ICM

JUNE 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) Define the following operating system features, in EACH case explaining the purpose of the feature:
   i Multi-programming
   ii Automatic job scheduling
   iii Spooling
   iv Memory management
   v Virtual memory [3 each]
   b) Explain the purpose of **locking** in a multi-user environment, and how deadlock can be avoided. [5]

2. A LIBRARY uses several different input devices and several different output devices in supporting staff and users who borrow books. Describe in detail TWO input devices and TWO output devices which might be in use in a **library**. For EACH device state:
   - The purpose of the device
   - The user (customer, staff or both)
   - The form which the data takes
   - How the device reads, or outputs, the data [20]

3. a) Explain what is meant by the **Fetch-Execute cycle**. Describe IN DETAIL each stage of the cycle. [10]
   b) Explain the roles of an operating system, and discuss why those roles are important. [10]

4. a) The use of technology is important in enabling visually impaired users to access computers. Name TWO technologies (input or output) which enable visually impaired users to access a computer. For EACH technology explain:
      - the purpose of the technology
      - how the technology works, referring to any hardware or software elements [8]
   b) Explain what is meant by **recursion** and write a pseudo-code programme to calculate n! (Factorial n). [7]
   c) Explain the purpose and operation of a **stack**. [5]

5. The laws of Boolean Algebra are used in the circuit design of computers.
   a) Explain the following laws of Boolean Algebra. In EACH case, use an example to illustrate your answer:
      i Commutative Law
      ii Associative Law
      iii Distributive Law [9]
   b) Explain the purpose of NAND and NOR [4]
   c) Use logic to Change A. (B+~C) to NAND only components. [7]

continued overleaf

6. a) Explain the function and purpose of EACH of the following modern storage device or medium. In each case give ONE advantage offered by that storage device or medium:
   i USB Flash Drive
   ii CD
   iii High Density DVD
   iv The Cloud [12]
   b) Explain what is meant by a **cyclic redundancy check** and how it is used to ensure data integrity. [8]

7. a) Explain the purpose and function of the CPU (Central Processing Unit), describing the main components of the CPU. Draw a diagram of the CPU which shows the main components and use the diagram to illustrate your answer. [12]
   b) Explain the meaning, purpose and function of EACH of the following registers:
   i MAR
   ii MBR [6]
   c) Explain the purpose of an accumulator. [2]

8. a) Explain what is meant by **RISC**, and discuss the advantages it offers. [10]
   b) Mobile devices present new challenges for the design of operating systems. Discuss the main challenges of designing an operating system for a mobile device, making reference to the features of a mobile device. [10]