**Name:** _____ **Class:** _____ **Index Number:** _____

Anglo-Chinese School
(Barker Road)

# PRELIMINARY EXAMINATION 2021

## SECONDARY FOUR
## EXPRESS

## COMPUTING
## PAPER 1

## 7155/01

## 2 HOURS

**INSTRUCTIONS TO CANDIDATES:**

Do not open this booklet until you are told to do so.
Write your name and index number clearly in the spaces at the top of this page.
Write in dark blue or black pen. You may use soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Approved calculators are allowed.

Answer **all** questions.

The number of marks is given in brackets [ ] at the end of each question or part of question.
You should show all your working.
The total mark for this paper is 80.

| TOTAL | / 80 |
|---|---|

***This paper has 14 pages, inclusive of the cover page.***

**1** A bank uses spreadsheet software for computing its loans.

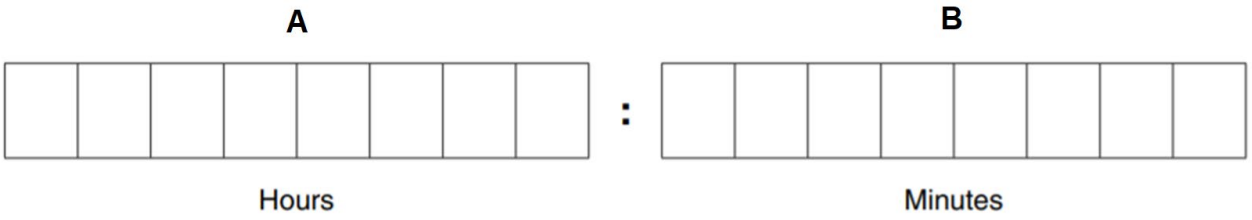
Draw a line between the spreadsheet function and its description.

| Function | | Description |
|---|---|---|
| | | • Calculate the interest payment for a given period |
| PPMT | • | • Calculate the amount of money to be paid at the end of the loan |
| FV | • | • Calculate the required interest rate per period of a loan |
| RATE | • | • Calculate the instalment for a loan |
| PMT | • | • Calculate the amount of money to be loaned |
| | | • Calculate the principal payment for a given period |

[4]

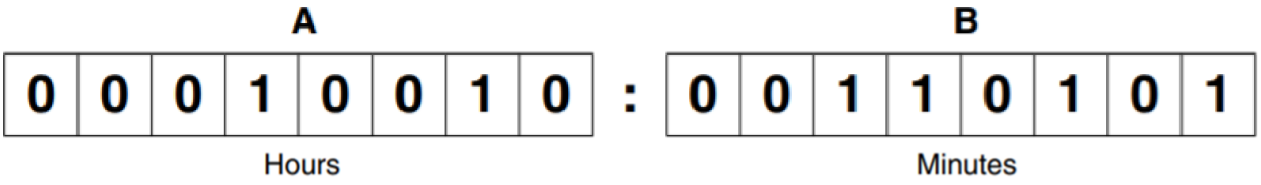
**2** A digital clock is controlled by a microprocessor. It uses the 24 hour clock. The hour is represented by an 8-bit register, **A**, and the number of minutes is represented by another 8-bit register, **B**.

**(a)** Show how 13:46 can be represented by these two registers.




[2]

**(b)** State the hexadecimal representation of the following two registers.




Hours (hex) ..... Minutes (hex) ..... [2]

**(c)** State the minimum number of bits that can be used to represent a 24 hour clock

Hours ..... bits Minutes ..... bits [2]

**3** Program development typically occurs across five distinct stages.

**(a)** List any **two** stages in developing a program.

1 .....

2 .....[2]

**(b)** Describe what is “agile” software development.

.....

.....

.....

.....[2]

**4** Computers comprise various electronic components and hardware.

**(a)** The table contains hardware commonly used with a computer. Tick (✓) **one** or **more** boxes in each row to indicate if the hardware is an input, output or storage device.

| Hardware | Input device | Output device | Storage device |
|---|---|---|---|
| Speakers | | | |
| Processor register | | | |
| Touchscreen monitor | | | |
| Microphone | | | |

[4]

**(b)** Complete the following table for the types of external storage:

| Type | Example | Advantage | Disadvantage |
|---|---|---|---|
| Optical | ..... | Large storage capacity of up to gigabytes (GB) of data | Lower maximum storage capacity |
| ..... | Hard Disk | Relatively cheap and large storage capacity of up to terabytes (TB) of data | .....<br>.....<br>..... |
| Solid-state | ..... | .....<br>.....<br>..... | More expensive |

[5]

**5** **(a)** Draw the truth table for a NAND gate.

[2]

