



ICM

MARCH 2016

HARDWARE & OPERATING SYSTEMS

Instructions to candidates:

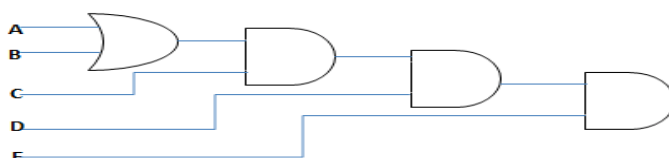
- a) Time allowed: Three hours (plus an extra ten minutes' reading time at the start – do not write anything during this time)
 - b) Answer any FIVE questions
 - c) All questions carry equal marks. Marks for each question are shown in []
 - d) Mark allocation should determine the length of your answer 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
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1. a) A supermarket uses several different input devices to collect data from staff and customers. Describe in detail THREE input devices which might be in use in a supermarket. For EACH device state:
 - the purpose of the device
 - the user (customer, staff or both)
 - the form which the data take
 - how the device reads the data[5 each]
 - b) Explain in detail the purpose of double buffering and how it operates. [5]
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2. a) The manager of a busy office wishes to buy a printer and asks for your advice. The office prints a lot of large documents and would like to occasionally print in colour. They are considering buying either an inkjet printer or a laser printer. Write a report describing the functionality of EACH of these two types of printer. Highlight the advantages and disadvantages that each type will offer. [10]
 - b) The use of assistive technology is important in enabling disabled users to access computers. Name TWO assistive technology devices (input or output) which enable physically disabled users to use a computer. For EACH device explain:
 - the purpose of the device
 - how the device works, referring to any hardware or software elements
 - any issues which may arise in implementing the device[10]
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3. a) For EACH of the data structures STACK and QUEUE:
 - i explain the purpose of the data structure, giving ONE possible use of EACH data structure
 - ii list the basic operations which can be performed on EACH data structure
 - iii describe how EACH data structure might be stored in a computer[10]
 - b) Write a pseudo-code algorithm to insert an element at the front of a linked list. [10]

continued overleaf

4. a) Explain the purpose and function of a parity check, and distinguish between odd and even parity. [2]
 b) Assuming even parity, consider the transfer of the following byte: 1001001. What would be the value of the parity bit? What would the value be if you assumed odd parity? [2]
 c) There are many different types of file. Explain what is meant by EACH of the following file types, and what they would normally hold:
 i Program file
 ii Data file
 iii Parameter file
 iv Document file [8]
 d) Choose TWO modern storage devices which could be used for storing data and transferring data between computers. For EACH device, explain in detail:
 • how it physically stores data
 • the advantages and disadvantages of using the device. [8]

5. Your computer manager has asked you to write a report comparing and contrasting the following TWO operating systems:
 a) Windows
 b) OS X
 Draft the report, covering the following:
 • Functionality: what EACH system does and how it does it
 • Usability: assessment of the user interface of EACH system and the way users can interact with it
 • Security: assessment of how security issues are dealt with in EACH system
 • Applications: typical applications of EACH system [20]

6. a) Derive the Boolean expression for the logic circuit shown below: [6]



- b) Use a truth table to prove $A.(B+C) + A.\sim B.\sim C = A$ (Note \sim represents NOT). [8]
 c) Explain **De Morgan's Law**, using an example to illustrate your answer. [6]
7. a) Explain what is meant by the **Von Neumann architecture**. Use a diagram to illustrate your answer. [8]
 b) One of the limitations of the Von Neumann architecture is known as the Von Neumann bottleneck. Describe what is meant by the **Von Neumann bottleneck**, and give TWO methods for mitigating it. [6]
 c) Explain what is meant by **BIOS**. Describe in detail its purpose and how it is implemented. [4]
 d) What is meant by **UEFI**? [2]
8. a) Write an assembly language program that reads a number n and displays the value $4n + 3$. You can write your program using a real instruction set or pseudo-code. [8]
 b) Describe the function of the following in the fetch-execute cycle.
 i Program counter (PC)
 ii Memory address register (MAR)
 iii Memory data register (MDR)
 iv Instruction register (IR)
 v Control unit (CU)
 vi The data bus [10]
 c) Explain the purpose and function of **cache**. [2]