IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
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N07/5/COMSC/HP1/ENG/TZ0/XX

COMPUTER SCIENCE
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PAPER 1

Monday 12 November 2007 (afternoon)

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Section A: answer all the questions.
- Section B: answer all the questions.

SECTION A

*Answer **all** the questions.*

1. Outline what is meant by *prototyping*. *[2 marks]*

2. Outline the function of the *linker*. *[2 marks]*

3. State **three** items of documentation that are usually included in a software package. *[3 marks]*

4. Describe how the computer carries out a *machine instruction*. *[4 marks]*

5. Outline what is meant by *double buffering*. *[2 marks]*

6. (a) Define *interrupt*. *[2 marks]*

(b) Describe how an interrupt is detected and identified by the processor. *[4 marks]*

7. Compare *batch* and *real time processing*. *[3 marks]*

8. (a) State **three** types of *file organization*. *[3 marks]*

(b) State **two** operations that are commonly carried out on files. *[2 marks]*

9. Given the following *recursive method*.

```
public static void charOut( char a, char b, int n)
{
  if (n>0)
  {
    System.out.println(a);
    charOut(b,a,n-1);
    System.out.println(b);
  }
}
```

Determine the output produced by the call `charOut('1','2',2)`.
Show all your working. *[4 marks]*

10. Outline **two** advantages of using *bar codes* in a warehouse data collection system. *[2 marks]*

11. A microprocessor embedded in a plastic card can be used to store information that can be read from, or stored on, the card using special terminals.

(a) Outline **one** advantage and **one** disadvantage of such cards. *[2 marks]*

(b) Outline **two** conditions that need to be met for such cards to be widely used. *[2 marks]*

12. By drawing an appropriate *truth table* determine whether the following *Boolean expressions* are equivalent or not. *[3 marks]*

$$A \bullet \overline{B}$$
$$\overline{A} + \overline{B} \bullet A$$

SECTION B

*Answer **all** the questions.*

13. Two of the most common computer operations are *sorting* and *searching*.

(a) Explain what is meant by sorting. *[2 marks]*

(b) Explain what is meant by searching. *[2 marks]*

(c) State **one** example of internal sort method and state its efficiency in *BigO notation*. *[2 marks]*

(d) State **one** example of search method and state its efficiency in BigO notation. *[2 marks]*

(e) Sorts are time consuming and it may be a good policy to avoid them where possible. Explain how this could be done. *[2 marks]*

14. A large company sets up a Wide Area Network (WAN) so that customers can place orders directly with the company's computer.

(a) Identify the *hardware* needed by the customer to place an order. *[2 marks]*

(b) State **one** advantage to the company and **one** advantage to the customer of such a system. *[2 marks]*

(c) The communication uses a *packet switching* system. Explain how packet switching works. *[4 marks]*

(d) Compare *parallel* and *serial transmission*. *[2 marks]*

15. An accounting system accepts data from a keyboard. Each *transaction record* consists of the following fields: account number, description and value. Data is stored in a *sequential transaction file*, validated, and all valid transactions copied to a *direct access file* and an error report produced.

(a) Define an appropriate data structure to hold the transaction data. *[3 marks]*

(b) Draw a *system flowchart* representing this process. *[4 marks]*

(c) Explain the difference between *transaction* and *master files*. *[3 marks]*

16. The linked list is held in memory in a table, which has room for 100 entries. The first item on the list is pointed to by the pointer start.
All free locations in the table are linked and nextAvailable is a pointer to the next free location in the table.
Each node consists of a student's name and a pointer to the next item in the list. Pointer –1 is the *sentinel value*.
The table currently holds four entries in such a way that they can be retrieved in alphabetical order

start [0]

nextAvailable [4]

	STUDENT'S NAME	NEXT STUDENT
0	Adams, Jose	3
1	Turner, Ivor	–1
2	Kliss, Mary	1
3	Brown, Charlie	2
4		5
5		6
6		7
.		
.		
98		99
99		–1

(a) Determine the new state of the table and pointers start and nextAvailable after name Lohy, Ann has been inserted in the list given above. *[3 marks]*

(b) Determine the new state of the table and the pointers start and nextAvailable after name Kliss, Mary has been deleted from the **original** list. *[3 marks]*

(c) Describe, by means of diagrams, or otherwise, how this list can be held in a memory as a dynamic data structure. *[4 marks]*

17. An organization wishes to create a *database* containing all relevant members' data.

Data from hundreds of members' forms is collected.

(a) Describe a suitable method of data input. *[2 marks]*

(b) Describe a method to be used to reduce the number of input errors. *[2 marks]*

(c) Explain how the loss of *data integrity* can be minimized in the following types of errors

(i) program errors *[2 marks]*

(ii) errors in data transmission *[2 marks]*

(iii) errors in operating procedures. *[2 marks]*

18. Digital computers use binary codes to represent data.

(a) (i) Explain why digital computers are based on the *binary number system*. *[2 marks]*

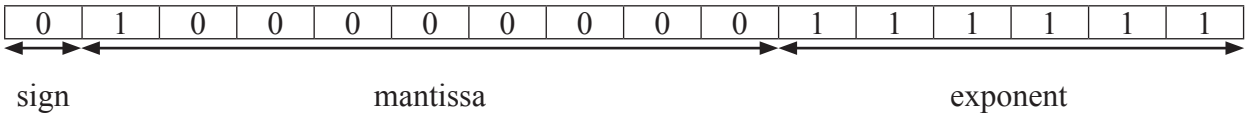
(ii) State why the *hexadecimal number system* is frequently used in computing. *[1 mark]*

(b) Convert:

(i) $111100001010_{(2)} = ?_{(16)}$ *[1 mark]*

(ii) $347_{(16)} = ?_{(2)}$ *[1 mark]*

(c) A *two's complement* binary representation of a floating-point number with a ten-bit *mantissa* followed by a six-bit *exponent* is stored within the following register.



Determine its decimal value.
Show all your working. *[5 marks]*