

Subject : IB Computer Science HL

Level : Higher Level , year 1

Exam : Final Exam June 2016 - Mr. Mulkey's Class

Date : 2 June 2016

Time: 13:00 - 15:00

Length: 2 hours

Contents: 7 pages , 22 questions

Candidate's Name

INSTRUCTIONS TO CANDIDATES:

- **Write your name in the box above.**
- **Do not open the exam paper until told to do so.**
- **Answer ALL questions.**
- **Write ALL answers on the separate answer sheets provided.**
- **Use a black or a dark blue pen to write your answers (no pencils).**
- **Calculators, computers, phones and other digital devices are prohibited.**

***** Possible Printing Errors *****

It is possible that a printing error might occur.

In that case, students should should make a **reasonable** assumption about what the problem says and continue and answer the question.

Students must assume that ALL Java code is **written correctly** - there are **no Syntax Errors**. The answer will NEVER be "the program won't run due to a Syntax Error" – UNLESS the question clearly states that there is a Syntax Error in the code.

Students must also assume that no Compile Time errors would occur, UNLESS the problem specifically says that there is a compile-time error.

1. Explain how **ASCII codes** function.
Then explain the difference between ASCII and UNICODE . [2 marks]

2. State what will be printed by the following commands: [2 marks]

```
String[] names = {"Alex", "Carla", "Betty", "Doug", "Earl"};
int count = names.length;
output( names[ 3 ] );
output( names[count - 1] );
```

3. Predict exactly what will be printed by the following commands : [2 marks]

```
int a = 20;
int b = 7 ;
int c = a % b;
int d = a / b;
output( c );
output( d );
```

4. (a) Change the binary number **01010011 bin** to the equivalent **decimal** value (base 10). [1 mark]

- (b) Change the decimal number **123 dec** to the equivalent **binary** number. [2 marks]

5. A Laptop computer is likely to contain both RAM memory and Hard Disk storage.
For each of these 2 types of storage, describe one function that it
can perform that would not be performed by the other, and include
an explanation of why that function is best performed by that memory type. [4 marks]

6. It is possible to store a NUMBER in a String variable, like this:

```
String value = "135" ;
```

Explain why it is usually a bad idea to store numbers in String variables. [3 marks]

7. Describe a situation where a user might type a number and it would cause
an OVERFLOW error. Explain why the error occurs. [2 marks]

8. Explain how classes and objects are related,
and also how they are different. [2 marks]

9. It is possible to input a DATE as a String, like "4 July, 1776", and then
store it in a Date type variable. That converts the String into an equivalent
number, as the number of milliseconds since 1 Jan 1970.

Describe one advantage of storing a date as a number of milliseconds
rather than storing it as a String. [2 marks]

10. Explain what "parallel arrays" are, including a specific example of when they are
needed instead of one single array. [2 marks]

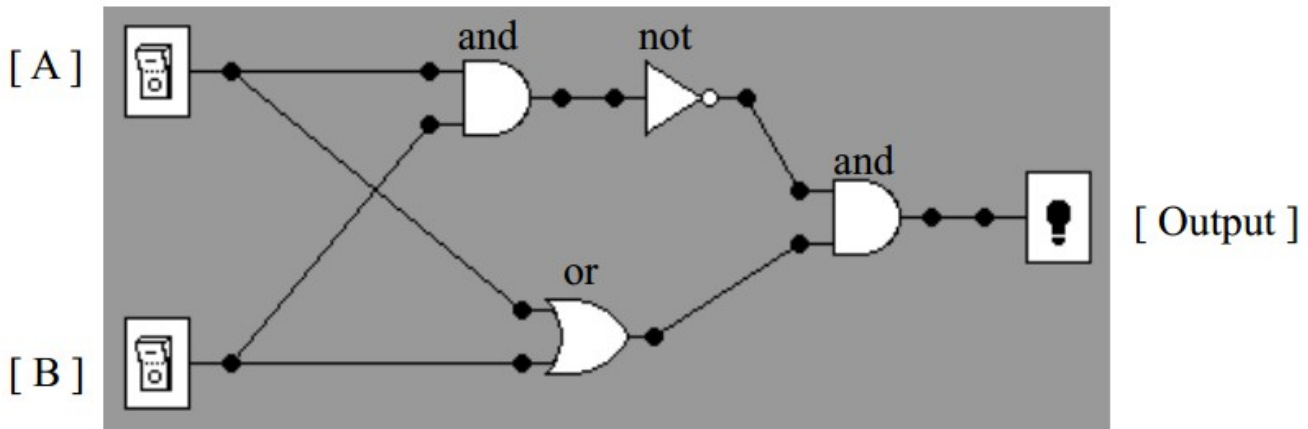
11. Assume that the array **PRICES[]** contains exactly **100 double** values, e.g. {12.99 , 2.50 , 29.00 ,}

(a) Write a method called **countSmall()** that counts how many of the values are below 10.00 [4 marks]

(b) Write a method that will **sort** the numbers in order, from largest to smallest. [4 marks]

=====

12. About Logic Gates



(a) Study the circuit above. Then fill in the following truth table for the circuit: [4 marks]

A	B	Output
0	0	
0	1	
1	0	
1	1	

(b) Explain the difference between **Inclusive OR** and **Exclusive OR (XOR)** gates. [2 marks]

(c) Explain why **NAND gates** are commonly used in USB Stick storage chips. [2 marks]

=====

#13

(a) Outline 2 differences between a **Linked-List** and an **Array**. [2 marks]

(b) Explain the purpose of the method: **LinkedList.remove(int p);** [2 marks]

=====

14. The following PSEUDOCODE algorithm adds up the numbers $1 + 0.5 + 0.25 + 0.125$

```
SUM = 0
X = 1
SUM = SUM + X
X = X*0.5
SUM = SUM + X
X = X*0.5
SUM = SUM + X
X = X*0.5
SUM = SUM + X
```

- (a) Assume the program will be changed to add up $1 + 0.5 + 0.25 + 0.125 + \dots + (0.5)^{999999}$ or stated differently: $0.5^0 + 0.5^1 + 0.5^2 + \dots + 0.5^{999999}$ (1 million terms). Outline **two reasons** that a **loop** should be used, rather than just writing a lot more commands.

