

End-of-Year Revision Exercise for Year 12 SL

(*) indicates question taken from IB past papers

Questions on Topic 1 System Fundamentals

- 1) (*) A medical centre uses a computer system to manage both patients' data and appointments. This system, which is used by the doctors, nurses and secretaries, has two unordered files: a patients' file and an appointments' file, both of which can only be accessed sequentially.

Every evening the following processing takes place:

- a list of appointments for the next day is printed out
 - reminders are sent by SMS text messages to the patients' mobile devices.
- a) Outline the pseudocode that the processing must follow when the system sends out the text reminders. [5]
- b) Describe two different methods that the medical centre could use that would allow data to be restored should it be lost for any reason. [4]

The medical centre is concerned about the privacy of the data it is storing and has to make decisions concerning:

- access to the data stored on this system
 - storing the data locally or through the use of a cloud service.
- c) Discuss the issues that should be considered before making these decisions. [6]

- 2) A company plans to build an off-site "Data Centre" to house its servers and associated devices. A system analyst is employed by the company to design and implement a computer system for the new Data Centre.

- a) State **two** methods of data collection which could be used in the analysis stage. [2]
- b) Explain why it may be useful to produce more than one prototype of the new computer system. [2]

There are two possible locations for the Data Centre:

- A central location in a major city
 - A town in an area where previously the main industry had been coal mining.
- c) Discuss the social implications of the company's choice of location for the Data Centre. [6]

Questions on Topic 2 Computer Organization

- 1) (*) Outline the role of the memory data register in the machine execution cycle. [2]
- 2) (*) Calculate how many different colours can be represented using two hexadecimal characters. [2]
- 3) (*) Construct a logic diagram for the following Boolean expression.

not A or (A and B) [3]

- 4) (*) Distinguish between random access memory (RAM) and read only memory (ROM). [3]
- 5) (*) Explain the roles of the data bus and the address bus in the machine instruction cycle. [4]
- 6) (*)
- a) State how the data stored in the following byte will be represented in hexadecimal. [1]
- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 |
|---|---|---|---|---|---|---|---|
- b) State how many integers could be represented in this byte. [1]
 - c) Outline why this byte could not be used to represent characters such as those used in Chinese. [2]
- 7) (*) Construct a truth table with two input variables. If the input variables are equal the value of the output variable should be True, otherwise it should be False. [2]

