950

Ollscoil na hÉireann, Gaillimh

National University of Ireland, Galway

Semester II Examinations 2004 / 2005

Exam Code(s)	2BN121, 2BP121
Exam(s)	Second Year Electronic Engineering Second Year Electronic & Computer Engineering
Module Code(s)	EE206 ii
Module(s)	Microprocessor Systems II
Paper No.	1
Repeat Paper	
External Examiner(s)	Professor S. McLaughlin
Internal Examiner(s)	Professor D. J. Wilcox Dr. F. Morgan
Instructions:	Answer any **three** questions. All questions carry equal marks *Candidates should note that marks may be lost if answers are not presented in a neat and legible format* *Where applicable, include rough-work calculations to obtain full marks for questions*
Duration	2 hrs
No. of Pages	5
Department(s)	Electronic Engineering
Course Co-ordinator(s)	

Requirements:

MCQ	
Handout	ADuC831 Microconverter data sheet (ADuC831.pdf) pp 2,18-24,55-58 ADuC831 Microconverter Quick Reference Guide (2 pages) HD44780 instruction set (2 pages)
Statistical Tables	
Graph Paper	
Log Graph Paper	
Other Material	

Q1.

a An ADuC831 uses an external crystal with periodic frequency of 11.059MHz. How many counts of the internal timer (in 16-bit mode) are required to measure a time interval of 50msec ? **2 marks**

(a) 921, 583 counts (b) 92,158 counts (c) 46,079 counts
(d) 46,907 counts (e) 65535 counts (f) none of the above

b An ADuC831 uses an external crystal with periodic frequency of 11.059MHz. The maximum time interval possible using a 16-bit timer is nearest to the following time : **2 marks**

(a) 11msec (b) 46 msec (c) 66 msec
(d) 71msec (e) 17 msec (f) none of the above

c Within the same priority level, which of the following interrupt sources has the highest priority ?

(a) Serial UART Interrupt (b) I2C Interrupt (c) ADC Interrupt **1 mark**
(d) External Interrupt 0 (e) Timer Interrupt 0 (f) Power Supply Interrupt

d What type of operation are SUBB and DEC instructions ? **1 mark**

(a) Arithmetic (b) Data (c) Boolean
(d) Logical (e) Branch & control (f) none of the above

e Write a modular 8031 assembly program which uses internal timer 0 to trigger execution of subroutine **SUBA** every second. Assume oscillator frequency of 11.059MHz.
Discuss the errors induced by the timer ISR and any other sources of error. **5 marks**

f A 24-hour timer has digit variable values **hr10, hr1, min10, min1, sec10, sec1** stored in data memory locations **35h → 30h** respectively. Write an 8031 assembly program subroutine **SUBA**, which updates the current 24-hour time (assume that subroutine SUBA is triggered every second). Listing 2.1 includes a pseudo-code description of the timer function (may be used as aid). **9marks**

```
if sec1 = 9 then
    sec1=0
    if sec10 = 5 then
       sec10=0
       if min1 = 9 then
          min1=0
          if min10 = 5 then
            min10=0
            if hr10 = 2 then          ; if hr10 = 2, allow only hr1 values 0, 1, 2, 3
               if hr1 = 3 then        ;time => 00:00:00
                  hr1 = 0
                  hr10=0 ,$
               else                   ;hr1_LT3
                  increment hr1
               end if
            else                      ;hr10_LT2  (hr10 = 0 or 1, allow hr1 values 0 -> 9)
               if hr1 = 9 then
                  hr1=0
                  increment hr10
               else                   ;hr1_LT9
                  increment hr1
               end if
            end if
          else                        ;min10_LT5
            increment min10
          end if
       else                           ;min1_LT9
          increment min1
       end if
    else                              ;sec10_LT5
       increment sec10
    end if
else                                  ;sec1_LT9
    increment sec1
end if
```

Listing 2.1 : Pseudo-code description of a 24-hr timer function.

Q2.

a Which of the following modes does the ADuC831 UART NOT support ? **2 marks**

(a) 8 bit data, variable baud rate
(b) 8 bit data, fixed baud rate
(c) 9 bit data, variable baud rate
(d) 9 bit data, fixed baud rate
(e) 8 bit data, synchronous serial shift
(f) all of the above

b What is the least significant bit resolution for a 12-bit ADC using $V_{ref} = 2.5V$? **2 marks**

(a) 1.6384mV (b) 2.26mV (c) 0.61mV
(d) 2.5V (e) 0.244mV (f) none of the above

c ADC channel 1 input uses ADuC831 pin **number** **1 mark**

(a) 44 (b) 2 (c) 1
(d) 19 (e) 8 (f) none of the above

d How many input channels, and at what resolution can the A/D converter in the ADuC831 support ?