**(b)** An alarm sounds when certain conditions occur in the main reactor of a chemical plant. The output, X of a logic circuit that drives the alarm must have a value of 1 only if:

either temperature is high and water level is high in the reactor

or water level is low and relief valve is off in the reactor

or temperature is low in the reactor

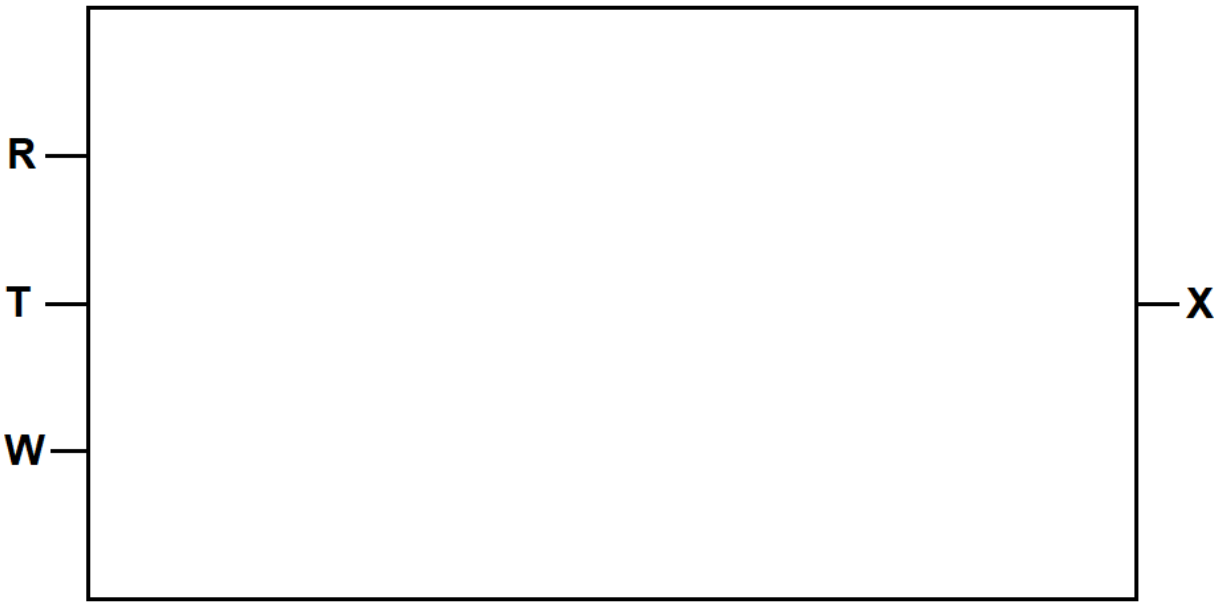
The inputs to the system are:

| Input | Binary | Condition |
|---|---|---|
| R | 0 | Relief valve off |
| | 1 | Relief valve on |
| T | 0 | Low temperature |
| | 1 | High temperature |
| W | 0 | Water level low |
| | 1 | Water level high |

**(i)** Write down the corresponding Boolean statement for the system.

.....[2]

**(ii)** Draw a logic circuit for the system.




[4]

**6** Progammers apply a variety of problem-solving techniques.

**(a)** The table shows two scenarios where the decomposition technique is used.

Complete the table by stating the approach used in each scenario.

| Scenario | Approach |
|---|---|
| Finding the lowest score in a class test. Take the first score on the list as input and output it as the lowest score for the first sub-problem. The output of the first sub-problem is used together with the second score on the list as inputs to a second sub-problem to output the lowest score. This process goes on until all the scores on the list have been compared, and the lowest score is shown as the final result. | ..... |
| Calculating the mean subject grade aggregate. The inputs of the program are individual scores of each subject. The program then separates into two distinct tasks. First task works on the conversion of the scores to grades and the second task sums all the grades and calculate the average grade. The average grade is then shown as the mean subject grade. | ..... |

[2]

**(b)** State **two** other problem-solving techniques.

1 .....

2 .....[2]

**7** Technology has enabled ease of communication with people all around the world.

**(a)** Describe **two** economic benefits to businesses using technology.

1 .....

.....

2 .....

.....[2]

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

.....

.....

.....[1]

**(c)** Organisations are susceptible against cyberattacks like phishing, pharming or spam.

**(i)** Explain the difference between phishing and pharming

.....

.....

.....

.....[2]

**(ii)** Firewalls are commonly deployed in networks. Explain how a firewall works.

.....

.....

.....

.....[2]

**(ii)** Describe **one** measure to manage spam.

.....

.....[1]

**8** Some data are shown in a spreadsheet.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 5 | 6 | 5 | 3 | 4 | 5 | 3 |
| 2 | | | | | | | | |
| 3 | COUNT | | | | | | | |
| 4 | SMALL | | | | | | | |
| 5 | MEDIAN | | | | | | | |
| 6 | MODE.SNGL | | | | | | | |

Determine the result for the following formulas:

=COUNT(A1:H1) .....

=SMALL(A1:H1,2) .....

=MEDIAN(A1:H1) .....

=MODE.SNGL(A1:H1) .....[4]

**9** Computers use a variety of networking devices and identifiers to communicate and exchange data with one another.

**(a)** A laptop requires an IPv6 address, MAC address and SSID to connect wirelessly to other computing devices or the internet. State what IPv6, MAC and SSID represent, what each is used for, and how each can be represented.

