THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION
Certificate

TECHNOLOGY

17th October 2002, 2.30 p.m.-4.30 p.m.
Time: TWO hours.

SECTION A

Answer TWO questions out of FOUR. Each question carries 30 marks.

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

1. The von Neumann computer consists of a program and data memory, registers, buses, and functional units (e.g., adders, shifters, ALUs) and operates in a two-cycle, fetch/execute mode.

    a) Briefly explain the contributions made to a computer by the memory, the registers, the functional units, and the buses. **(10 marks)**

    b) By means of suitable diagrams, explain the meaning of the fetch/execute cycle and show how an instruction is read from memory and executed. Your answer should show the sequence of actions and the flow of address and data information during the reading and execution of an instruction. Your answer does not have to cover advanced topics such as pipelining. **(20 marks)**

2. Computers store information in their memories. However, a modern PC or workstation may have eight or more individual memory systems using as many different memory technologies.

    a) Why does a computer have so many different memory systems? **(10 marks)**

    b) What are the major memory technologies (i.e., memory construction, fabrication, and operating principles) found in a typical modern state-of-the art PC? Briefly describe the characteristics of each technology. **(10 marks)**

    c) Describe the characteristics (capacity, price, access time, etc.) of the various memory subsystems found in a modern PC. **(10 marks)**

3. The British Computer Society (like the ACS, IEEE CS, and the ACM) has published a code of conduct (i.e., a set of rules and guidelines) dealing with the ethical considerations concerning computing professionals.

    It could be argued that ethical considerations have never been as important as they are to today's computer designers. For example, the CD writer and scanner introduce issues of copyright, the modem introduces issues of hacking, and removable storage introduces issues of computer viruses.

    Write an essay on the ethical considerations of computer design and operation.

    You are expected to explain how the various elements of a computer raise ethical considerations, what these considerations are, and to briefly state how they affect the professional life of a computing professional. You may make reference to the BCS's code of conduct but you are not expected to discuss the code of conduct in depth. **(30 marks)**

[Turn over

4. Modern peripherals, faster processors, and low-cost mass storage have led to the growth in **multimedia** applications of the computer.

   a)   What, in the context of home computing or the small business is the meaning of the term "multimedia"?

   (5 marks)

   b)   Specifically, what developments in computer technology (CPU, memory, and peripherals) over the last few years have lead to so much progress in multimedia applications? **(9 marks)**

   c)   In what ways is multimedia technology affecting the small home/office and the small business computer users?

   (9 marks)

   d)   What developments in multimedia technology are likely to appear over the next two years and how do you think they will affect the computer user? **(7 marks)**

SECTION B

Answer FIVE questions out of EIGHT. Each question carries 12 marks.

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

5. *a)*   In digital logic, state the difference between combinational and sequential circuits. **(4 marks)**

   b)   Describe the functions of the following digital devices. **(8 marks)**
   - *i)*   Multiplexer
   - *ii)*   Decoder
   - *iii)*   Shift Register
   - *iv)*   Counter

6. A Boolean function is given by:

$$F = \overline{A}\overline{B}\overline{C}\overline{D} + \overline{A}\overline{B}C\overline{D} + A\overline{B}C\overline{D} + A\overline{B}C\overline{D} + \overline{A}B\overline{C}D + \overline{A}BCD + AB\overline{C}D + ABCD$$

   a)   Reduce the function to its simplest form. **(8 marks)**
   b)   Draw the reduced circuit implementation of the function using logic gates. **(4 marks)**

7. *a)*   Describe the data access modes in microprocessor addressing. Give an example in each case, showing clearly memory and register access cycles. **(12 marks)**
   - *i)*   Direct Addressing
   - *ii)*   Indexed Addressing
   - *iii)*   Indirect Addressing

8. Briefly describe the main distinctions between the following:
   a) short-distance and long-distance data transmission.
   b) point-to-point and shared medium computer networks.
   c) synchronous and asynchronous data transmission
   d) serial and parallel data transmission   **(12 marks)**

9. *a)* A stack can be used to support the subroutine call/return mechanism and the passing of parameters. Explain with the use of examples how a stack works.   **(6 marks)**

   b) Briefly describe the operation of virtual memory.   **(6 marks)**

10. The following are pairs of terminologies that are commonly used in similar circumstances. Define and differentiate each pair of terminologies:
    a) Internet, and World Wide Web
    b) Domain Name, and Uniform Resource Locator
    c) IP address, and Internet Address   **(12 marks)**

11. *a)* Describe what is meant by Direct Memory Access (DMA) and state the benefits of DMA.   **(8 marks)**
    b) Define what is meant by Address(able) Space and show how it is related to the size of the Address Bus.
                                                                                   (4 marks)

12. *a)* Describe the ASCII character representation format.   **(2 marks)**
    b) Convert the decimal number 2002 to binary, octal and hexadecimal formats.   **(6 marks)**
    c) Convert the numbers -41 and 37 to two's compliment binary and find the two's compliment form of the two numbers.   **(4 marks)**