The Open University of Sri Lanka
Department of Electrical & Computer Engineering

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ECX3233 **Communications & Information Technology**
Final Examination 2006/2007 (closed book)

Date : March 25th, 2007 Time : 1330-1630

*This question paper consists of eight questions in four sections. Answer any **five** questions, including **at least one** from each section. All questions carry equal marks. Marks for each part are given in brackets.*

Section A

1. As you know the computer is a machine capable of diverse tasks. But you need appropriate hardware and software to accomplish each task. Think of one professional task you would like to do with a computer.

   a. Describe the task your task in some detail. (4)
   b. Based on your requirements, write the specifications for a computer system including the appropriate specifications for the basic unit, necessary peripheral devices, and the appropriate software. (6)
   c. Choose five items from among the hardware most important for your task. Describe briefly how each item functions, and why it is important for your task. (10)

2. An important part of the computer functioning is its memory. The right amount of memory is essential for optimal functioning of the system.

   a. What is the purpose of the memory in a computer system? (2)
   b. What are the two main types of memory? Why do we use two types of memory? (6)
   c. On hand a simple example, show how basic READ and WRITE operations are carried out by a microprocessor unit on a memory location. (6)
   d. Describe briefly three types of RAM technologies. (6)

Section B

3. The computer depends on binary arithmetic, but we also use hex and octal numbers. Perform the following operations. Marks will be awarded only when all relevant intermediate steps are shown.

   Convert the following values to decimal form:
   a. 10010011_2 b. $1A.D8_{16}$ (2)

   Convert the following to octal form:
   c. 10010010_2 d. 225.25_{10} (3)

   Find the value of **b** for
   e. $853_b = 1420_{10}$ (3)

   Perform the following binary additions:
   f. $10001_2 + 100111112$ g. $111100.001_2 + 11111.111_2$ (3)

   Perform the following binary multiplications:
   h. $111001_2 \times 1011_2$ i. $110.11_2 \times 1111.1_2$ (4)

   Perform the following subtraction in two's complement form:
   j. $5_{10} - 7_{10}$ (5)

4. Writing of large and complex programmes without errors posed a challenge that was met with different solutions.

a. Describe briefly structured programming. (2)

b. What are the two main structured programming methodologies? Describe, and compare them. (6)

c. Describe different symbols used in flowcharts. (4)

d. Using a flowchart, describe an algorithm to arrange five integers in descending order. (8)

Section C

5. The **Sundara Salu** Textile Company has five computers that they want to connect together. You, as the new IT manager is to oversee the project.

a. List the advantages and disadvantages of connecting the computers together. (5)

b. What are the main additional software and hardware that you may need? (5)

Now the **Sundara Salu** Textile Company has made good progress, and the number of computers has grown to twenty-five.

c. You are requested to upgrade the computer web. What are the changes that you propose? (5)

The **Sundara Salu** Textile Company has expanded rapidly, winning number of international contracts. There are four factories located in different free-trade-zones. Your system has to now incorporate a connection between these factories, as well as international transactions.

d. You may assume an expanded budget, and propose suitable changes to the network. (5)

For each part you should briefly justify your proposed hardware, software, topologies, security measures etc.

6. LANs are usually baseband networks. They operate according to a set of rules called the medium access method (protocols).

a. Name the two most popular access methods in use. (2)

b. List advantage and disadvantages of the each method. (6)

c. Describe the exchange of data between two computers operating within each access method separately. (12)

Section D

Read following text when answering questions of this section:

An amateur experimenter is testing the ability of sending a signal to fairly distant place. A simple transmitter is used to minimize the cost. A pre amplifier, a modulator, a power amplifier, and an antenna are connected in that order. The pre amplifier produces 100 mV output when a 5 kHz test signal is applied at its input. Expected frequency of the transmission is 100 kHz.

A radio link which is setup by an isotropic antenna (antennas which radiates equally in all directions) is used for this purpose. Experimenter found that the power density at a given distance r is obeying the inverse square law and is proportional to $\frac{1}{4\pi r^2}$

7.

a. State the most suitable analogue modulation technique for this application. (2)

b. Amplitude of the un-modulated carrier is 200mV. For the above mentioned modulating scheme, sketch the output waveform of the modulator with important values when the test signal is applied to the modulator through the pre amplifier. (8)

c. Find input signal power to the power amplifier, if the input impedance of the power amplifier is 100Ω. (6)

d. With aid of a sketch explain how the original signal can be recovered from modulated signal. (4)

8.

a. List advantage(s)/disadvantage(s) of using a radio link for communication purposes. (3)

b. Derive an expression to the received power density P (W/m^2) at d (m) distance away from a transmitting antenna that radiating Pt (W) amount of power. (6)

c. If the gain of the receiving antenna is 36 dB, determine the minimum transmitting power level to ensure 2mW power reception at a receiver connected to the antenna and located 1.5 km distance from the transmitter. (8)

d. State two ways of reducing transmitting power while ensuring minimum receiver power. (3)