

DEPARTMENT FOR CURRICULUM,  
RESEARCH, INNOVATION AND LIFELONG LEARNING  
Directorate for Learning and Assessment Programmes  
Educational Assessment Unit

**Annual Examinations for Secondary Schools 2018**

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**YEAR 10**

**COMPUTING**

**MARKING SCHEME**

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***MARKING SCHEME***

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## Section A

1. Computer programs and application packages can be found as **customisable**, **off-the-shelf** or **tailor-made**.

For each of the statements below indicate if it is **True** or **False**.

Statement	True/False	
The operating system is usually a tailor-made program:	<i>False</i>	[1]
Freeware software can be used for a limited time:	<i>False</i>	[1]
Tailor-made software are best suited for organisations that require certain personalised features:	<i>True</i>	[1]
Off-the-shelf software is usually not well documented:	<i>False</i>	[1]
Installing a software refers to the process that the end-user needs to carry out prior to running the software:	<i>True</i>	[1]

2. Technology in society has taken over in many aspects. Using the terms given below, match the most appropriate for the given scenarios: **Stock control**, **POS App**, **CAM**, **simulation** and **CAD**.



Scenarios	Term	
The process used to imitate a situation, for example blood flowing through veins:	<i>Simulation</i>	[1]
A system that makes use of a bar code reader to aid in transaction processing:	<i>POS</i>	[1]
This software converts the data of 3D designs into data that a 3D Printer understands and can therefore manufacture:	<i>CAM</i>	[1]
The use of computer systems to create, modify and analyse designs:	<i>CAD</i>	[1]
The activity of making sure that a company always has the right amount of goods available to sell:	<i>Stock Control</i>	[1]

3. Registers are hardware components which allow a small amount of temporary storage space. An example of a register is the shift register which performs arithmetic operations on the data it holds.

a. Shift the binary number **11110000** **once** to the left. [1]

<i>Answer: 111100000<sub>2</sub></i>
--------------------------------------

b. Convert the answer in part (a) to decimal and mention what arithmetic operation was performed. [1]

<i>Working here</i>	<i>Answer here</i>
	<i>480<sub>10</sub></i>
	<i>Multiplication by 2</i>

c. What would happen if the answer in (a) was to be stored in an 8-bit register? [1]

*Numerical Overflow*

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d. What is the result of double right shift? [1]

*Division by 4*

---

e. What is the minimum number of bits required to represent the days of the year? [1]

*9 bits*

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4. a. **CAL** is a very common acronym used in education. What does the acronym CAL stand for? Briefly describe CAL.

<b>CAL:</b>	<i>Computer-aided learning</i>	[1]
<b>Description:</b>	<i>The use of digital resources to aid in the learning</i>	[1]
	<i>process. [accept relevant answers]</i>	

- b. The **GPS** (Global Positioning System) is a computerised device very much used in travelling.



**Name** and **describe** another device/application used in travelling.

<b>Name:</b>	<i>Air traffic control, space travel etc.</i>	[1]
	<i>[Embedded systems such as an ABS/Auto Parking System in a car or Auto Pilot in an airplane are also relevant]</i>	
<b>Description:</b>	<i>Allocate 1 mark for description of (i)</i>	[1]

- c. **EFT** (electronic fund transfer) is the transfer of money from one bank to another. Briefly describe an **advantage** of EFT. [1]

*Allocate 1 mark for mentioning a good advantage;*

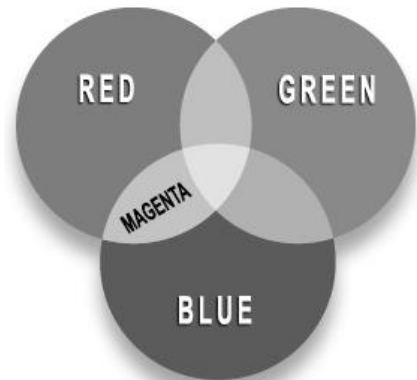
*such as No need to go to the bank, payments*

*done quickly, etc.*



5. Digital devices use hexadecimal codes to identify different colours. For example:

Colour	Code in Hex
White	FFFFFF
Black	000000
Blue	0000FF
Red	FF0000



As shown in the diagram on the right, different colours are made up as a mixture of the primary colours Red, Green and Blue. For example, if Red is mixed with Blue, Magenta is obtained.

