

THE BRITISH COMPUTER SOCIETY
THE BCS PROFESSIONAL EXAMINATION
Certificate

TECHNOLOGY

18th October 2001, 2.30 p.m.-4.30 p.m.
Time: 2 hours

SECTION A

Answer TWO questions out of FOUR. All questions carry equal marks.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

1. A computer's architecture (now commonly called the ISA or *instruction set architecture*) is made up of a computer's register set, instruction set, and addressing modes.

Describe the essential features of the instruction set architecture of any processor with which you are familiar (you may choose to describe a hypothetical processor). You are not expected to describe the entire instruction set, but you should give examples of the major instruction types (for example, arithmetic instruction, program flow control instructions, etc.). **(30 marks)**

2. The operating system is often called "*the point at which the hardware and software meet*". This statement is particularly true when it is applied to *memory management*.

a) What is the purpose of memory management (and virtual memory)? **(15 marks)**

b) How is memory management implemented in a typical microprocessor system? **(15 marks)**

3. Early personal computers were invariably stand-alone devices. Today's personal computers are often interconnected, either by means of local area networks or via the Internet.

a) Explain how a PC can be connected to the Internet via the public switched telephone network using a modem. Describe the way in which a modem works and the facilities it offers. Give the characteristics of a modern modem. **(15 marks)**

b) Data transmission is inherently error prone (particularly over the public switched telephone system). Briefly describe how a computer's hardware and software is able to reliably transmit information across such a network. **(8 marks)**

c) Not very long ago, the telephone modem that connects a computer to the Internet via the telephone system offered the domestic computer user the only practical means of communicating with the Internet. Commercial and business users were, of course, able to employ very expensive leased lines or connect directly to very high-speed networks.

In recent years, domestic computer users have been able to connect to the Internet at higher speeds than those provided by traditional telephone modems. Describe some of the techniques that give domestic computer users a higher-speed access to the Internet. **(7 marks)**

[Turn over

4. All computers have to provide an input/output mechanism that allows information from the external world to be read into the computer and information from the computer to be sent to the external world.

- a) There are three basic strategies for dealing with I/O transactions: polled or program-driven I/O, interrupt-driven I/O, and direct memory access (DMA).

Briefly describe how each of these I/O mechanisms operates and compare and contrast each of these three mechanisms in terms of their efficiency and cost of implementation. **(15 marks)**

- b) I/O transactions may take place in one of two ways: *synchronously* or *asynchronously*. These modes are also called *open-loop* and *closed-loop*, respectively. With the aid of timing diagrams, compare and contrast these two ways of controlling the flow of information in to or out of a computer. **(10 marks)**

- c) The two most important parameters of an I/O system are its *bandwidth* and its *latency*. Define the meaning of these two terms and explain their significance in evaluating the performance of an I/O system. **(5 marks)**

NOW PLEASE ANSWER QUESTIONS FROM SECTION B OVERLEAF →

SECTION B

Answer FIVE questions out of EIGHT. All questions carry equal marks.

*The marks given in brackets are **indicative** of the weight to each part of the question.*

5. a) Name any two *input* devices and any *output* devices on a computer system. (4 marks)
- b) State the purpose of the *data bus*, *address bus*, and *control bus*. (6 marks)
- c) A computer address bus comprises of 20 lines. What is the maximum amount of *addressable memory*? (2 marks)
6. Briefly describe the function of the following digital devices:
- a) Shift register (4 marks)
- b) Half adder (4 marks)
- c) Counter (4 marks)
7. A 2-input multiplexer is a circuit which steers one of the inputs to the single output, depending on the value on a third (control) input.
- a) Write the truth table for the multiplexer. (4 marks)
- b) Derive a simplified function for the multiplexer. (4 marks)
- c) Draw the circuit implementation using AND, OR and NOT gates. (4 marks)
8. a) Convert the 7-bit binary unsigned number 1011101 to its decimal equivalent. (4 marks)
- b) Convert the negative decimal number –113 to its 2s-compliment binary equivalent. (4 marks)
- c) Give the sum of the above two numbers as a 2s-compliment binary number. (4 marks)
9. a) Define what is meant by the *addressing mode* of a microprocessor. (3 marks)
- b) Describe each of the addressing modes: *immediate*, *indirect*, *index*, *register indirect*. (9 marks)
10. a) Describe and give illustrations of *bus*, *ring* and *star* network topologies. (6 marks)
- b) Give one advantage and one disadvantage of each of the above topologies. (6 marks)

11. a) Differentiate between an *analogue* signal and a *digital* signal. Give examples. **(4 marks)**

b) Define, and give an example of, each of the following: *primary memory*, *secondary memory*, and *cache memory*. For each type of memory, state whether the memory is *volatile* or *non-volatile*. **(8 marks)**

12. Briefly describe the following Internet-related terms and state their significance.

a) Domain Name Server (DNS) **(3 marks)**

b) Uniform Resource Locator (URL) **(3 marks)**

c) IP address **(3 marks)**

d) Gateway **(3 marks)**