

UNC Charlotte–ECGR4101/5101-Midterm Exam –10/12/05

You are permitted 50 minutes to take this test, no more. This is an open book/open notes test. You are allowed the following items for the test: calculators, books, notes, homework, labs, pencils and erasers. You are not permitted to have any of the following on your desk during the test: computer, cell phone, or other electronic assistance. Failure to abide by this policy will result in a zero for the test and a visit to the UNC Charlotte honor board. Put your answers on the answer sheet - use only that paper. Turn in the answer sheet at the end of the test. You may keep this test booklet.

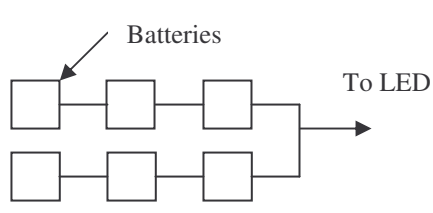
Multiple Choice - Questions 1-15: Each of these multiple choice questions is worth 4 points for a correct answer, 0 points for an incorrect answer. Circle your answers on the bubble sheet.

- 1) According to the ECGR4101 programming standards, which of the following should be included in the header of a subroutine?
 - a. Subroutine name
 - b. Assumptions
 - c. Inputs/Outputs
 - d. Interfaces
 - e. All of the above**

- 2) Which of the following does the ncrct0.a30 C start-up module NOT do?
 - a. Load static variables with their initialized values
 - b. Initialize the stack pointer
 - c. Set all digital general purpose I/Os to inputs**
 - d. Set up the variable interrupt vector table
 - e. Define the location of ROM and RAM

- 3) What is the one thing that all of our code should have?
 - a. Your name and file name in comments at the top of every file.**
 - b. Twelve subroutine.
 - c. a while(1) loop in every subroutine
 - d. a function call to the skip_lcd.c file.
 - e. None of the above

- 4) You have several 650mAh 1.5V batteries and a LED that has an average drain of 3.5mA at 4.5V. If you had the following battery configuration how long would the LED stay lit?



Batteries

To LED

 - a. 557.1 hours
 - b. 185.7 hours
 - c. 371.4 hours**
 - d. 209.3 hours
 - e. 191.4 hours

- 5) What is the number of address bits required to address any byte in a memory that contains 4096 bytes?
 - a. 2
 - b. 8
 - c. 12**
 - d. 16
 - e. 20

- 6) How many bits does program counter register consist of?
 - a. 20 bit**
 - b. 16 bit
 - c. 8 bit
 - d. 10 bit
 - e. 12 bit

- 7) In C, the term *volatile* is applied to a variable in order to:
- Tell the compiler that a variable's value may change due to forces other than the program in which the variable appears.**
 - Tell the compiler that a variable's value is not constant
 - Mark that a variable may be optimized out of the code when unused
 - Tell the compiler to store the variable's value in "volatile" ram instead of "non-volatile" ram such as an EEPROM
 - None of the above
- 8) Use the following C code for questions 9-12: **(Answer for 8: "a" – a freebie!)**

```
void main() {  
  
    char bird[10]; /* bird starts at memory location 0810H */  
    char c1, c2;  
    int i;  
    char *ptr1;  
  
    i=2;  
    strcpy(bird, "robin");  
    ptr1=&bird[1];  
    ptr1=ptr1+i;  
    c1=*ptr1;  
    c2=bird[0];  
}
```

- 9) What is the memory location of c1?
- 0800H
 - 0810H
 - 0811H
 - 0820H
 - None of the above**
- 10) What is the value of ptr1 after the program has run?
- 0810H
 - 0811H
 - 0812H
 - 0813H
 - None of the above

Ans. d

- 11) What is the value of c1 after the program has run?
- r
 - o
 - b
 - i**
 - None of the above
- 12) What is the value of c2 after the program has run?
- null
 - Can't tell from the program.
 - 'r'**
 - 'o'
 - None of the above

- 13) What will happen if you try to write to an array element larger than your array?
- An error will be reported
 - The program won't compile
 - Nothing.
 - You don't know, but it will most likely be bad.**
 - The array will redefine itself bigger.

- 14) What is the total address space for our class microcontroller?
- 31 kbytes
 - 384 kbytes
 - 415 kbytes
 - 419 kbytes
 - 1024 kbytes**

- 15) According to the assembly code to the right, what does it perform in C language?

- While loop**
- If-Else statement
- Switch statement
- For loop**
- None of the above

```

mov.w #0000H, -6[FB]
L7:
cmp.w #000aH, -6[FB]
jge L8
add.w #0001H, -6[FB]
jmp L7
L8: ...

```

Note: could be either a or d!

Written Answer

- 16) What area of RAM is available for the user program on the SKP30262 board, assuming the monitor program is still used? List the range of addresses and exact size in bytes (not k bytes). (5 points)

Ans. Range: 0x400-0x07F7F

31616 Bytes

- 17) Given the following information of a particular analog to digital converter, determine the value of the digitally represented voltage and the step size of the converter. (10 points)

- The device is an 10-bit ADC with a reference voltage of $v_{ref+}=5$ volts, $v_{ref-} = 0v$.
- The digital representation is 0001 0010.

**Ans. Step Size = $5v/1024$
=4.88Mv**

**Voltage represented = $18*4.88mV$
=0.088V**

- 18) Imagine you have an embedded system that uses your SKP board. The system will:

- Req. 1: Use C programming language
- Req. 2: Use the `skp_bsp.h` file provided, especially the Macros.
- Req. 3: Use the other standard `.A30`, `.H`, and `.INC` files
- Req. 4: Sent the processor to always read the thermistor value with the ADC, 8-bits
- Req. 5: Poll SW1. When it is pressed, light all lights.
- Req. 6: Also when SW1 is pressed, read the 8-bit thermistor value from the ADC register and write the lower 8 bits to an unused 8-bit port on the SKP (use the hardware schematic to help).
- Req. 7: Make the written code as short as possible, using the provided macros where possible. You only need the main subroutine.
- Req. 8: Include a few comments.

Part a) Write the pseudocode which implements the above functionality (30 points)

Part b) Write the C code which implements the above functionality (45 points)

Ans.

```
a) Pseudo code
// Name: James Conrad - 10/17/05
// File: main.c
// Function: when sw1 is pressed, turn the LEDs on and write
// the ADC value to the port.
// Inputs: sw1, ADC;   Outputs: LEDs, Port0
Setup a Port
Setup a switch
Setup a LEDs
Setup ADC
While (1) {
    If (! sw1) {
        Turn on the LEDs
        Read ADC
        Mask lower 8 bits
        Write lower char to the port
    }
}
```

b) C-code:

```
// Name: James Conrad - 10/17/05
// File: main.c
// Function: when sw1 is pressed, turn the LEDs on and write
// the ADC value to the port.
// Inputs: sw1, ADC;   Outputs: LEDs, Port0

# include skp_bsp.h
void main (void){
    ENABLE_SWITHCES
    ENABLE_LEDs
    pd0= (unsigned char) 0Xff;
    adcon1=0x28;    // perform repeated A/D conversions,
    adcon2=0x01;    // read data when needed
    adcon0=0xC8;    // <- start measuring!
    while (1){
        if (!sw1){
            LED(GRN_LED, LED_ON);
            LED(YLW_LED, LED_ON);
            LED(REDE_LED, LED_ON);

            P0=(unsigned char) ad0&0xff;
        }
    }
}
```