Using the table above:

- Convert the Hexadecimal code for **red** and **blue** to **binary**.
- Add the two binary numbers for red and blue to find the binary equivalent of the colour Magenta.
- Find the hexadecimal code of Magenta, as obtained in part (b).
- To create the colour **white** on computer screens, red, blue and green are mixed together. After studying the colour codes above, what is the hexadecimal code for **green**?

Working here

a.	<b>Red:</b>	1111 1111 0000 0000 0000 0000	[1]
	<b>Blue:</b>	0000 0000 0000 0000 1111 1111	[1]
b.	<b>Addition:</b>	1111 1111 0000 0000 1111 1111	[1]
c.	<b>Magenta in Hex:</b>	FF00FF	[1]
d.	<b>Green in Hex:</b>	00FF00	[1]

6. a. Logic gates are the building blocks for any type of electronic circuit that can manipulate the signals in binary form (0 and 1).

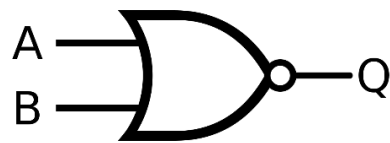


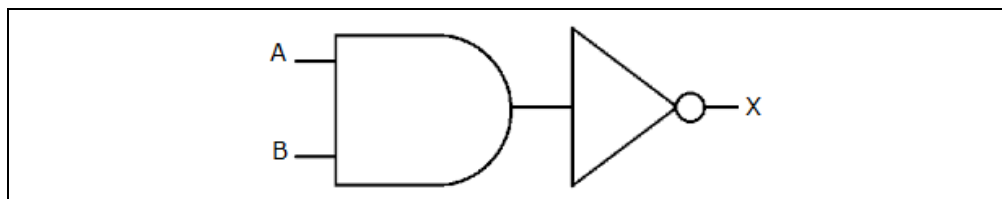
Figure 1

For example, the **NOR** gate, as shown in Figure 1, is made up of an **OR** and a **NOT** gate as shown in Figure 2. The same concept is applied for the **NAND** gate.



Figure 2

- i. Using **two** gates, represent the NAND gate. [1]



- ii. Draw the truth table for the NAND gate. [1]

<b>A</b>	<b>B</b>	<b>X</b>
0	0	1
0	1	0
1	0	0
1	1	0

- iii. Extract the Boolean expression for the NAND gate. [1]

$$X = \overline{(A.B)}$$

- b. A company safe can only be opened (S=1) if:

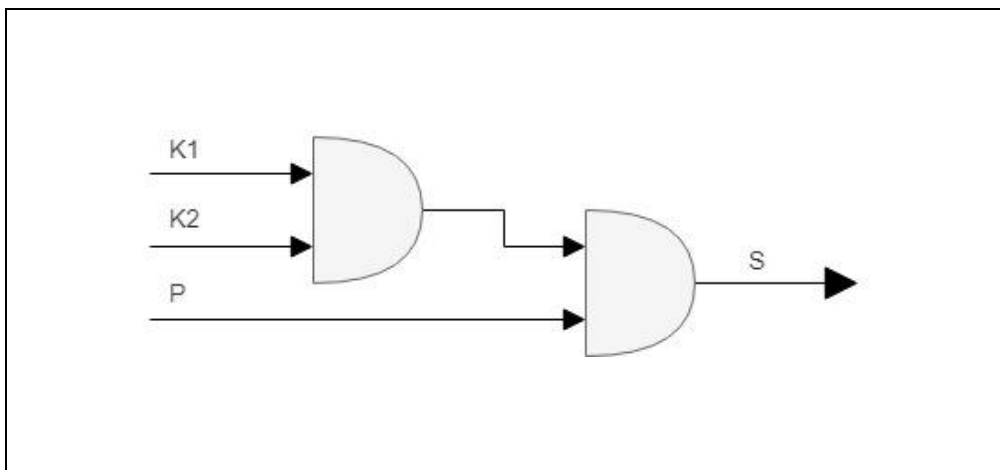
- Two keys (K1=1 and K2=1) are used simultaneously,
- The correct pass code is entered (P=1)



