The British Computer Society
1 Sanford Street
Swindon
Wiltshire
United Kingdom
SN1 1HJ

THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION
Certificate

TECHNOLOGY

10th April 2000 - 2:30p.m. - 4:30p.m.
Time: TWO hours

SECTION A

Answer TWO questions out of FOUR from this section. All questions carry equal marks.

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

1. *a)* Draw the structure (i.e. internal organisation) of a simple central processing unit that is capable of executing instructions. Your diagram should include registers, buses, and the ALU. The system you describe may correspond to a specific machine or you may describe a generic computer. **(10 marks)**

b) For the computer whose internal structure you have drawn, explain the purpose and function of each component. **(5 marks)**

c) Explain the sequence of actions that takes place when an instruction is read from memory and executed. **(5 marks)**

d) Discuss the limitations of the simple machine you have described and explain how modern computer manufacturers are overcoming the limitations of the simple "von Neumann computer". **(10 marks)**

2. It can be argued that the success of the personal computer revolution owes as much to the development of versatile, powerful, low-cost peripherals such as CD-ROMs as to developments in computer architecture and semiconductor technology.

Discuss how progress in the development of peripherals has contributed to the success of:

i) The desktop personal workstation
ii) The portable computer (both the laptop and notebook).

Your answer should include the characteristics and performance of several modern peripherals. **(30 marks)**

3. The world of computer communications is a world of *standards* and *protocols*; for example, RS232, V90, HDLC, TCP/IP, X25.

a) What, in the context of computer communications, are standards and protocols and why are they so important? **(8 marks)**

b) The ISO 7-level model for "Open Systems Interconnection" provides a framework for developing communications protocols. For example, this model includes a "data link layer" and a "network layer". Explain why such a *layered structure* has been devised. **(8 marks)**

c) The growth in the use of the Internet in the late 1990s has been exponential and has surpassed the wildest expectations of those who created the Internet.

The Internet has now reached the level of a mature technology. However, its explosive growth has brought with it problems; both technological and social (i.e. economic, ethical, political). Discuss how the Internet's growth and applications are currently being limited and suggest possible solutions. **(14 marks)**

[Turn over

4. The operating system is sometimes described as "the point at which hardware and software meet". Discuss the truth, or otherwise, of this statement with reference to:

a) The role of interrupts (i.e. exceptions). **(15 marks)**
b) Memory management. **(15 marks)**

SECTION B

Answer FIVE questions out of EIGHT from this section. All questions carry equal marks.

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

5. Briefly describe the function of the following digital devices:

a) Multiplexer **(4 marks)**
b) Shift Register **(4 marks)**
c) Counter **(4 marks)**

6. A Boolean function F is given by:

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

Using a simplification method of your choice, show that the function is equivalent to

$$F = \bar{B}\bar{D} + BD$$

Draw an implementation of the function using logic gates. **(12 marks)**

7. Describe the primary use of each of the following memory devices; include in your answer whether the device is a volatile or non-volatile memory.

a) Cache **(3 marks)**
b) Registers **(3 marks)**
c) RAM **(3 marks)**
d) CD-ROM **(3 marks)**

8. *a)* State the main distinction between short-distance and long-distance data transmission. **(2 marks)**

b) Give one advantage and one disadvantage of point-to-point, and shared medium computer networks. **(4 marks)**

c) Draw diagrams of **TWO** different network topologies giving an advantage and a disadvantage of each. **(6 marks)**

9. *a)* Apart from memory management, state **FOUR** functions of an operating system. **(4 marks)**

b) Define virtual memory and describe its operation. **(8 marks)**

10. Define the following terminology

a) Internet and World Wide Web **(4 marks)**
b) Hyper Text Mark-up Language **(4 marks)**
c) Uniform Resource Locator **(4 marks)**

11. *a)* Give reasons why I/O interfaces are used to connect devices to computers. **(6 marks)**

b) Define what is meant by Direct Memory Access and describe its operation. **(6 marks)**

12 *a)* Convert 12.75 to a normalised binary number using 1 sign bit, 6-bit exponent, and 16-bit mantissa. **(4 marks)**

b) Convert the decimal number 2766 to hexadecimal. **(4 marks)**

d) Carry out the sum of the decimal numbers –41 and +37 using 8-bit two's complement arithmetic. **(4 marks)**