



# ICM

DECEMBER 2016

HARDWARE & OPERATING SYSTEMS

**Instructions to candidates:**

- a) Time allowed: Three hours (plus an extra ten minutes' reading time at the start – do not write anything during this time)
  - b) Answer any FIVE questions
  - c) All questions carry equal marks. Marks for each question are shown in [ ]
  - d) Mark allocation should determine the length of your answer and the time you spend on it. Generally, one mark is awarded for each valid point
  - e) Ensure that you pay particular attention to words underlined, in CAPITALS or in **bold**. FEW OR NO MARKS will be awarded to any question where these are ignored
  - f) Use RTL (Register Transfer Language) to define actions in questions related to Fetch-Execute cycle or assembly language programming
  - g) Read all sections of any question before attempting any part of it
  - h) No computer equipment, books or notes may be used in this examination
- 
1.
    - a) 16-bit memory location X contains the binary value 1001 0111 1010 0000. This could represent any of the following:
      - an instruction
      - a pure binary number
      - a BCD number
      - a floating point number
      - i Define clearly the separate situations which might occur when the CPU might interpret X in EACH of the above ways.
      - ii Explain HOW it would know this was the appropriate interpretation.
      - iii Comment on whether in each case the interpretation is possible OR state what additional facts would be needed to fully decode it. [8]
    - b) State FOUR types of addressing modes normally available in low-level languages. Distinguish between them by giving a clear explained example for EACH. [3 each]
  2.
    - a) Describe the new storage systems which have appeared since diskettes and hard drives. Explain why there has been this need for rapid improvements and the opportunities they offer. [10]
    - b) A computer system may be described as **multi-media**. Explain what this means and list the hardware components likely to be found in such a system, both inside and outside the main case. [10]
  3.
    - a) Printers used with personal computers have different characteristics from those normally found in large-scale systems. Differentiate between the two types. [6]
    - b) Select a printer suitable for printing the master copy of an examination paper. Explain why it is suitable and describe the mechanics of its operation. [7]
    - c) Select a different type of printer from that in b), suitable for printing utility bills sent out to over a million consumers. Explain WHY it is suitable and also HOW this printer works. [7]

*continued overleaf*

4. People entering a clinic are each given a card carrying a number. These person-numbers are held in an array P[1 to 10]. The array is treated as a dynamic circular queue so that P[1] follows P[10]. The contents of the array at a given point in time are:

Array position	1	2	3	4	5	6	7	8	9	10
Person-number	21	30	51	43	81	69	53	60	18	81

- a) Define **queue** in TECHNICAL terms. [3]
- b) Two other factors define the queue:  
 Start of queue = 7  
 Number of people in the queue = 6
- i IN ORDER, write down the person-numbers of people in the queue.
  - ii Give a reason why person-number 51 is in the array. [8]
  - iii Explain why the number 81 occurs twice. [8]
- c) Define the term **stack**. Explain why a stack is unsuitable for the above application. [4]
- d) Given the instructions PUSH and POP for handling a stack, draw up a table with 10 rows. Assuming the numbers 1, 2, 3 etc. are used at each successive PUSH, complete the following table. Column 1 should contain the instructions PUSH, POP, PUSH, PUSH, POP, PUSH, PUSH, POP, POP, POP in successive rows. [5]

Instruction	Stack contents (top first)	Number output from stack
-------------	----------------------------	--------------------------

5. a) Select THREE of the following methods of data capture. For EACH:
- describe the physical processes undertaken by the HARDWARE that enable the device to read one set of data AND
  - describe a practical business application that would benefit most from this means of data capture, explaining WHY it is most appropriate
- i Bar-code reading
  - ii MICR
  - iii OCR
  - iv OMR [5 each]
- b) i Define the term **double-buffering**.
- ii Explain its purpose.
  - iii With the aid of a diagram explain how it operates. [5]

6. The four common types of addressing available in assembly language programming are:
- IMMEDIATE
  - DIRECT
  - INDIRECT
  - INDEXED
- For EACH type of addressing, define its functions and give a clear example of its use with sample assembly language instructions. Include memory locations where data/instructions are held. Either use Register Transfer Language (RTL) or explain carefully so that it is clear what value is accessed in EACH case. [5 each]

7. a) Describe IN DETAIL the steps that take place during the FETCH stage of the FETCH-EXECUTE cycle. [4]
- b) Below are four examples of assembly instructions with their explanation. For EACH, describe in detail all the stages of the EXECUTE phase of the FETCH-EXECUTE cycle, including how registers are changed.
- i STO TOTAL Return the contents of the accumulator to memory location TOTAL. [4]
  - ii SUB PAID Subtract the contents of memory location PAID from accumulator. [4]
  - iii BLE LOOP Transfer control in the program to label LOOP if the current value of the accumulator is less than or equal to zero. [4]
  - iv OUT 6 Display the numeric contents of the accumulator on the screen at the current position of the cursor and using exactly 6 character positions. [4]

8. a) EITHER explain how to direct the operating system OR write suitable commands with explanation to perform the following:
- i Give diskette file M read-only status. [3]
  - ii Give diskette file N read/write status.
  - iii Find out which files on a diskette have read-only status. [3]
- b) Display a list on paper of sub-directory X of the hard disk showing only those files with extension name BAK and ordering them by date and time. [5]
- c) Compare two text files (P, Q) in the current directory. Direct those lines that are different on the files to a diskette file (R). Case should be ignored. [4]
- d) Use TWO different methods of obtaining ONLINE help about a particular operating system command such as "defrag". [3]
- e) Create a batch file called UPDATE.BAT in the BATCH sub-directory of the hard disk. When activated, this should ask for a 3-digit number (e.g. 098) and then copy all files with these three digits as the first three characters of the filename from sub-directory ACCOUNTS to a diskette. [5]