- i. Draw the truth table for the above scenario. [1]

<b>K1</b>	<b>K2</b>	<b>P</b>	<b>S</b>
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

- ii. Draw the logic circuit for the truth table (scenario). [1]



7. Mrs Abela referred to a software house to create a computerised system for her company. The systems analyst informed her that apart from the program, the software house will also provide the following documentations:

- User Documentation
- Technical Documentation
- Program Documentation

a. Briefly **describe** the three types of documentation by mentioning at least **one item** found in each manual.

<b>User:</b>	<i>Designed to assist persons in using the system – includes</i>	[1]
	<i>installation/input/output screenshots – accept relevant answers</i>	
<b>Technical:</b>	<i>This specifies the needs of the program – includes type</i>	[1]
	<i>of CPU &amp; speed, memory required – accept relevant answers</i>	
<b>Program:</b>	<i>Used to modify and maintain programs – includes</i>	[1]
	<i>flowcharts, source code – accept relevant answers</i>	

b. The technical documentation is aimed for technicians and/or end-users. For whom are the user and program documentations aimed?

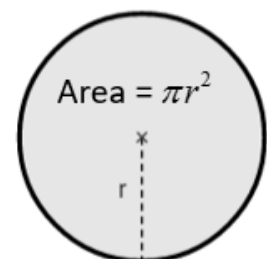
<b>User:</b>	<i>End-users</i>	[1]
<b>Program:</b>	<i>Programmers</i>	[1]

8. The snippet program below is used to find the area of a circle.

```

Line 1  final double PI = 3.142;
Line 2  System.out.print("Enter radius of circle: ");
Line 3  rad = Keyboard.readDouble();
Line 4  double area = PI*rad;
Line 5  System.out.println("The Area is: "+area);

```



As it is, the program has **two errors**.

a. Name the two errors together with their line numbers.

- Error 1:** Syntax Error [½]
- Line number:** Line 3 [½]
- Error 2:** Logic Error [½]
- Line number:** Line 4 [½]

b. Rewrite the instructions without errors mentioned in part (a).

**Error 1:** `double rad = Keyboard.readDouble();` [1]

**Error 2:** `double area = PI*rad*rad;` [1]

c. Briefly explain a **test data** that can be used to test this snippet.

**Test data:** *Enter text for radius – accept relevant answers* [1]

9. a. Represent the decimal numbers **95** and **-105** as 8-bit Twos complement binary numbers. *Show your working.*

<i>Working here</i>
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<b>-105<sub>10</sub> :</b>	<i>10010111<sub>2</sub></i>	[1]
<b>95<sub>10</sub> :</b>	<i>01011111<sub>2</sub></i>	[1]

b. If **A = B + C**, where **B = 95<sub>10</sub>** and **C = -105<sub>10</sub>** work out the value of **A** in binary and convert it to decimal to justify your answer. *Show your working.*

<i>Working here</i>
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<b>A (in binary):</b>	<i>11110110<sub>2</sub></i>	[1]
<b>A (in decimal):</b>	<i>-10<sub>10</sub></i>	[1]

c. What is common among all the negative numbers represented by the 8-bit twos complement binary number system?

*The MSB of all negative numbers must be 1.* [1]



10. Mr Grech is the owner of a supermarket, and due to the increase in clients, he wishes to expand his business. So, he referred to a systems analyst for advice with regards to digitising his business.



