

Annual Examinations for Secondary Schools 2014

**FORM 4** **COMPUTING** **MARKING SCHEME**

**Section A – Answer all Questions**

1. The CPU can carry out arithmetic on binary values in its registers.

a. Given an **8-bit register**, how would you represent:

i. Unsigned 56 [1]  
 $00111000$  *½ mark for 111000*

ii. -56 in Two's Complement [2]  
 $11001000$  *1 mark for 11000111*

b. Use **8-bit two's complementation** to subtract 56 from 88. [2]

$00100000$  *½ mark for correct conversion of  $88_{10}$  to  $01011000$*   
*½ mark for addition of  $01011000$  and  $11000111$*   
*1 mark for correct answer*

2. Logic circuits are designed to carry out specific functions.

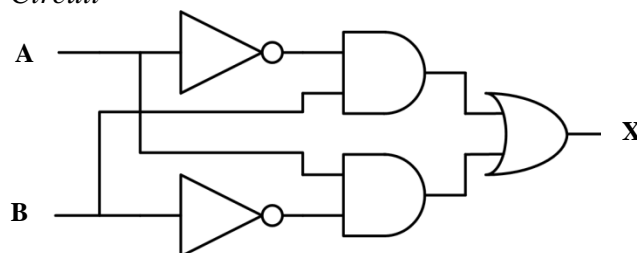
Use **AND**, **NOT** and **OR** gates to represent the logic circuit for the following

a. truth table:

(X is the output of the circuit)

A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

Space for Logic Circuit



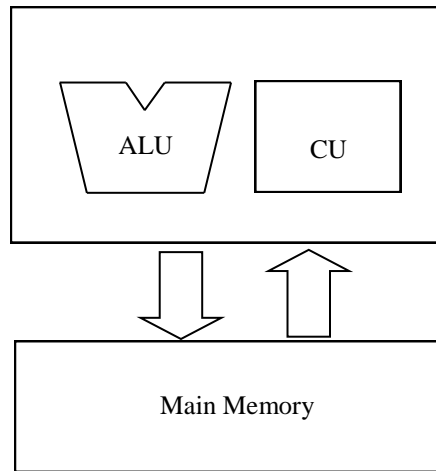
*1 mark for partly correct circuit*  
*½ mark for labelling of input and output*

b. Give the **Boolean expression** for the above circuit. [2]

$X = A'.B + A.B'$  *1 mark for partly correct answer*  
*1 mark for correct expression of incorrect logic circuit*

3. The diagram below shows various system components. [3]
- a. **Label** the following system components:

**ALU, CU, Main Memory**



*I mark for each correct answer*

- b. What is a CPU register? [1]  
Small amount of CPU temporary storage. (Accept reasonable answers)
- c. Explain the role of the **accumulator** register. [1]  
Storing intermediary results of CPU calculations. (Do not accept 'works out calculations', etc.)
4. There are various steps in the system lifecycle.
- a. State **two** things that are normally done during the system design stage of the system lifecycle. [2]  
 i. System flowcharts are drawn up.  
 ii. File structures are determined. (Accept reasonable answers)
- b. What is **system changeover**? [1]  
When a company/user moves from an old system on to the new system.
- c. Give **one** advantage of the following changeover methods: [2]  
 i. Parallel changeover  
More reliable as data loss due to teething problems is less likely.  
 ii. Direct changeover  
Less redundancy of work  
(Accept reasonable answers)
5. System testing is an important step in the system lifecycle.
- a. What is a syntax error? [1]  
An error in the use of the syntactical rules of a language. (Do not accept 'an error in the program', etc.)