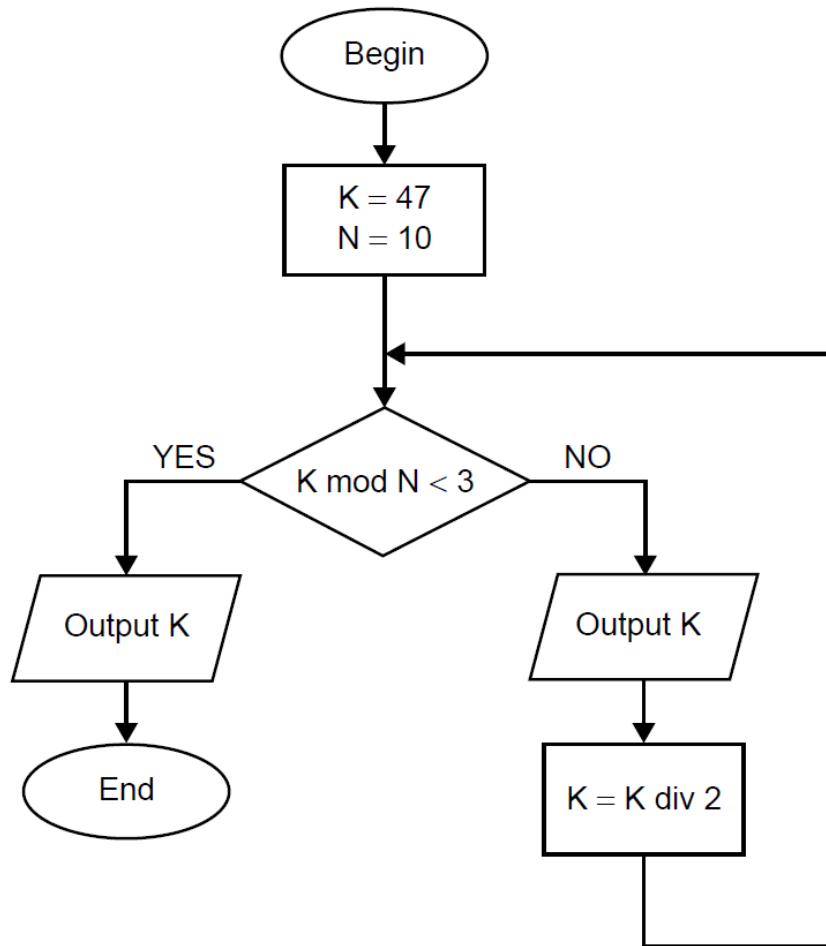
Questions on Topic 3 Networks

- 1) Define the following terms: (a) topology, (b) data integrity and (c) protocol
- 2) About check digits
 - a) Why are they used?
 - b) Explain how they work.
- 3) What is a check sum?
- 4) What is a parity bit?
- 5) How does a client-server network work?
- 6) Explain the terms: (a) hub, (b) switch and (c) router
- 7) Compare and contrast the similarities and differences between a LAN and a WLAN.
- 8) Explain the terms: (a) VLAN, (b) WAN, (c) SAN, (d) intranet, (e) extranet, (f) VPN, (g) PAN and (h) peer-to-peer.
- 9) A VLAN is safer than a LAN. Why?
- 10) The management of a VLAN (as compared to a LAN) is complex. Why?
- 11)
 - a) Explain briefly what the OSI and the TCP/IP models are.
 - b) Explain briefly what each level performs.
- 12) What is the difference between the following:
 - a) Secure VPN
 - b) Trusted VPN
 - c) Hybrid VPN

- 13) What is the difference between a site-to-site VPN and a remote-access VPN?
- 14) (*) An international company is in the process of moving its Head Office from Europe to Asia.
- a) Identify **two** possible compatibility issues as a part of data migration. [2]
 - b) Outline how a virtual private network (VPN) will allow employees who are in Europe to communicate with the Head Office in Asia. [2]
 - c) Outline **one** social issue associated with this process. [2]

Questions on Topic 4 Computational Thinking with Java

- 1) Write a program that accepts a mark from 0 to 100. The program outputs one of the following messages:
- a) The number you entered is not between 0 to 100.
 - b) The grade is Fail (mark is below 40)
 - c) The grade is Pass (mark between 40 and 59)
 - d) The grade is Credit (mark is between 60 and 79)
 - e) The grade is Distinction (mark is between 80 and 100)
- 2) A linear integer array contains 100 elements
- a) Fill the array with random numbers that range from 1 to 50.
 - b) Find the biggest difference between two adjacent elements.
- 3) A linear array contains 10 strings. Write a program that:
- a) Asks the user to fill the array with the strings.
 - b) Calculates the average length of the strings.
 - c) Asks the user to enter a string and then outputs the number of times the string appears in the array.
- 4) (*) Consider the following algorithm.



Determine the outputs that will be produced by this algorithm. [3]

- 5) (*) Construct a trace table for the following algorithm

```

A = 3
B = 7
loop while B >= A
  A = A + 1
  output (B - A)
  B = B - 1
end loop
  
```

[4]

- 6) (*) Explain **two** benefits of using sub-procedures within a computer program. [4]
- 7) (*) The following method, calcBMI() accepts person's height (H) in metres (m) and weight (W) in kilograms (kg) and returns their Body Mass Index (BMI).

```

calcBMI (H, W)
    X = H * H
    B = W / X
    return B
endcalcBMI

```

Boris weighs 104 kg and is 2.00 m tall. His BMI can be calculated by calling method calcBMI() as follows:

BorisBMI = calcBMI(2.00, 104).

a) State the value of variable BorisBMI. [1]

A person can belong to one of the following four weight categories:

BMI	Weight category
less than 18.5	underweight
from 18.5 but less than 25.0	normal weight
from 25.0 but less than 30.0	overweight
greater than or equal to 30.0	obese

b) Use pseudocode to construct an algorithm which accepts a person's BMI and outputs the weight category the person belongs to. [4]

The data about a group of adults and their height measurement (in metres) and weight measurement (in kg) is held in three one-dimensional arrays.

	NAME		WEIGHT (kg)		HEIGHT (m)
[0]	Annie	[0]	52.40	[0]	1.56
[1]	Boris	[1]	100.00	[1]	2.00
[2]	Hugh	[2]	105.00	[2]	2.03
[3]	Paul	[3]	61.00	[3]	1.75
[4]	Robby	[4]	88.00	[4]	1.80
...
...
[29]	Zara	[29]	68.00	[29]	1.71

Where

NAME is a one-dimensional array holding names (currently sorted in alphabetical order).

WEIGHT is a one-dimensional array holding weight measurement in kilograms.

HEIGHT is a one-dimensional array holding height measurement in metres.

For example, NAME[0] is Annie. Her weight measurement is 52.40 kg and can be found in WEIGHT[0].

