THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY (level 04)
ECD 2212
COMPUTER ARCHITECTURE
FINAL EXAMINATION 2005

DATE : 29th APRIL 2006 **TIME : 9.30 – 12.30 hours**

INSTRUCTIONS TO CANDIDATES

Answer **FIVE** questions.

NOTE: When you have to write any assembly language program for your answer, you must include appropriate comments where necessary. **Full marks will be given to correct programs, with comments.**

Refer attached data sheets of the 8051 microcontroller, when answering questions in this paper

1. (a) Using the data pointer (DPTR) and R0 (or R1) as pointers to the source and destination bytes, write an assembly language program to transfer 1000 bytes from location 0280 h to location FF00 h in the external RAM.

   (b) In a data block transfer routine, determine whether to start from the first byte or the last byte of the data block; in the situation when source and destination blocks
   - (i) overlap
   - (ii) does not overlap

2. (a) To illustrate the Boolean (bit-addressable) capabilities of the microcontroller a student wrote the following program:

```
org 8000h
setb p1.4
loop: mov c, p1.4
      mov p1.0, c
      sjmp loop
```

[note: c is the carry bit]

Prior to running the program s/he connected an LED to p1.0 and a push-button to p1.4. Her/his intention was to light the LED when the push-button is pressed. Comment about the correctness of the program and in case if it does not work, explain how it should be modified.

(b) Modify the program discussed in (a) so that the LED will light when the push-button is released and will off when the push-button is pressed.

3. The following program was written by a student to flash an LED connected to bit 0 of port 1.

```
LED_flag equ 0f h
org 7000h
start:
        jb LED_flag, LED_off
        setb LED_flag
        clr p1.0
        mov r1, #0h
        mov r2, #0h

wait_1:
        djnz r1, wait_1
        djnz r2, wait_1
        sjmp start

LED_off:
        clr LED_flag
        setb p1.0
        mov r1, #0h
        mov r2, #0h

wait_2:
        djnz r1, wait_2
        djnz r2, wait_2
        ljmp start
```

(a) Modify and rewrite the program in an efficient manner, so that several lines of code is not repeated.

(b) If the clock frequency is 12 MHz calculate the time in which the LED is either on or off.

(c) What are the advantages/disadvantages of using software timing routines instead of micro-controller timers to obtain the required delay?

4. During an experiment, it is required to count the number of pulses generated during a period of 100 ms. Using the two timers of the microcontroller one as a timer to generate the required time period and the other as the counter, write an assembly language program to perform this operation. Using a diagram, show how the input signal is connected to the micro-controller. If this experiment is to be performed correctly, what can you say about the frequencies of the incoming pulses and that of the microcontroller? [Assume a digital input]

5. Instead of the timer, using software delay loops write an assembly language program to implement the situation considered in question 4.

6. In a certain experiment a student has to find out the time a particular LED is on, using one of the timers of the micro-controller. In this situation, the particular LED is on when a push-button is continuously pressed (i.e. s/he has to continuously press the push-button to keep the LED on) and when the push-button is released the LED is off. Using a diagram illustrate how the LED and the push-button is connected to the microcontroller in this experiment and write an assembly language program to perform the operation. [Hint: use either GATE0 or GATE1 of the TMOD SFR]

7. Write the flash LED program considered in question (3) as an interrupt service routine.