The list below shows some of the stages a systems analyst goes through to analyse and create a new system. For this **given scenario**, suggest some task/s that the analyst performs at each of the following stages.

- i. Project selection and feasibility study.

Checks the approximate cost of the new system etc. [1]

- ii. Present system study and analysis.

Interviews the owner of the supermarket for further information etc. [1]

- iii. Design of the new computerised system.

Designs the Inputs and Outputs of the supermarket system etc. [1]

- iv. Implementation and changeover methods.

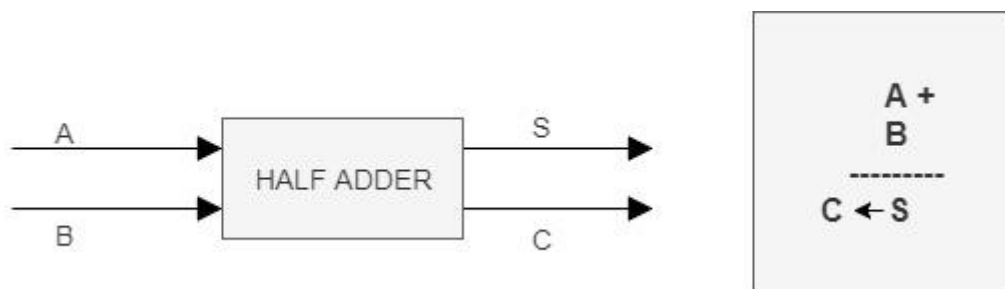
Installs the software in the hardware being used etc. [1]

- v. Control and review.

After some time rechecks the effectiveness of the system etc. [1]

[Allocate 1 mark only for relevant answer related to the scenario]

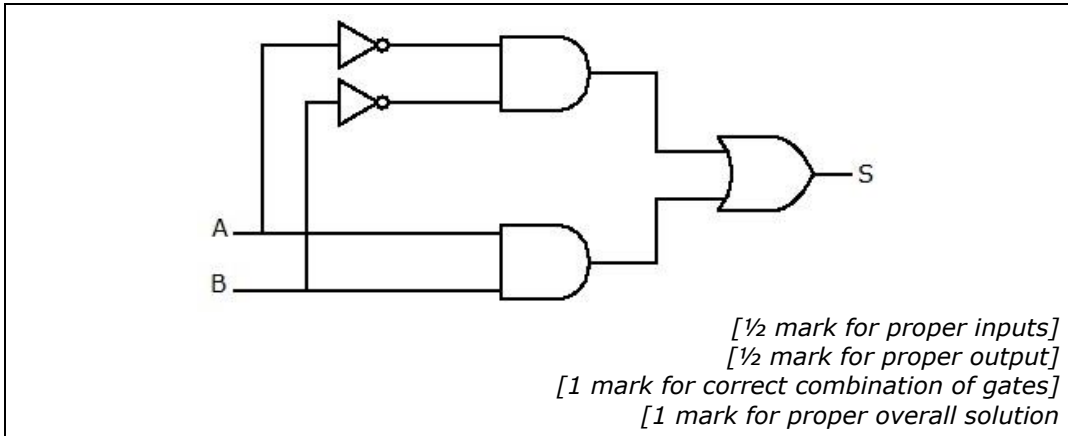
11. The diagram below summarises the binary addition.



- a. The output (**S**) is the addition of **A** and **B**. Complete the below truth table. [1]

<b>A</b>	<b>B</b>	<b>S</b>
0	0	0
0	1	1
1	0	1
1	1	0

- b. Using AND, OR and NOT gates only, draw the logic circuit for the truth table obtained in (a). [3]



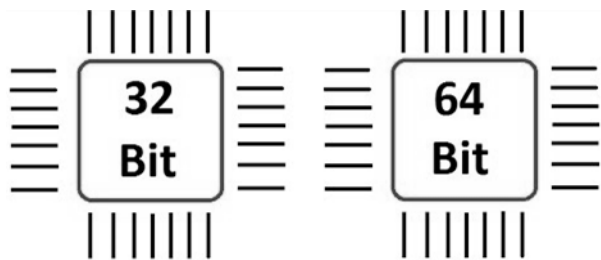
- c. C gives the carry bit for each addition operation. Hence, what **single** logic gate can be used to perform the carry for addition? [1]