(a) 6 channels @ 10 bits resolution
(b) 8 channels @ 10 bits resolution
(c) 8 channels @ 12 bits resolution
(d) 8 channels @ 16 bits resolution
(e) all of the above
(f) none of the above **1 mark**

e Draw a detailed block diagram representation of a successive approximation ADC. Describe the operation of each section and all signals/buses. **4 marks**

f Define ADCCON1, ADCCON2, and ADCCON3 SFR bit settings to provide single sampling and conversion of the ADuC831 on-chip temperature sensor. **7 marks**

g Write assembly code routine **TEST** to set the carry flag if any or all bits 7 to 4 of the Accumulator are set (other bits of ACC are don't care) **2 marks**

h Modify subroutine **TEST** to set the carry flag if any or all bits 7 to 4 of the Accumulator are clear (other bits of ACC are don't care) **1 mark**

Q3.

a A serial interface supports 8-bit data, start bit and stop bit at 9600 baud. How many characters per second transfer can this serial link support ? **2 marks**

(a) 9600 (b) 10 (c) 960
(d) 12 (e) 4096 (f) none of the above

b Why is serial communications method known as **asynchronous communication** **2 marks**

c Full duplex communication defines **1 mark**

(a) queued 2-way communication (b) concurrent 2-way communication
(c) interleaved communication on single wire (d) multi-level voltage communication
(d) 12-bit binary communication (e) none of the above

d What is the default Stack Pointer bit setting ? **1 mark**

(a) 30h (b) 20h (c) 07h
(d) 7Fh (e) 00h (f) 08h

e List an advantage and disadvantage of the use of serial port communication **2 marks**

f Define T3CON SFR bit settings to provide 9600 baud support using 8031 timer 3 **2 marks**

g Define SCON SFR bit settings to configure the serial port for transmit only **3 marks**

h Write 8051 assembly code to transmit a single byte, stored in ACC, on the serial port. Include comments explaining the code used **4 marks**

i Explain two commonly used methods for converting a BCD value to its ASCII equivalent **3 marks**

Q4.

a A principal use of the DB instruction is to : **2 marks**

(a) define a look-up table (b) invert a bit value (c) decrement accumulator B

(d) place data on a bus (e) set interrupt vector address (f) none of the above

b How many core clock cycles does the ADuC831 require to execute the INC DPTR instruction ?

(a) one cycle (b) two cycles (c) four cycles

(d) twelve cycles (e) twenty-four cycles (f) none of the above **1 mark**

c What type of operation are JZ and RET instructions ? **1 mark**

(a) Arithmetic (b) Data (c) Boolean

(d) Logical (e) Branch & control (f) none of the above

d The MOVX assembly instruction performs the following data move : **1 mark**

(a) an extended 16-bit data word (b) a byte to/from external data memory

(c) a byte to/from an I/O port (d) a byte to D/A converter

(e) a byte to/from UART (f) none of the above

e How many levels of interrupt priority does the ADuC831 support ? **1 mark**

(a) 2 levels of priority (b) 4 levels of priority (c) 8 levels of priority

(d) 16 levels of priority (e) 255 level of priority (f) none of the above

f Describe the electrical connections used to interface the ADuC831 with a Hitachi HD47780 LCD. What functions do each of the control signals perform ? Describe how data can be written to the LCD and sketch the write access timing diagram for the LCD. Why might you want to read data from the LCD ? **4 marks**

For question parts g, h, i, assume that default LCD control signal values are RS=0, RW=0 & EN=1 and that an LCD 8-bit interface is used. Include comments in code and list any assumptions made. Use a modular code structure.

g Write an 8051 assembly code subroutine which transfers a single control byte to the LCD and then waits for the LCD to complete this task (using LCD busy flag polling). Assume that the LCD has already been initialised (including font & cursor position) **4 marks**

h What is the advantage of using LCD busy flag polling method ? **1 mark**

i Write an 8051 assembly code subroutine which transfers the data character string "Summer 2005" to the LCD. Use the DB directive to define the string. Include handling of a string delimiter character. **5 marks**