**(i)** IPv6 address .....

.....

.....

.....[3]

**(ii)** MAC address .....

.....

.....

.....[3]

**(iii)** SSID .....

.....

.....

.....[3]

**(b)** State **two** key differences between the functions of a router and a bridge.

1 .....

.....

2 .....

.....[2]

**(c)** A ..... is used in combination with an IP address to identify a program that is running on a network. [1]

**10** The following pseudo-code represents an algorithm that asks the user to enter a word and stores this in the variable `word`. It then asks the user to enter the number of letters to be extracted from `word` in reverse; this number is stored in the variable `numLetters`.

The algorithm extracts the amount of letters the user entered from word, starting with the last letter and then outputs these letters.

```
OUTPUT "Enter a word with more than 3 letters, but less than 10
       letters: "
INPUT word
OUTPUT "Enter the number of letters you want to extract from the
       reversed word: "
INPUT numLetters
newWord = revsubstring(word, numLetters)
OUTPUT newWord
```

**(a)** The function `revsubstring(theString, numCharacters)` returns a number of characters, `numCharacters` from the reversed `theString`.

In the following example:

`theString = "computing"`

`revsubstring(theString, 4)` would return the string `"gnit"`

**(i)** State the output for `revsubstring(revsubstring("computing", 7), 5)`.

.....

.....[1]

**(ii)** Write pseudo-code for the algorithm in the `revsubstring` function. You can assume a start index of 0.

```
FUNCTION revsubstring(theString, numChar)
```

.....

.....

.....

```
END FUNCTION
```
.....[2]

**(iii)** Give an example of test data for the `revsubstring` function for each test case condition in the following table.

| Test case condition | Test data |
|---|---|
| Normal | |
| Error | |
| Boundary | |

[3]

**(b)** The algorithm needs to validate the number, `numLetters`, immediately after it is input.

**(i)** The number, `numLetters` must be more than 1, but less than the number of characters in `word`.

Identify an appropriate data validation technique that can be used to validate this input.

.....

.....[1]

**(ii)** Write pseudo-code for the algorithm to restrict the input of the number `numLetters` to more than 1 but less than the length of `word`. The algorithm should continually ask for a new number until a valid number 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 return its length as an integer.

.....

.....

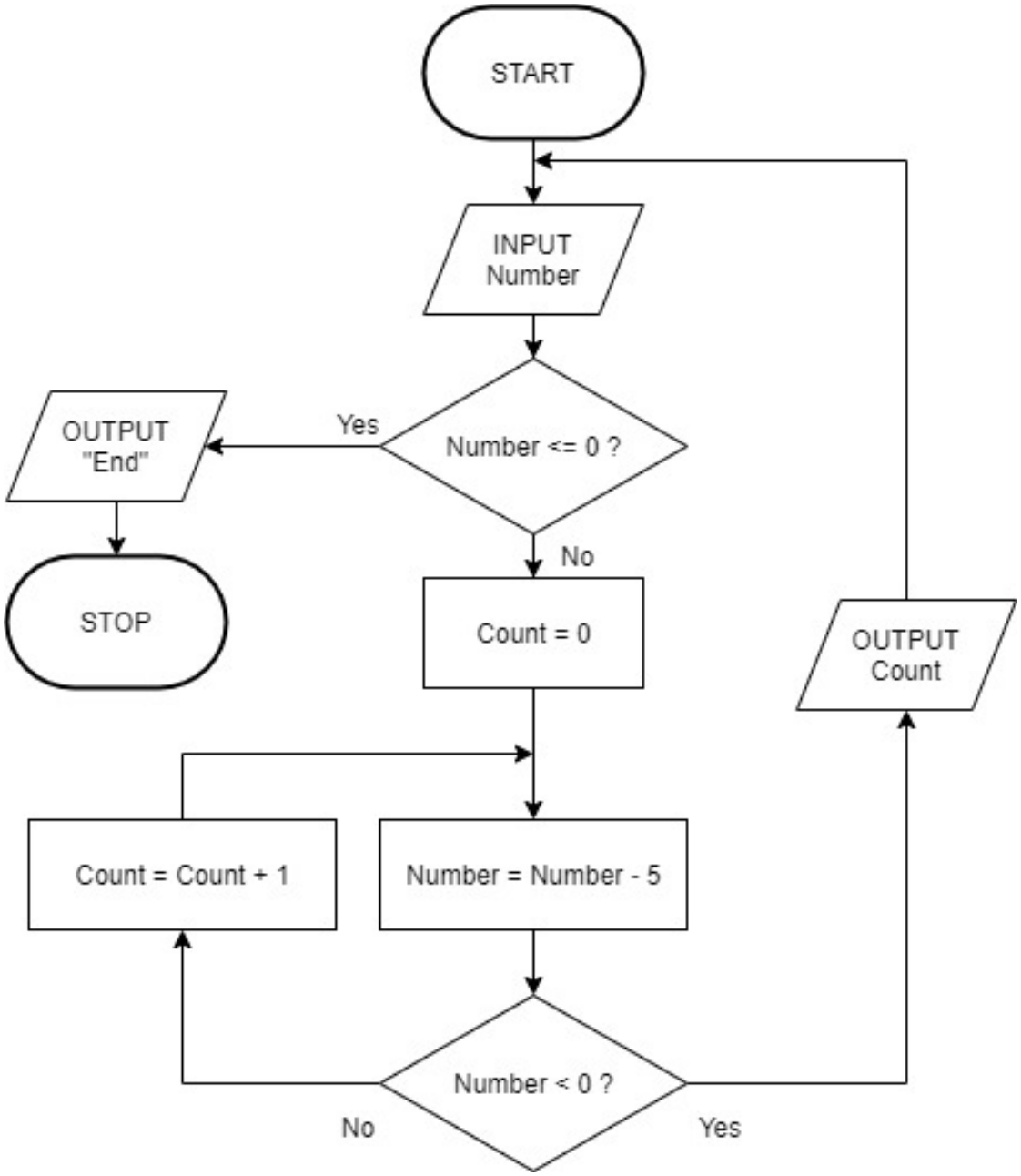
.....