AND GATE

## Section B

12. In 2003, AMD brought 64-bit architecture to its microprocessors, a move Intel soon followed in 2004.

64-bit CPUs have a wider *instruction set* than 32-bit processors. Besides, 32-bit CPU architectures are based on 32-bit rather than 64-bit registers, address buses and data buses.



- a. What is a CPU's **instruction set**? [1]

The complete set of instructions that can be recognized and executed by a central processing unit.

- b. 64-bit processors are often preferred to their 32-bit counterparts, especially by end users who require systems with larger amounts of RAM.

Explain why, unlike a 32-bit system, a 64-bit system allows significantly more than 4GB of RAM.

This is because the address space of a 32-bit system is  $2^{32}$  bytes of RAM which is roughly 4GB and 64-bit systems have an address space of  $2^{64}$ .

- c. Fill in the blanks with the appropriate bus. *The first one is given as example.*

	<b>Address Bus</b>	<b>Control Bus</b>	<b>Data Bus</b>
i.	A bus carrying control information between the CPU and RAM.		Control Bus
ii.	A one-way bus.		<i>Address Bus</i> [½]
iii.	A two-way bus.		<i>Data Bus</i> [½]

- d. For certain resource-heavy applications, a 64-bit wordlength is required. How does wordlength contribute to the performance of a computer system? [1]

*It determines the number of bits the CPU can send, receive or process at one go.*

- e. In a game running on a 64-bit CPU, the player is identified by his username which is stored in 16-bit Unicode character set. How many words are there if the username is 'MAX15'? [1]

*5 letters x 16bits = 80bits, 80/64 = 2 words are required*

*ANSWER = 2 WORDS*

- f. The CPU contains several special-purpose registers. Define special-purpose registers. [1]

*A special-purpose register performs a specific task with the data it holds.*

- g. Fill in the blanks: [2]

The Program Counter holds the address of the next instruction to be executed, whilst the *instruction register* holds the instructions currently being executed by the CPU. During program execution, the ALU stores intermediate arithmetic and logic answers in the *accumulator*.

- h. Computer systems often use two's complementation for representing numeric values. [1]

What range of two's complement numbers can be represented in a 64-bit CPU?

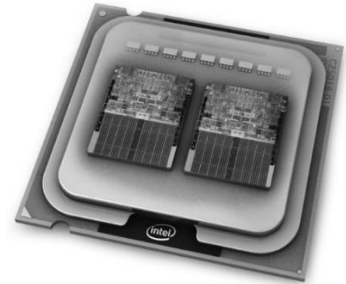
*$-2^{64-1} - 1$  to  $2^{64-1}$*

- i. CPU performance tends to be also dependent on the amount of cache available. Briefly explain the role of cache memory in CPU performance. [1]

Cache is a faster type of memory which stores frequently accessed instructions.

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One other major improvement in microprocessors was the introduction of multiple cores; that is a CPU structure that encloses more than one processor. It can therefore be said that a quadcore CPU has four Arithmetic Logic Units (ALUs).



- j. What is the role of the ALU? [1]

The ALU carries out mathematical and logic operations on the operands in an instruction ...accept also 'The ALU processes instructions'.

- k. Suggest **one** advantage of having multiple cores. [1]

[Accept answers related to parallel processing]

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- l. Name **two** power-hungry applications that tend to require a particularly high-end CPU. [1]

Games, Virtual Reality/Augmented Reality applications, video editing applications etc.

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- m. While 64-bit computing is now standard in most laptops and desktop computers, 8-bit and 16-bit processors can still be found in the modern household devices. [2]

Suggest an application for such processors. Briefly explain your answer.