HEIGHT[0] is 1.56 which represents Annie's height measurement in metres.

c) State the name of the person whose height is held in HEIGHT[3]. [1]

d)

i) Identify **one** reason why a binary search algorithm cannot be used to find the name of person whose height is given. [1]

ii) Describe how the name of person whose height is given could be output. [2]

e) Construct an algorithm which will output the names of all the people whose BMI is greater than this group's average BMI.

You should call method calcBMI() in your answer. [6]

8) (*) Consider the array NUMBERS.

NUMBERS

[0]	[1]	[2]	[3]	[4]	[5]
3.12	43.20	12.45	78.43	13.50	43.67

a)

i) Identify the consequence of attempting to output NUMBERS[6]. [1]

ii) Describe a method of preventing the problem in part (a)(i). [2]

b) Construct the algorithm that will output the average of all values in the array NUMBERS. [4]

The method minPos() determines the index of the smallest value in an array.

The method maxPos() determines the index of the largest value in an array.

For example, NUMBERS.maxPos() is 3.

Consider the following algorithm fragment.

```
S=NUMBERS.minPos()
L=NUMBERS.maxPos()
T=NUMBERS[S]
NUMBERS[S]=NUMBERS[L]
NUMBERS[L]=T
```

c)

- i) Show the contents of the array NUMBERS after the algorithm is applied. [2]
- ii) Deduce the purpose of the algorithm. [2]
- d) Construct the algorithm for the method maxPos(). [4]

9) Three IB students are working on a programming project. They have 10 days to complete the work. To plan the project activities and timeline they produce the following Gantt chart.

Project activity	Timeline in days									
	1	2	3	4	5	6	7	8	9	10
Define the problem										
Design algorithms										
Code the program										
Design test data										
Test and correct modules										
Overall program test										
Produce documentation										

- a) State two tasks students should perform to define a problem. [2]
- b) Identify two tools or techniques that students could use to represent algorithms. [1]
- c) Discuss whether beta testing would be appropriate in this scenario. [3]
- d) Outline three criteria that could be used when deciding which programming language is to be used for coding. [3]
- e) From the Gantt chart above
 - i) identify two tasks that could be done concurrently; [1]
 - ii) identify two tasks that should be done sequentially. [1]
- f) Explain why a Gantt chart may not be suitable for planning a large business project. [4]

10) Consider the array 'data' and the program fragment shown below.

	[0]	[1]	[2]	[3]	[4]	[5]
data	-2	2	4	3	0	-1

```
public double [ ] doIt ( double [ ] inArray)
{
    int n = inArray.length;
    double [ ] outArray = new double[n];
    for ( int i=1; i<n-1; i=i+1)
    {
```

```

        outArray [i] = inArray [i-1] + inArray [i] + inArray [i+1];
        outArray [i] = outArray [i] / 3.0;
    }
    return outArray;
}

```

The method 'doIt' is called by the statement `double [] d = doIt (data);`.

- a) By copying and completing the following table, trace the method 'doIt' for this call and show the contents of the array outArray after each pass through the loop. [4]

outArray	[0]	[1]	[2]	[3]	[4]	[5]
Original	0	0	0	0	0	0
i=1						
i=2						

- b) State the effect of the doIt () method on the values in the array data. [1]
- c) Outline why the loop cannot start and end on the indices of the first and last elements of the input array. [2]
- d) Construct statements to modify the doIt () method so that the first and last elements of the output array are also computed. The first element of the output array will be the average of the first two elements of the input array. The last element of the output array will be the average of the last two elements of the input array. [2]

Similarly, for the two-dimensional array data2 shown below, an average value can be calculated for each interior element as follows.

The average value for the interior element marked X is the average of itself and its four neighbouring elements which are marked A, B, C, and D.

$$\text{(Average} = (X+A+B+C+D)/5.0)$$

data2	[0]	[1]	[2]	[3]	[4]	[5]
[0]						
[1]		A				
[2]	D	X	B			
[3]		C				
[4]						

- e) Construct a code fragment that computes the average for the value at data2 [1] [4]. [2]

f) The method `doIt2 (double [] [] in2Array)` fills a two-dimensional output array `out2Array[] []` so that:

- each interior element of the array `out2Array` is the average of the corresponding element and its four neighbouring elements (as explained above) in the array `in2Array`
- all elements on the edges of `out2Array` are kept at their default value of zero.

Construct the method `doIt2()`, which is called by the statement

`double [] [] e = doIt2 (data2)`. It has been started below.

```
public double[ ] [ ] doIt2(double[ ] [ ] in2Array)
{
    ...
} [6]
```

g) Outline how the elements on the edge of `out2Array` could be given values equal to the average of the corresponding element and its neighbouring elements in `in2Array`. [3]