.....

.....

.....[3]

**11** Consider the following flowchart that inputs a sequence of numbers.



**(a)** Complete the following trace table for the algorithm.

Use the data `18`, `10`, `-2` as input.

| Number | Count | OUTPUT |
|---|---|---|
| | | |
| | | |
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| | | |

[3]

**(b)** Describe the purpose for the algorithm.

.....

.....

.....[2]

**12** Write an algorithm, using pseudo-code or a flowchart that does the following:

- reads a number
- computes the factors for the number and stores them in an array
- outputs the array containing the factors
- clears the array and repeats by asking the user for another number. The program will stop immediately when zero is entered for the number

You must validate the input to ensure that it is positive. Prompt the user to re-enter if not.

[6]

**End of Paper**

Anglo-Chinese School
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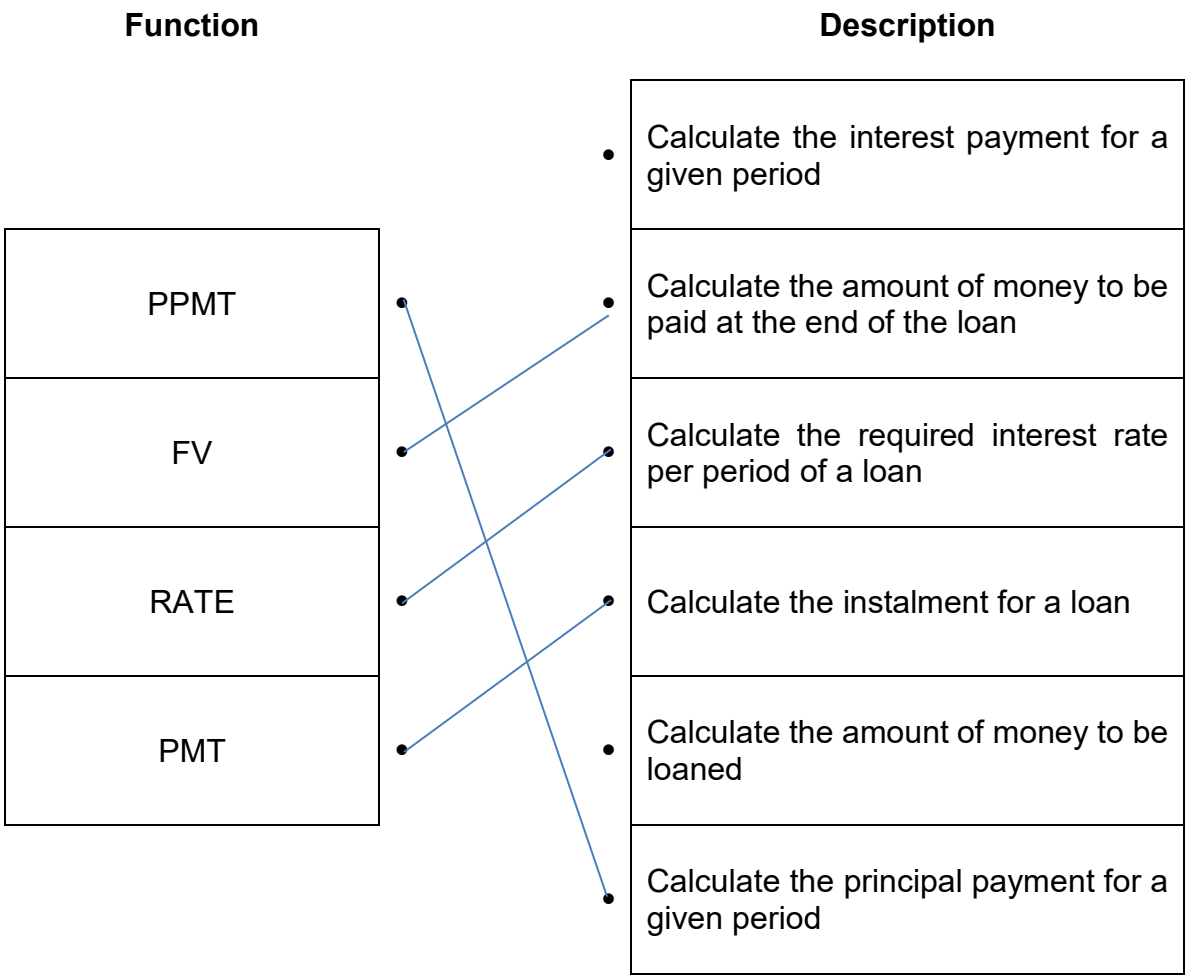
# PRELIMINARY EXAMINATION 2021
# SECONDARY FOUR EXPRESS
# COMPUTING PAPER 1

