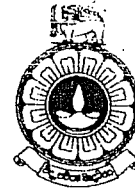


**THE OPEN UNIVERSITY OF SRI LANKA**  
**DIPLOMA IN TECHNOLOGY (level 04)**  
**ECD 2212**  
**COMPUTER ARCHITECTURE**  
**FINAL EXAMINATION 2005**



035

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**DATE : 29<sup>th</sup> APRIL 2006**

**TIME : 9.30 – 12.30 hours**

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**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.