- b. Give the term for: [2]
- Checking a program by working through a section of it manually.  
Dry Run
  - An error in a program.  
Bug
- 
- c. Look carefully at the following section of code: [2]
- ```
average = num1 + num2/total;
System.out.println ("The average is " + average);
```
- Identify a logic error in this code.  
The formula for finding the average is wrong and will give an incorrect value for average.
  - In what circumstances can the above code give a runtime error?  
If the value of total is 0 the division operation will give a run time error.
- 
6. There are various character coding systems.
- How many different characters can be represented by a **7-bit** character coding system? [1]  
128 *Accept also 2<sup>7</sup>*
  - If in a character coding system 'A' is represented by **binary** 65, give the **binary** equivalent of 'F'. [2]  
1000110 *1 mark for 70*
  - An 8-bit register holds the binary pattern 01000001.
    - What will be the value stored in the register after an **Arithmetic Shift Left**? [1]  
10000010
    - Therefore what does an Arithmetic Shift Left do to a number? [1]  
It doubles the number
- 
7. a. Identify the difference between system and application software. [2]
- |                      |                                                                                                    |
|----------------------|----------------------------------------------------------------------------------------------------|
| System Software      | <i>A layer of software that manages system resources and hence helps run application software.</i> |
| Application Software | <i>Software designed to perform a particular function. Needs system software to run.</i>           |
- (Accept reasonable answers)*
- Give **two** differences between tailor-made and off-the-shelf packages. [2]
- | <b>Tailor made packages</b>                  | <b>Off-the-shelf packages</b>                |
|----------------------------------------------|----------------------------------------------|
| <i>Software is not immediately available</i> | <i>Readily available</i>                     |
| <i>Likely to be more expensive</i>           | <i>Less expensive as it is mass-produced</i> |
- (Accept reasonable answers)*
- What application software would you use to keep track of business sales? [1]  
Spreadsheet *(Accept reasonable answers)*

8. Java is an Object Oriented Language.

a. Answer **True** or **False**. [3]

|      |                                                                          |              |
|------|--------------------------------------------------------------------------|--------------|
| i.   | An object is an instance of a class.                                     | <i>True</i>  |
| ii.  | A class is a blueprint for an object.                                    | <i>True</i>  |
| iii. | A programmer should not declare more than one instance of a given class. | <i>False</i> |

b. Write a line in Java to declare and create an instance called 'personA' of a class called 'Person'. [2]

*Person personA = new(Person);*

*I mark for: Person personA;*

9. This question is about Software Documentation.

a. Name **two** things you expect to find in program documentation. [2]

i. *Program listing with inline documentation*

ii. *System flowcharts*

*(Accept reasonable answers)*

b. Give **two** reasons why such program documentation is important. [2]

*Aids modularity: when many people are working on creating the same system / adequate documentation can help ensure the different modules work well together.*

ii. *Useful reference during system maintenance.*

c. What is a user manual? [1]

*A document that offers the user instructions on installation and use of the software, including annotated tutorials etc.*

10. CPU evolution has been a long struggle to improve its efficiency.

a. **Name** and **briefly describe** the relevance of 3 factors that determine CPU speed. [3]

| Factor             | Description                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Clock Speed</i> | <i>The number of times the system clock changes state per second, determining the number of CPU cycles per second.</i>                   |
| <i>Wordlength</i>  | <i>The number of bits the CPU can send, receive or process at a time. The larger the wordlength the more efficient the CPU.</i>          |
| <i>Cache</i>       | <i>Very fast, volatile memory that is immediately accessible to the CPU. Larger and faster cache therefore improves CPU performance.</i> |

*(Accept reasonable answers)*

b. What is address space? [1]

*The number of memory locations a CPU can directly access*

c. What is the address space of a 16-bit address bus? [1]

*2<sup>16</sup> or 65536*

11. Registers are limited to storing a certain range of values.
- a. What is the **range** of two's complement numbers that can be stored in an **8-bit register**? [2]  
 $-2^{8-1}$  to  $2^{8-1}-1$  Or  $-128$  to  $127$   
*1 mark for correct lower value*  
*1 mark for correct upper value*
- 
- b. Use **8-bit binary** to add 34 and 244. [2]  
 $100010110$   
*1/2 mark for 34 = 00100010*  
*1/2 mark for 244 = 11110100*  
*1 mark for correct answer*
- 
- c. If the result of your calculation in (b) was to be stored in an 8-bit register, what type of error would it generate? [1]  
*Overflow error*

