

## INFORMATION SYSTEMS PRINCIPLES AND NETWORKING

(TWO AND A HALF HOURS ALLOWED)

*You have ten minutes to read through this paper before the start of the examination.*

*Answer a total of FIVE questions.*

*Select at least TWO from section A,  
AND at least TWO from section B.*

*Each question carries 20 marks.*

### SECTION A

1. When an interrupt occurs, an Interrupt Handler (or Interrupt Servicing Routine) takes control. When the Interrupt Handler has completed its work, control is returned to the interrupted program.
  - a. Explain the terms *Interrupt* and *Interrupt Handler*. [5 Marks]
  - b. Explain the advantages of having an interrupt capability in a computer. [4 Marks]
  - c. Describe the hardware events in the processor when an interrupt occurs. [5 Marks]
  - d. Describe the actions carried out by the Interrupt Handler. [6 Marks]
  
2. The magnetic disc drive remains the most useful auxiliary (backing) store device for computer systems. Several techniques are used with magnetic discs to help improve system performance. Explain the purpose and operation of THREE of the following:
  - a. Direct Memory Access.
  - b. Disc Cache.
  - c. Defragmentation.
  - d. Virtual Storage (also called virtual memory). [20 Marks]
  
3. Buffers are needed in many components of computer systems.
  - a. Explain the term *Buffer*. [6 Marks]
  - b. Suggest TWO benefits of fitting a buffer to a printer. [4 Marks]
  - c. A matrix printer operates at 160 characters per second in draft mode and at 60 characters per second in 'near letter quality' (NLQ) mode; it has an 8000 byte buffered interface. A computer transmits a 9120 character text document to the printer at 960 characters per second (9600 baud). By means of a calculation or otherwise, explain the action of the buffer, the likely printing times, and whether any handshaking occurs:
    - (1) when the printer operates in draft mode.
    - (2) when the printer operates in NLQ mode. [10 Marks]

4. The ASCII 7-bit character code became an international standard. However, ASCII 7 proved to have many limitations, and Unicode has been introduced. Unicode is supported by many major software systems such as *Windows* and *Java*.
- Explain briefly how the ASCII 7 character set is organised, distinguishing between legible symbols and control codes. [6 Marks]
  - Describe TWO limitations of ASCII 7. [4 Marks]
  - Explain how the limitations of ASCII 7 were partially overcome using 8-bit codes. [4 Marks]
  - Compare Unicode with ASCII 7; discuss whether Unicode provides a complete solution to coding problems. [6 Marks]
5. Computers are often classified as CISC (Complex Instruction Set Computer) or RISC (Reduced Instruction Set Computer) according to the type of processor. RISC systems were developed partly because of the performance limitations of CISC systems.
- Explain the meaning of the term *Instruction Set*. [3 Marks]
  - With examples, explain your understanding of Complex Instructions and suggest a reason for their use. [6 Marks]
  - Explain some of the performance disadvantages of programs written for CISC systems. [5 Marks]
  - Summarise the main features of RISC systems. [6 Marks]

### SECTION B

6. Modern operating systems (and the Java Virtual Machine) need to manage the problems of concurrency which can arise during multiprogramming and multitasking.
- Explain the term *multiprogramming*. [3 Marks]
  - Explain how problems of concurrency can arise in multiprogramming; (use a diagram and an example such as printer operation to clarify your description). [7 Marks]
  - Describe TWO possible consequences if concurrency problems are not handled correctly. [4 Marks]
  - Describe in detail ONE technique for handling concurrency. Discuss whether your method would be effective both for printer and disc operation. [6 Marks]
7. Computers start by means of a 'bootstrap' process. For a single user system, such as a typical Personal Computer (PC):
- Describe in detail the start-up process from the execution of the bootstrap until the operating system takes control. [8 Marks]
  - Explain how main memory of 256 Mbytes would be organised and allocated. [8 Marks]
  - If the computer failed to start from the main hard disc drive, explain the recovery actions you would take. [4 Marks]
8. Ethernet is a popular bus topology Local Area Network (LAN) which uses the CSMA/CD (carrier sense multiple access with collision detection) access method.
- With the aid of a diagram, explain the term *Bus Topology*. [3 Marks]
  - Suggest TWO problems of transmitting messages on the bus. [4 Marks]
  - Explain the principles of the CSMA/CD access method. [5 Marks]
  - Explain how a long message is organised for transmission along the bus. [5 Marks]
  - How does a computer recognise a message intended for it? [3 Marks]

9. Numbers can be stored either in binary fixed-point form or in binary floating-point form.
- Explain the main features of:
    - Binary fixed-point representation.
    - Binary floating-point representation. [8 Marks]
  - Show how the decimal number 4.8 could be stored in a single 16-bit storage location as:
    - A binary fixed-point number, **and** as:
    - A binary floating-point number. [8 Marks]
  - Explain why computer arithmetic is performed in floating-point form, although fixed-point arithmetic is simpler and quicker. [4 Marks]

10. Negative numbers may be represented as binary digits in the computer by several methods.
- Name THREE methods of representing negative numbers. [3 Marks]
  - For each method, show how the integers +86 and -86 would be represented in an 8-bit (byte) storage format. [6 Marks]
  - With TWO reasons, suggest which of the three methods would be the best. [4 Marks]
  - Using the preferred method, show the steps in performing the following arithmetic in 8-bit binary format:

+86	+86	+86	-86
+6	-6	+86	-86
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+92	+80	+172	-172

Indicate any errors which arise and suggest how they could be detected. [7 Marks]