**ANSWER KEY**

**1** A bank uses spreadsheet software for computing its loans.

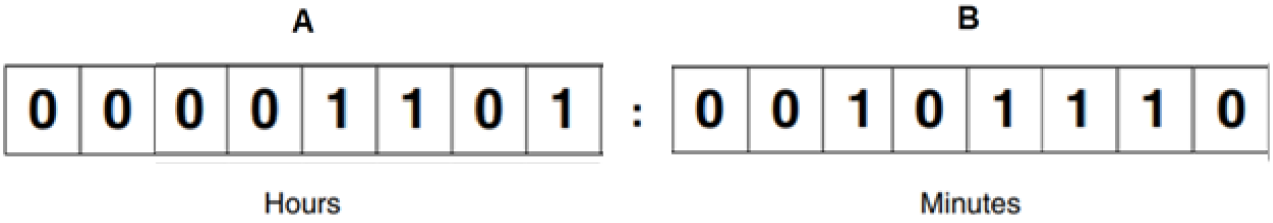
Draw a line between the spreadsheet function and its description.




[4]

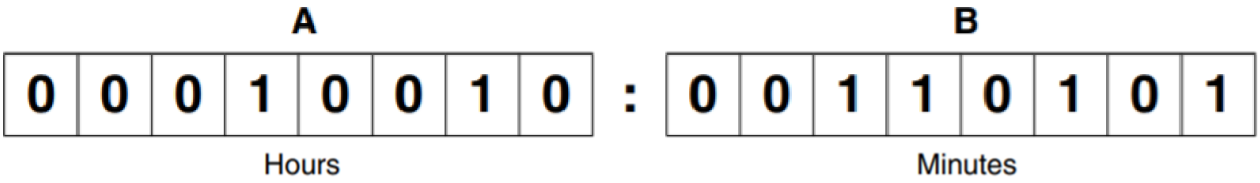
**2** A digital clock is controlled by a microprocessor. It uses the 24 hour clock. The hour is represented by an 8-bit register, **A**, and the number of minutes is represented by another 8-bit register, **B**.

**(a)** Show how 13:46 can be represented by these two registers.




[2]

**(b)** State the hexadecimal representation of the following two registers.




Hours (hex) **12** Minutes (hex) **35** [2]

**(c)** State the minimum number of bits that can be used to represent a 24 hour clock

Hours **5** bits Minutes **6** bits [2]

**3** Program development typically occurs across five distinct stages.

**(a)** List any **two** stages in developing a program.

Either two of the following (1 mark each):
- Gather requirements
- Plan solutions
- Write code
- Test and refine code
- Implement code

**(b)** Describe what is "agile" software development.

It is a non-traditional approach to software development whereby there is no distinct stages [1] and code may be continuously written and refined while the gathering of requirements is still taking place. [1]

**4** Computers comprise various electronic components and hardware.

**(a)** The table contains hardware commonly used with a computer. Tick (✓) **one** or **more** boxes in each row to indicate if the hardware is an input, output or storage device.

| Hardware | Input device | Output device | Storage device |
|---|---|---|---|
| Speakers | | ✓ | |
| Processor register | | | ✓ |
| Touchscreen monitor | ✓ | ✓ | |
| Microphone | ✓ | | |

1 mark for each correct row [4]

**(b)** Complete the following table for the types of external storage:

| Type | Example | Advantage | Disadvantage |
|---|---|---|---|
| Optical | DVD or CD [1] | Large storage capacity of up to gigabytes (GB) of data | Lower maximum storage capacity |
| Magnetic [1] | Hard Disk | Relatively cheap and large storage capacity of up to terabytes (TB) of data | Vulnerable to drops and mechanical shocks [1] |
| Solid-state | Memory cards / SD cards [1] | Much faster; Smaller in size and lighter in weight or Uses very little power and produces no noise [1] | More expensive |

[5]

**5** **(a)** Draw the truth table for a NAND gate.

| Inputs | | Output |
|---|---|---|
| A | B | X |
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

