IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

N05/5/COMSC/HP2/ENG/TZ0/XX

COMPUTER SCIENCE
HIGHER LEVEL
PAPER 2

Monday 7 November 2005 (morning)

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.

1. A global array of sorted records, named `MASTER`, is used as a queue. Each record contains a file name and a file size. The array is sorted according to file size with the smallest file at the start of the array.

(a) Define a suitable record for the array. *[3 marks]*

The global array, `TRANSACTION`, holds unsorted records which are to be added to `MASTER`. When the records in `TRANSACTION` are transferred to `MASTER` they are first sorted and then the two arrays are merged to produce a new, sorted `MASTER` array.

(b) Write a sub-routine to sort `TRANSACTION` using a *selection* sort with **for** loops. The array can hold 100 records and all unused records have nil values for the file name. Include an early exit for a partly full array. *[11 marks]*

(c) Write a sub-routine that will merge `TRANSACTION` into `MASTER`. If `MASTER` becomes full the merge should stop. The array `MASTER` can hold 200 records. *[12 marks]*

(d) Describe a procedure that would enable `TRANSACTION` to continue to accept data after the two arrays have been merged. *[4 marks]*

This question requires the use of the Case Study.

2. A MIS (Management Information Systems) can reduce the number of man-hours required to run businesses.

(a) Explain **two** ways in which this can be a positive factor for employers and employees. *[4 marks]*

(b) Explain why the Total Cost of Ownership is often less than the costs minus the benefits. *[4 marks]*

(c) Explain **one** way that the result of using MIS can be unpredictable. *[2 marks]*

(d) Discuss the implications of privacy in information technology. *[4 marks]*

A solution to a problem can often be achieved by designing a customised software solution.

(e) (i) State the stages of the traditional software design lifecycle and identify the way in which it is cyclic. *[3 marks]*

(ii) Compare your answer to part (i) with the cyclic nature of the prototyping approach to software design. *[5 marks]*

(f) Explain why it is sometimes suggested that the final prototype should be abandoned and the final design started from scratch. *[4 marks]*

(g) State **two** other ways that can be used to develop solutions and state a disadvantage with each. *[4 marks]*

3. (a) Using the words *seek*, *latency* and *read/write* outline how long it takes to access data from a hard disk. *[5 marks]*

Disks gradually become fragmented over time.

(b) (i) Outline how a disk becomes *fragmented*. *[2 marks]*

(ii) Outline how *defragmentation* fixes this problem. *[2 marks]*

Chip memory works differently to disk memory.

(c) (i) Outline how RAM is accessed by the CPU. *[2 marks]*

(ii) Explain why access to RAM is faster than access to disk memory. *[2 marks]*

(d) Outline the function of the *interrupt register*. *[2 marks]*

4. A circuit is required to control a printer. Inputs to the circuits are:

Condition	yes	no
Paper present	1	0
Ink present	1	0
Job being printed	1	0
New job waiting	1	0

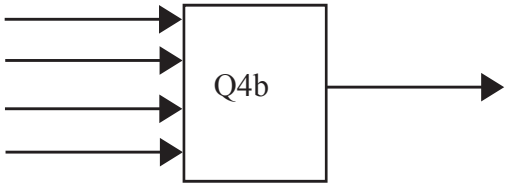
The circuit generates a signal if there is paper and ink and no job being printed and there is a new job waiting. The generated signal is fed back to the computer where the print job is waiting.

(a) State the name given to this process. *[1 mark]*

(b) Draw the logic diagram for this circuit using the correct symbols. *[5 marks]*

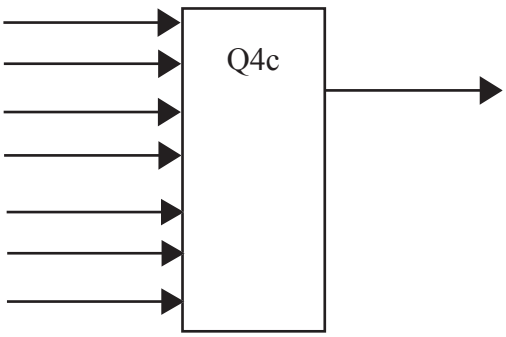
Three sensors are placed around the printer to detect if paper is jammed. If any paper is jammed the return signal is switched off.

(c) Assume that the box in the diagram below represents your answer to part (b). Redraw the diagram and add the additional logic gates needed to switch off the output if any sensor generates a signal. *[3 marks]*



An additional output signal is required that is normally on but is switched off if either paper or ink (or both) are missing.

(d) Assume that the box in the diagram below represents your answer to part (c). Redraw the diagram and add the additional logic gates to your circuits. *[2 marks]*



An alternative to the circuit would be a chip running a computer program that does the same thing.

(e) Outline **one** advantage and **one** disadvantage of using a programmed chip rather than an electrical circuit. *[4 marks]*

5. A school wants to enter student grades, as a percentage value, into a computer program which is being designed.

(a) Describe how you would design the testing of the proposed program. *[5 marks]*

(b) State at which point in the *software design life cycle* testing should be planned and explain why. *[3 marks]*

(c) State who should plan the testing and state why. *[1 mark]*

Once the program is designed and working, the data is to be input.

(d) Describe how the input could be *validated* and *verified*. *[4 marks]*

(e) State whether *validation* or *verification* should be executed first and suggest why. *[2 marks]*