[Accept mention of any smart appliance such as a programmable microwave which does not need a large wordlength to execute the program chosen by the user]

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13. A computer game called 'Snake' is being developed. In this game the user navigates a snake to win points.

The game rules are as follows:

- If the snake hits a **rock**, it grows smaller and loses a life;
- If the snake hits a **mouse**, it eats it and grows bigger;
- If the snake hits an **elixir**, it earns a lifepoint;
- The snake dies when its lifepoints **OR** size become 0. At this point '**Game Over**' is displayed on the screen.

- a. Part of class **Snake** is shown below:

This section of code displays the snake on the screen. The position of the snake depends on the values of variables x and y. Variable 'x' represents the horizontal axis and variable 'y' represents the vertical axis.

```
Line 1  import java.awt.*;
Line 2  import java.applet.*;
Line 3  import static java.lang.Math.random;
Line 4
Line 5  public class Snake extends Applet {
Line 6      String userName;
Line 7      int lifePoints = 3;
Line 8      int size = 5;
Line 9
Line 10     public void paint(Graphics g){
Line 11         //generate random number for x
Line 12         int x = (int)(500.0 * random()) + 1;
Line 13
Line 14         //generate random number for y
Line 15         int y = (int)(500.0 * random()) + 1;
Line 16
Line 17         for(int i=0; i<size-1; i++){
Line 18             g.drawString("*", x+i, y+i);
Line 19         }
Line 20     }
Line 21 }
```

- i. What are the initial values of the variables 'size' and 'lifePoints'?

size:	5	[1/2]
lifePoints:	3	[1/2]

- ii. Complete the code in line 12 and line 15 so that they generate a random integer from 1 to 500.

```
Line 12    int x = (int) (500.0 * random()) + 1;
Line 15    int y = (int) (500.0 * random()) + 1;
```

The Java library named 'awt' provides means for programmers to produce GUI features.

- iii. What do you understand by 'GUI features'? [1]

These are features that allow a human-computer interface that includes windows, icons, buttons etc.

- iv. Explain the function of this line in the above code: [1]

```
import java.awt.*;
```

The import statement ending in an asterisk imports all classes from that package 'awt' OR the package 'awt' is being imported for possible integration in this code.

- b. The application also includes the methods shown below. [1]

```
...lines of code before
Line 34    public void getElixir(){
Line 35        this.lifePoints++;
Line 36    }

Line 37    public void eatMouse(){
Line 38        this.size++
Line 39    }

Line 40    public void hitRock(){
Line 41        this.lifePoints____;
Line 42        if ((this.lifePoints > 0) ___ (this.size>0)){
Line 43            System.out.println ("I am hit!");
Line 44            System.out.println ("Snake life points: "
+ _____);
Line 45        }
Line 46        else {
Line 47            _____;
Line 48        }
Line 49    }

...lines of code after
```

- i. **Explain** what happens to the snake when the method eatMouse() is called. [1]

The size of the snake is incremented by 1.

- ii. Complete method hitRock(). [4]

```
public void hitRock(){
    this.lifePoints--;
    if ((this.lifePoints > 0) && this.size>0){
        System.out.println ("Snake was hit!");
        System.out.println ("Snake life points:
        " + this.lifePoints);
    }
    else {
        System.out.println ("Game Over!");
    }
}
```

- c. The scope of variable 'i' in method paint(Graphics g) is the: [1]
- for loop
  - class Snake
  - method paint(Graphics g)

- d. State whether the following statements are True or False? [3]

Statement	True/False
The 'do...while' loop is a pre-tested/pre-conditioned looping construct.	<i>False</i>
A non-void Java method can return a value to the method that calls it.	<i>True</i>
An integer variable can hold whole numbers only.	<i>True</i>

- e. When the game is distributed, its **user manual** will be distributed with it. Name **two** things you expect to find in the user manual. [2]

Guide on using the main functions of the system.

Information about where to find help and further details.

*[accept relevant answers]*