

# UNC Charlotte – Fall 2004 - Exam 1 - September 24, 2004

Name: \_\_\_\_\_ Solution\_\_\_\_\_ Student ID: \_\_\_\_\_ Solution @uncc.edu

Question	1-5	6-10	11	Total
Score	25/25	41/40	85/85	151/150

**Multiple Choice - Questions 1-5: Each of these multiple choice questions is worth 4 points for a correct answer, 0 points for an incorrect answer. Circle your answers on this exam booklet. Multiple circles will be marked as incorrect.**

- 1) Which of the following can be done with a single LC-3 instruction?
  - a. **Set a register to zero.**
  - b. Set a memory location to zero.
  - c. Rotate a register's value to the left by one bit.
  - d. Any of the above.
  - e. None of the above.
  
- 2) While running the LC-3 simulator, in debug mode, one can cause execution of one or more instructions by:
  - a. RUN command
  - b. set breakpoint command, followed by the RUN command
  - c. Single step command
  - d. **All of the above**
  
- 3) A computer memory contains:
  - a. instructions only.
  - b. data only
  - c. **both instructions and data.**
  - d. neither instructions nor data.
  
- 4) Typically the size of each register is \_\_\_\_\_ the size of values processed by ALU.
  - a. **identical to**
  - b. less than
  - c. greater than
  - d. unrelated to
  
- 5) For the number  $A[15:0] = 0110110010001111$ ,  $A[14:13]$  is \_\_\_\_\_  $A[3:2]$ .
  - a. less than
  - b. **the same as**
  - c. greater than
  - d. cannot be determined

## Short Answers

- 6) (10 points) Convert  $-265_{10}$  to hexadecimal (16 bits two's complement notation) by hand. Show your work below.

Answer: 

XFEF7, must be in hex, 5 for showing work, 5 for correct
--

- 7) (5 points) Translate the following ASCII codes into strings of characters by interpreting each group of eight bits as an ASCII character:  $0x74696B372B21$

Answer: 

tik7+! 1 point for each correct (1 point bonus!)
--

- 8) (5 points) Sign extend the 6-bit 2's complement binary number  $111000$  to a 8-bit 2's complement binary number. Then express this number in hexadecimal.

Answer: 

xF8, must be in 8-bit hex, 5pts, all or nothing
---

9) (10 points) What is the range of numbers which can be represented by 9 bits if we are representing two's complement integers? (express as the formula and as decimal numbers)

Formula:	$-2^{n-1}$ to $2^{n-1}-1$ 3points
Decimal:	-256 to 255

10) (10 points) Encode the following LC-3 assembly language instruction: ADD R0,R7,#-1  
Show your result in hexadecimal.

Answer:	x11FF, 2 points for each nibble, 2 points for trying
---------	--

**Problem 11: LC-3 instructions (85 points)**

Consider the following contents of an LC-3 memory:

```
1001 0000 0011 1111
0001 0000 0010 0001
0001 0010 0000 0001
0000 1010 0000 0010
0010 0000 0000 0100
0000 1110 0000 0001
0010 0000 0000 0011
1111 0000 0010 0001
1111 0000 0010 0101
0000 0000 0011 1101
0000 0000 0100 1110
```

Write the assembly-language code represented above. This will start at memory location x3000. include all assembler directives (i.e. .ORIG, .END), and include labels where needed. Write two lines of comments at the top of your code describing what this small program does. (Hint: my solution has 15 lines, including comments and assembler directives).

```
; James Conrad, TEST1.ASM, 9/24/04 (note - name optional)
; This will compare two numbers (in R0 and R1). If they are Equal,
; print "=", if they are not, print "N" (150 points for
description)
        .ORIG X3000                    5 points for each correct
        NOT  R0,R0                      line. You needed to include
        ADD  R0,R0,#1                    valid labels. OUT and HALT
        ADD  R1,R0,R1                    could have been TRAPs
        BRNP NOTEQUAL
        LD   R0,EQUAL
        BR   PRINT
NOTEQUAL LD   R0,NOTEQ
PRINT    OUT
        HALT
EQUAL    .FILL x3D                      5 extra point for identifying
NOTEQ    .FILL x4E                      these as FILLs
        .END
```