1 mark for correct sequence of inputs and 1 mark for output [2]

**(b)** An alarm sounds when certain conditions occur in the main reactor of a chemical plant. The output, X of a logic circuit that drives the alarm must have a value of 1 only if:

either temperature is high and water level is high in the reactor

or water level is low and relief valve is off in the reactor

or temperature is low in the reactor

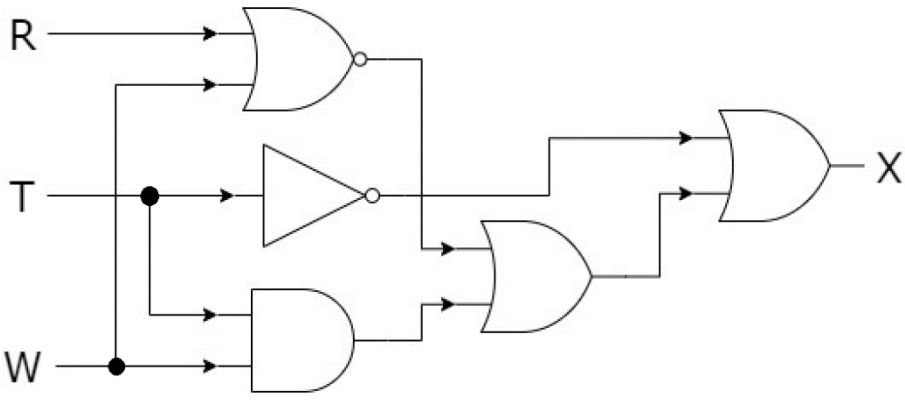
The inputs to the system are:

| Input | Binary | Condition |
|---|---|---|
| R | 0 | Relief valve off |
| | 1 | Relief valve on |
| T | 0 | Low temperature |
| | 1 | High temperature |
| W | 0 | Water level low |
| | 1 | Water level high |

**(iv)** Write down the corresponding Boolean statement for the system.

X = T AND W OR NOT W AND NOT R OR NOT T .....[2]
Also accept
X = (T AND W) OR (NOT W AND NOT R) OR (NOT T)
X = T AND W OR W NOR R OR NOT T

**(v)** Draw a logic circuit for the system.




1 mark each for each correct 3 gates and 1 mark for ORing the gates [4]

**6** Progammers apply a variety of problem-solving techniques.

**(a)** The table shows two scenarios where the decomposition technique is used.

Complete the table by stating the approach used in each scenario.

| Scenario | Approach |
|---|---|
| Finding the lowest score in a class test. Take the first score on the list as input and output it as the lowest score for the first sub-problem. The output of the first sub-problem is used together with the second score on the list as inputs to a second sub-problem to output the lowest score. This process goes on until all the scores on the list have been compared, and the lowest score is shown as the final result. | Incremental |
| Calculating the mean subject grade aggregate. The inputs of the program are individual scores of each subject. The program then separates into two distinct tasks. First task works on the conversion of the scores to grades and the second task sums all the grades and calculate the average grade. The average grade is then shown as the mean subject grade. | Modular |

[2]

**(b)** State **two** other problem-solving techniques.

1 Pattern Recognition

2 Generalisation

[2]

**7** Technology has enabled ease of communication with people all around the world.

**(a)** Describe **two** economic benefits to businesses using technology.

Any appropriate benefit (1 mark for each benefit)
Development of mobile applications for businesses that enable online purchases anytime, anywhere.
The rise of social media has led to the increased use of social media for marketing purposes and has helped businesses to better understand buying habits and consumer needs by analysing social media posts.
Improvements in communications technology have also reduced business costs through the use of cheap and effective video conferencing calls in place of face-to-face meetings.

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

Any appropriate ethical issue raised (1 mark)
Should some kinds of false information on the Internet be blocked or would this be taking censorship too far?
Is it right to collect and analyse social media posts in ways that the original authors may not have intended?
Technology has made it easier for business to send out unsolicited spam. Should companies be taken to task for persistent spamming

**(c)** Organisations are susceptible against cyberattacks like phishing, pharming or spam.

**(i)** Explain the difference between phishing and pharming

Phishing is the use of emails and fake websites [1 mark] that appear to be from reputable companies in order to steal personal information while pharming involves more sophisticated techniques in intercepting requests sent from a computer to a legitimate website and redirection to a fake website [1 mark] to steal information.

**(ii)** Firewalls are commonly deployed in networks. Explain how a firewall works.

A firewall is a device or computer program that prevents unauthorised access to or from a private network. It works by monitoring each piece of information [1 mark] that is transmitted through a network. Then the information would be either blocked or allowed to pass [1 mark] through based on a set of rules configured by an administrator.

**(ii)** Describe **one** measure to manage spam.
Any appropriate measure (1 mark)
Avoid giving your email address to unfamiliar contacts or untrusted websites.
Look out for options to turn off email updates or participation in mailing lists when signing up for or changing the settings of an online account.
Use email services with spam filtering features.

