array at the start of the algorithm are:

Num[0]	Num[1]	Num [2]	Num[3]	Num [4]
26	38	32	15	27

(c) Complete the following trace table for the algorithm.

Flag	Count	Num[0]	Num[1]	Num[2]	Num[3]	Num[4]	Store
		26	38	32	15	27	
1							
0							
1	0	38	26				26
1	1		32	26			26
	2						
1	3				27	15	15
0							
	0						
	1						
1	2			27	26		26
	3						
0							
	0						
	1						
	2						
	3						

[5]

## (d) Describe the purpose for the algorithm.

To sort [1 mark] numbers in the list in a descending [1 mark] order. Note that Store is not the output

.....[2]

- **12** Write an alternating case text algorithm, using pseudo-code that does the following:
  - reads a word
  - generates a new word that alternates the case in the word. The case of the first character in the word would be fixed as the initial starting case, with subsequent characters alternating between uppercase or lowercase. Example: Input of "acSbr" should generate "aCsBr" while input of "ACSBr" would generate "AcSbR".
  - outputs the new word

You can assume that the text string is entirely comprising of alphabets. There is no need to validate the text string. You can also make use of the following methods:

Method	Function
<pre>text.islower()</pre>	returns TRUE if text is lowercase; FALSE if otherwise
<pre>text.isupper()</pre>	returns TRUE if text is uppercase; FALSE if otherwise
<pre>text.lower()</pre>	converts text to lowercase
text.upper()	converts text to uppercase

(-1 mark for final mark if pseudo-code if fully written in python)

```
INPUT Word # 1 Mark for input
First = Word[0]
# 1 Mark to check case of first character
IF First.isupper() == TRUE THEN
    Flaq = 0
ELSE
    Flag = 1
ENDIF
Final word = First
FOR Char IN Word[1:] # 1 Mark for iteration
# 1 Mark for adding character to output string
# 1 Mark for alternating case
    IF Flaq == 0 THEN
        Final word += Char.lower()
        Flaq = 1
    ELSE
        Final_word += Char.upper()
        Flaq = 0
    ENDIF
NEXT Char
OUTPUT Final_word # 1 Mark for output
```

[6]