[2 marks]

- (b) Write **Java commands** using a **loop** to add up: $0.5^0 + 0.5^1 + 0.5^2 + \dots + 0.5^{999999}$ [4 marks]

=====

15. Assume that 10 international schools in 5 different countries wish to form a partnership. They will share information about courses that they teach, as well as personal information about students and teachers. The new INTSCHOOLS partnership will need computer systems.

- (a) Outline 2 advantages of allowing each school to use their own favorite computer systems. [2 marks]
- (b) Outline 2 disadvantages of allowing various schools to choose different computer systems. [2 marks]
- (c) Assume that INTSCHOOLS decides to purchase a large computer system that will be used in the same way in all the schools. [2 marks]

Outline 2 reasons that there will be problems connected with having schools in several countries all using the same computer systems.

=====

16. The following questions are about **Operating Systems** in a laptop (notebook) computer such as a PC laptop or a MacBook.

- (a) Explain why Operating Systems must include **memory management** features, including how this is related to loading programs from the hard-disk. [2 marks]
- (b) Explain how **multi-tasking** works, including a specific example of when it is beneficial to a user. [2 marks]

=====

- # 17. Assume that the class EMAIL (below) is used to store eMail addresses and names. Each EMAIL object will contain the eMail **address** and **name** of a user.

```
public class EMAIL
{
    String address = "";
    String name = "";
}
```

The **collect()** method below inputs eMail addresses and stores them in LinkedList DATA . After running **collect()**, DATA contains lots of EMAIL objects. This method is part of a larger program.

```
LinkedList<EMAIL> DATA = new LinkedList<EMAIL>();

public void collect()
{
    String MORE = "Y";

    while( MORE.equals("Y") )
    {
        String N = input("Name ?");
        String A = input("eMail address?");
        EMAIL temp = new EMAIL();
        temp.name = N;
        temp.address = A;
        DATA.add(temp);

        MORE = input("Type another name ? (Y/N)");
    }
}
```

After running the **collect()** method, the **printAll()** method (below) will print all the eMail addresses.

```
public void printAll()
{
    int count = DATA.size();

    for(int x = 0; x < count ; x=x+1)
    {
        EMAIL info = DATA.get(x);
        System.out.println( info.address );
    }
}
```

- (a) Write a Java method called **findName(String find)** . This method accepts **find** as a parameter. The method must search in DATA for a **name** that matches **find** . Whenever it finds a matching name, it should print out the email **address** for that person. If there are many addresses for the same name, it should print all of them. [4 marks]
- (b) Write a new method called **checkEmail(String address)** . This method accepts an eMail address as a parameter. It checks the following: (1) **address** contains the '@' symbol ; (2) there are at least 2 characters to the left of the '@' symbol ; (3) the **address** contains a period '.' symbol ; (4) the period '.' symbol occurs to the right of the '@' symbol. If any of these 4 checks fails, then the method returns "bad" . Otherwise, the method returns "good". [6 marks]

===== Questions 18-22 are for HIGHER LEVEL STUDENTS ONLY =====

- #18 A clothes washing machine probably contains a CPU (microprocessor).
Outline 2 reasons that the washing machine does NOT need a GUI operating system. [2 marks]

- #19 Explain the major difference between a STACK and a QUEUE. [2 marks]

- #20 An MP3 music player might use **encryption** or **compression**.
Decide which is more useful in an MP3 music player
and explain how it is used in the music player. [2 marks]

- #21 - This question is about **ROBOTS**

- (a) Assume that a vacuum cleaning robot moves around in a room and sweeps up dirt.
Explain the roll of **sensors** in this robot, and explain why it would
not be a good idea to create such a robot WITHOUT sensors. [3 marks]
- (b) Explain what the term **AUTONOMOUS** means, and why this is significant for robots. [2 marks]
- (c) Explain why a robot would probably not be using a Windows or Mac operating system. [3 marks]

#22 Assume that a **two-dimensional array** named **MONEY** contains **4 rows** and **20 columns**. Part of the MONEY array data is shown here.

14	35	25	18	27	9more columns here
10	20	30	16	21	4more columns here
15	46	17	14	13	1more columns here
0	0	0	0	0	0more columns here

//-- Study the code below. --//

```
int num = 0;

for(int row = 0; row < 4; row = row + 1)
{
    num = num + MONEY[row][3];
}

output( num );
```

//----- end of code -----//

(a) Explain what will be printed by the code above.

[2 marks]

(b) Write a Java method that USES LOOPS to :

- add up the total of each COLUMN, and save the total in the bottom row, where the 0 is written
This produces 20 results, one for each column.
- then examine all the results in the bottom row,
and find the LARGEST TOTAL and output this result.

[8 marks]