### Section B

12. Computers have various applications in society.
- a. What do the following abbreviations stand for? [2]  
 i. CAD Computer Aided Design  
 ii. CAM Computer Aided Manufacture
- 
- b. Give an example of where a **CAD CAM** system can be used and briefly explain your answer. [2]
- |                           |                                                                                                               |
|---------------------------|---------------------------------------------------------------------------------------------------------------|
| Where CAD CAM can be used | <i>Car Manufacture</i>                                                                                        |
| Explanation               | <i>CAD is used to design models and linked to a CAM system for manufacture, often using robotic arms etc.</i> |
- (Accept reasonable answers)*  
*Do not accept non answers: e.g. 'in a factory', 'for production', 'to design' etc.*
- c. A Virtual Learning Environment (VLE) (like *Fronter*) can be a useful CAL tool. A VLE offers online facilities that allow teachers to share resources with students. They also allow students to submit their work online and receive teacher feedback, results and school reports. The system can be accessed by students, parents, teachers and members of the administration who have a login name and password. [2]
- Suggest **two** ways in which a VLE can be key in helping students improve their performance.
- i. *Students can receive feedback on homework more immediately and this tends to improve motivation.*  
 ii. *Parents can login and view their children's reports at any time in order to discuss their progress with them.*
- (Accept reasonable answers)*

d. Name **one** use of computers in the following fields: [6]

|      |                       |                                                                                                       |
|------|-----------------------|-------------------------------------------------------------------------------------------------------|
| i.   | Medical diagnosis     | <i>Use of ultrasound machines for detection of health issues.</i>                                     |
| ii.  | Office Automation     | <i>Use of wordprocessors to efficiently produce and edit documents.</i>                               |
| iii. | Business              | <i>Use of e-commerce to enhance trade.</i>                                                            |
| iv.  | Aviation              | <i>Use of simulators to train pilots/ use of gps etc.</i>                                             |
| v.   | Ecology               | <i>Use of GPS-enabled chips to track animal movement.</i>                                             |
| vi.  | School Administration | <i>Use of and online system for attendances: making it easier to track and deal with absenteeism.</i> |

(Accept reasonable answers)

e. What is **EFTPOS**? [1]

*An electronic fund transfer at a point of sale, it refers to the use of credit cards etc. for money transfers at the point of sale.*

f. Explain one way **EFTPOS** is advantageous: [2]

|     |                 |                                                                      |
|-----|-----------------|----------------------------------------------------------------------|
| i.  | To the shop     | <i>Having less money in the shop tills is safer against robbery.</i> |
| ii. | To the customer | <i>One does not need to carry a lot of cash on him.</i>              |

(Accept reasonable answers)

13. Below is an incomplete Java class called Student:

```
public class Student {
    String name;
    String surname;
    int totalExamMark;
    _____;//array to hold 10 marks

    public void findHighest(){
        int h = _____;
        int i;//counter

        for ( _____){
            if ( _____){
                h = markList[i];
            }
        }
        System.out.println("The highest mark is: " + h);
    }
}
```

a. Write a line to declare the array called *markList* to hold a total of 10 whole marks. [2]

*int[] markList = new int[10];*

- b. Complete the method *findHighest* such that it outputs the highest mark in the array *markList* [3]

```
public void findHighest(){
    int h = 0;
    int i;

    for (i=0;i<10;i++){
        if (markList[i]>h){
            h = markList[i];
        }
    }
    System.out.println("The highest mark is: " + h);
}
```

- c. Write a method called *findAverage()* that finds and outputs the average of the marks in *markList* [5]

```
public void findAverage(){
    this.totalExamMark = 0;
    int i;
    for (i=1;i<10;i++){
        this.totalExamMark += this.markList[i];
        //or this.totalExamMark = this.totalExamMark + this.markList[i];
    }
    double average = this.totalExamMark/10;
    System.out.println("The average mark is: " + average);
}
```

*1 mark for correct looping condition*  
*1 mark for finding total*  
*1 mark for declaration of variable average*  
*1 mark for output of average*  
*1 mark for correct method*

- d. Answer **True** or **False** [3]

|      |                                             |              |
|------|---------------------------------------------|--------------|
| i.   | The for loop is a predetermined loop        | <i>True</i>  |
| ii.  | The while loop is executed at least once    | <i>False</i> |
| iii. | The do...while loop is a predetermined loop | <i>False</i> |

- e. The following variable types are all used for whole numbers: [2]

**int, short, byte, long**

|     |                                                                                             |                                                                           |
|-----|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| i.  | Which of these variable types has the smallest range?                                       | <i>byte</i>                                                               |
| ii. | Why is it important not to use larger variable types than necessary when writing a program? | <i>So that executing the program does not take up space unnecessarily</i> |