IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
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M05/5/COMSC/HP1/ENG/TZ0/XX

COMPUTER SCIENCE
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PAPER 1

Monday 9 May 2005 (afternoon)

2 hours

INSTRUCTIONS TO CANDIDATES

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

SECTION A

*Answer **all** the questions.*

1. State **two** items that would be included in *system documentation* written during the development of software for a computer system. Outline the importance of these two items in the *software life cycle*. *[4 marks]*

2. State a suitable use for OMR forms and describe why the use is suitable. *[3 marks]*

3. With reference to number bases, explain why one kilometre is equivalent to 1000 metres whereas one kilobyte is equivalent to 1024 bytes. *[2 marks]*

4. Describe the difference between a *multi user* and a *multi tasking* operating system, stating **one** example of each. *[4 marks]*

5. Describe the features of communication lines which improve the quality of data transmission. *[3 marks]*

6. Explain the role of the *instruction register*, the *program counter* and *buses* in the *machine instruction cycle*. *[6 marks]*

7. The following number is held in *floating point* with 8 bits for the *mantissa* and 4 bits for the *exponent* in *normalized* form. The *exponent* and the *mantissa* are held in *two's complement*.

0	1	1	1	0	0	1	0	0	1	0	1

(a) Evaluate the decimal equivalent of the number. *[3 marks]*

(b) Show the representation of –113. *[3 marks]*

(c) With reference to this method of storing numbers, explain the meaning of *truncation error*. *[2 marks]*

8. A binary search tree is used to hold the names of individuals in alphabetical order. They are placed on the tree in the order they arrive. Construct such a tree for the following:

Ankita, Mina, Dean, Elisabeth, Wataru *[4 marks]*

9. By stating the *BigO* efficiency of each, compare the efficiency of a bubble sort with that of a quicksort. *[4 marks]*

10. Define *direct memory access* (DMA). *[2 marks]*

SECTION B

*Answer **four** questions.*

11. The following algorithms have been written as part of a large statistical package.

```
function FACT(val N integer) result integer
    if N = 2 then
        return N
    else
        return N * FACT(N - 1)
    endif
endfunction FACT


function PERM(val n integer, val r integer) result integer
    PERM < -- FACT(n) / (FACT(r)*FACT(n - r))
endfunction
```

(a) Using a trace table, or otherwise, determine the value of `FACT`(5). *[4 marks]*

N	return value
5	

(b) Use both algorithms to deduce the value of `PERM`(5,2). *[4 marks]*

(c) Outline why the parameter N needs to be pass-by-value. *[2 marks]*

12. A chemical factory produces three dangerous gases, A, B and C, which have to be constantly monitored to ensure that they do not exceed specific levels. If these limits are exceeded then the corresponding inputs A, B and C are set to logical true.

C is always dangerous if it exceeds its limit.
A and B neutralise one another so they are only dangerous if one or the other, but not both, exceed their limit.
A warning signal, X, is given if either A **or** C are dangerous.
A danger alarm, Y, is sounded if A **and** C are both dangerous **or** if B **and** C are both dangerous.

(a) Represent the inputs A, B and C and the corresponding outputs X and Y in a truth table. *[4 marks]*

(b) Hence, or otherwise, produce logical expressions for the outputs X and Y. *[2 marks]*

(c) Construct a logic circuit for the alarm Y from the inputs A, B and C. *[4 marks]*

13. A large town has a central booking system for tickets to events such as concerts, plays, sports matches and musicals. A central computer holds details of all events and this computer can be accessed from shops in the town that sell tickets. Booking can also be done over the Internet.

(a) Describe how *interrupts* and *polling* can be used in a *multi access* system and explain why *interrupts* would be more suitable in this case. *[6 marks]*

The details of events held include a unique code for each event, the date, the place and the type of event.

(b) Compare *direct access* with *partially indexed access* as methods of accessing data about a specific event. *[4 marks]*

14. An *object-oriented program* is written to generate geometric shapes to be used when writing the code to produce screen displays. One of the shapes used is a regular polygon, which can have up to eight sides, all of which are the same length. (For example a triangle, square, *etc.*). The screen display is produced by rotating, filling and resizing the shapes.

(a) Identify example data and operations that could be *encapsulated* in the polygon object. *[4 marks]*

One particular display consists of large red triangles and small blue hexagons.

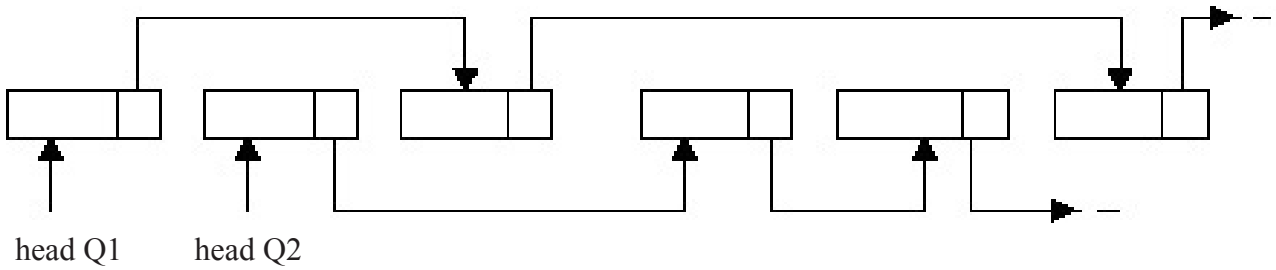
(b) Explain the advantages of *encapsulation* when producing the screen display. *[2 marks]*

(c) Explain how *inheritance* and *polymorphism* can be used to provide a variety of polygons. *[4 marks]*

15. A simulation is set up to examine the best way in which queues of customers can be reduced. The simulation program holds two queues in memory and simulates customers joining and leaving each of the queues.

(a) Compare the advantages and disadvantages of holding these queues as two *static data structures* with holding them as *dynamic data structures*. *[2 marks]*

It is decided to hold each queue in a linked list as follows:



(b) Using a diagram, algorithm or any other suitable method, describe the steps required to find the third person from the tail of queue 1, remove them and add them to the tail of queue 2. *[6 marks]*

(c) Explain why a doubly-linked list would be a more efficient way of holding these queues. *[2 marks]*