**13** Some data are shown in a spreadsheet.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 5 | 6 | 5 | 3 | 4 | 5 | 3 |
| 2 | | | | | | | | |
| 3 | COUNT | | | | | | | |
| 4 | SMALL | | | | | | | |
| 5 | MEDIAN | | | | | | | |
| 6 | MODE.SNGL | | | | | | | |

Determine the result for the following formulas:

=COUNT(A1:H1) 8

=SMALL(A1:H1,2) 3

=MEDIAN(A1:H1) 4.5

=MODE.SNGL(A1:H1) 5 [4]

**8** Computers use a variety of networking devices and identifiers to communicate and exchange data with one another.

**(a)** A laptop requires an IPv6 address, MAC address and SSID to connect wirelessly to other computing devices or the internet. State what IPv6, MAC and SSID represent, what each is used for, and how each can be represented.

**(i)** IPv6 address

IPv6 address stands for Internet Protocol version 6 [1 mark]
IP address is used to identify a computer or device in a network [1 mark]
IPv6 address is represented as eight groups of four hexadecimal digits, each group representing 16 bits. [1 mark]

**(ii)** MAC address

MAC address stands for Media Access Control address [1 mark]
MAC address is used to identify a particular network interface card [1 mark]
MAC address is represented by a 12-digit hexadecimal number (6-Byte binary number), separated by hyphens or colons. [1 mark]

**(iii)** SSID

SSID stands for Service Set Identifier [1 mark]
SSID identifies a wireless access point (WAP) and all devices connected to it [1 mark]
SSID is represented by a 32 byte string. [1 mark]

**(b)** State **two** key differences between the functions of a router and a bridge/switch.

1
A network bridge constructs a single network by connecting two **similar** networks together.
A router keeps the connected networks (which may use fundamentally different protocols) **separate**.
[1 mark]
2
A bridge uses **MAC addresses** to keep track of the devices that are connected to each side of the bridge.
A router forwards packets between the networks using **Internet protocols**.
[1 mark]

**(c)** A port number is used in combination with an IP address to identify a program that is running on a network. [1]

**9** The following pseudo-code represents an algorithm that asks the user to enter a word and stores this in the variable `word`. It then asks the user to enter the number of letters to be extracted from `word` in reverse; this number is stored in the variable `numLetters`.

The algorithm extracts the amount of letters the user entered from word, starting with the last letter and then outputs these letters.

```
OUTPUT "Enter a word with more than 3 letters, but less than 10
       letters: "
INPUT word
OUTPUT "Enter the number of letters you want to extract from the
       reversed word: "
INPUT numLetters
newWord = revsubstring(word, numLetters)
OUTPUT newWord
```

**(a)** The function `revsubstring(theString, numCharacters)` returns a number of characters, `numCharacters` from the reversed `theString`.

In the following example:

`theString = "computing"`

`revsubstring(theString, 4)` would return the string `"gnit"`

**(i)** State the output for `revsubstring(revsubstring("computing", 7), 5)`.

`"mputi"`.....[1]

**(ii)** Write pseudo-code for the algorithm in the `revsubstring` function. You can assume a start index of 0.

```
FUNCTION revsubstring(theString, numChar)
    revString = theString[::-1] # 1 mark for reverse
    return revString[:numChar] # 1 mark for slicing

END FUNCTION
```
.....[2]

**(vi)** Give an example of test data for the `revsubstring` function for each test case condition in the following table.

| Test case condition | Test data |
|---|---|
| Normal | `"computing", 5` |
| Error | `"eat", 5` |
| Boundary | `"eat", 3` |

[3]

**(b)** The algorithm needs to validate the number, `numLetters`, immediately after it is input.

**(iii)** The number, `numLetters` must be more than 1, but less than the number of characters in `word`.

Identify an appropriate data validation technique that can be used to validate this input.

Range check.....

.....[1]

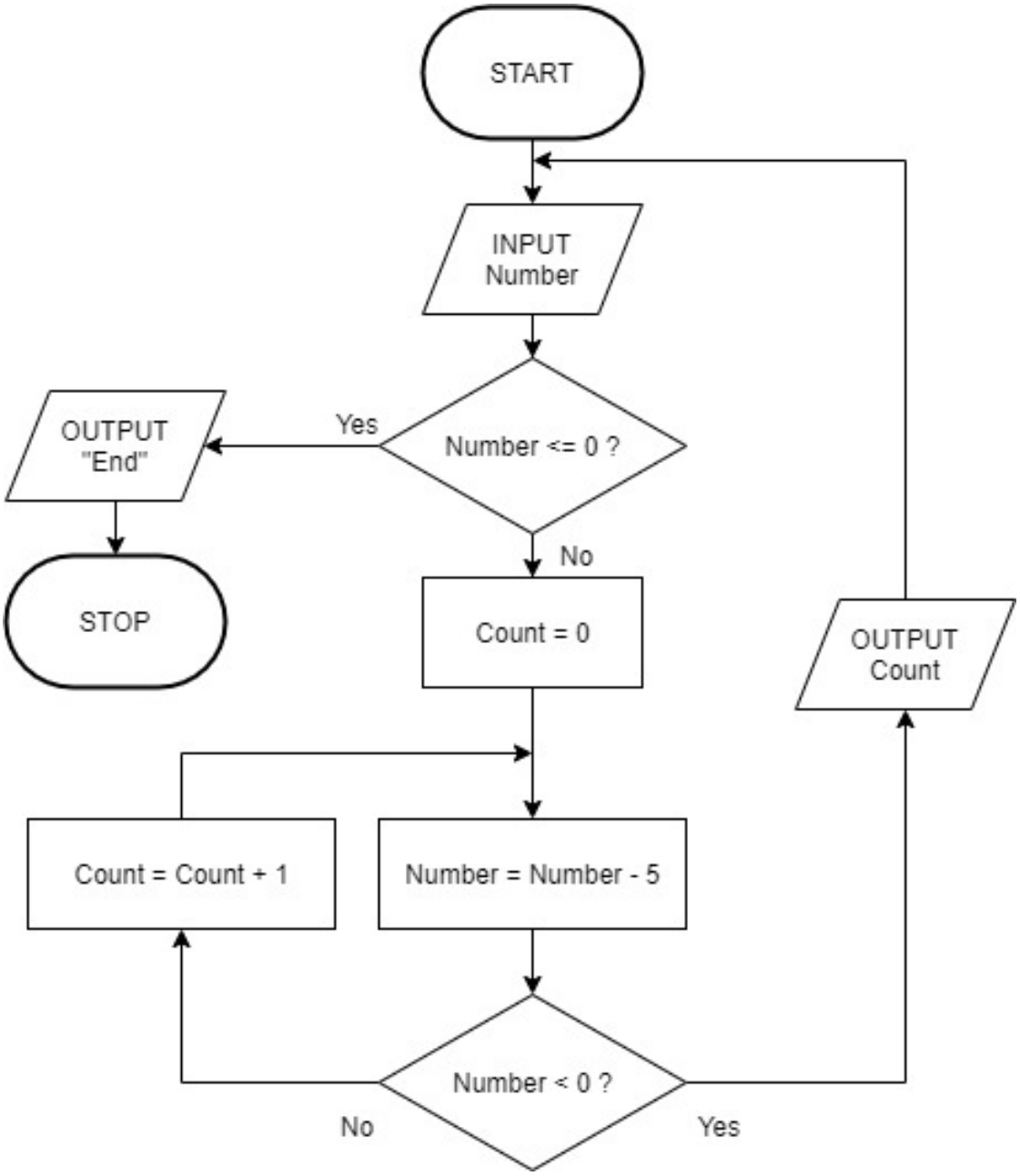
**(iv)** Write pseudo-code for the algorithm to restrict the input of the number `numLetters` to more than 1 but less than the length of `word`. The algorithm should continually ask for a new number until a valid number is entered.

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 return its length as an integer.

```
WHILE numLetters <= 1 OR numLetters >= length(word):
    INPUT numLetters
ENDWHILE
or
WHILE TRUE:
    INPUT numLetters
    IF numLetters > 1 OR numLetters < length(word):
        BREAK
ENDWHILE

# 1 mark for while loop; 1 mark for correct condition; 1
mark for re-input
```

**10** Consider the following flowchart that inputs a sequence of numbers.




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

Use the data `18`, `10`, `-2` as input.

| Number | Count | OUTPUT |
|---|---|---|
| 18 | 0 | |
| 13 | 1 | |
| 8 | 2 | |
| 3 | 3 | |
| -2 | | 3 |

| | | |
|---|---|---|
| 10 | 0 | |
| 5 | 1 | |
| 0 | 2 | |
| -5 | | 2 |
| -2 | | 'End' |
| | | |
| | | |
| | | |

1 mark for each column [3]

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

Calculating the quotient of any positive numbers when divided by 5 (1 mark)

Loops until input number is 0 or negative. (1 mark)

[2]

**11** Write an algorithm, using pseudo-code or a flowchart that does the following:

- reads a number
- computes the factors for the number and stores them in an array
- outputs the array containing the factors
- clears the array and repeats by asking the user for another number. The program will stop immediately when zero is entered for the number

You must validate the input to ensure that it is positive. Prompt the user to re-enter if not.

```
INPUT number # 1 mark for input and correct sequence
WHILE number != 0 # 1 mark for iteration to check number = 0
    factorlist = [] # ensure array is cleared
    WHILE number < 0 # 1 mark to validate positive number
        OUTPUT "Number must be positive"
        INPUT number
    ENDWHILE
    IF number == 0
        BREAK
    ENDIF
    FOR count = 1 TO number # 1 mark to determine factors
        IF number MOD count == 0
            factorlist.APPEND(count) # 1 mark factors in list
        ENDIF
    OUTPUT factorlist # 1 mark for output
    INPUT number
ENDWHILE

# Program should meet all listed requirements for full marks.
```

[6]