UNC Charlotte – Fall 2004 - Exam 2 – November 3, 2004

Name: _____**SOLUTION**_____ User ID _____

Question	Multiple Choice 1-5	Short Answer 6-10	Long Answer 11	Total
Score	/25	/50	/75	/150

Multiple Choice - Questions 1-5: Each of these multiple choice questions is worth 5 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 cannot be done using the LC-3 simulator program? (circle your answer)
   - **a. Assemble a program.**
   - b. Load an object file.
   - c. Set a breakpoint.
   - d. None of the above

2) Interrupt-driven I/O is more efficient that polling because:
   - a. Polling consists of interrupt-driven I/O plus additional overhead.
   - b. Interrupts to the processor take less time than polling loops.
   - c. The statement is wrong. Polling is more efficient than interrupt-driven I/O.
   - d. **The processor can perform other tasks instead of constantly being in a loop checking to see if the status bit has changed. (Answer)**

3) The instruction TRAP x25 causes the PC to be loaded with the memory address:
   - a. x0025
   - b. **the contents of x0025 (Answer)**
   - c. x2500
   - d. x0250

4) If R6 is the stack pointer and contains the value x4001, and R0 contains the value to be pushed onto the stack, what will be the contents of R6 after this push routine:

```
PUSH  ADD R6,R6,#-1
      STR R0,R6,#0
```

   - a. x4000 **(Answer)**
   - b. x4002
   - c. x4001
   - d. x4003

5) The execution of the JSR instruction at location x4202, causes R7 to be loaded with:
   - a. x4200
   - b. x4202
   - c. x4201
   - **d. x4203 (Answer)**

Short Answers

6) (10 points) Examine the following code. How many times will "Hello world!\n" be printed?

```
int num = 1;
while (++num <=5) printf ("Hello world!\n");
```

Answer: Four (4) (all or none)

7) (10 points) Assume `num1` has the value x0547 and `num2` is x1234. What is the value of the expression `(num1 || num2) && !(num1 && num2)`

Answer: Zero (0) / False (partial credit if some work shown)

8) (10 points) Assume the declaration `int i=3, j=9;` What is the value of i and j after the following instruction executes: `j=i++;`

Answer:
i = 4
j = 3 (5 points each value)

9) (10 points) Assume the declaration `int i=3;` What is the value of i after the following instruction executes: `if (i=5) printf("go49ers!");` Will `"go49ers!"` be printed?

Answer:
i = 5,
Yes, the line will be printed (5 points each answer)

10) (10 points) Write a loop in C that prints the even numbers between 1 and 101. Use the least amount of code. No comments needed.

Answer:

```
for ( int i=1; i < 101; i++) {        // 3 points for for, 4 points for if, 3 points for printf
   if ((i%2) == 0)
     printf ("%d", i);  }
```

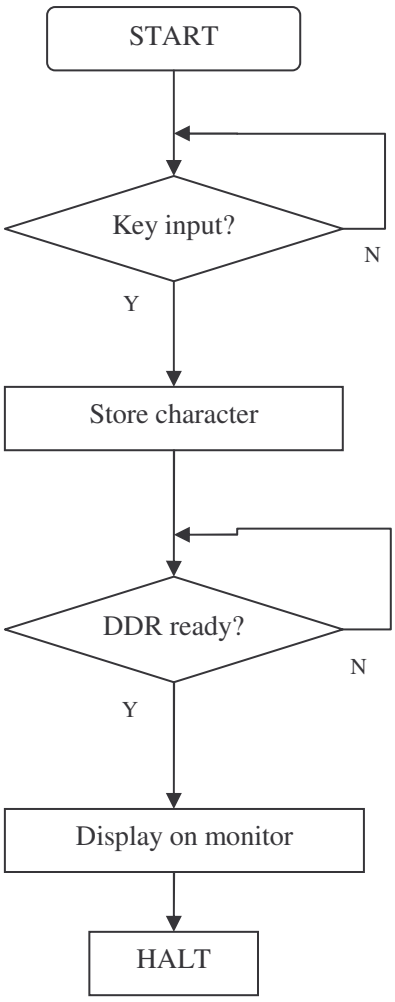
Problem 11: LC-3 instructions (75 points)

a) Without using the input or output TRAPs, write a small LC-3 ***program*** to read a single character typed on the keyboard, write it back to the console, and halt. Include ***ALL*** code and data (and addresses) necessary to do this. You do not need to write comments for this problem, but use meaningful labels. Yes, this seems to be a bit silly (a small program reads one character then halts), but I am testing your knowledge of program structure needed. You may use the HALT trap.

b) Write a flowchart for the above problem.

a)

```
            .orig x3000
in          LDI   R7, KBSR
            BRzp  in
            LDI    R0, KBDR
out         LDI   R7, DSR
            BRzp  out
            STI    R0, DDR
            HALT
KBSR        .FILL xFE00
KBDR        .FILL xFE02
DSR         .FILL xFE04
DDR         .FILL xFE06
            .end
```



a) Code: 65 points:
* KBSR/KBDR/DSR/DDR definitions =15
* .orig/.halt/.end = 10
* wait loop for input = 10
* read KBdata = 5
* wait loop for output = 10
* write to Display =5
* No more than 13 lines of code/data =10

b) Flowchart: 10 points
2 for having the start/end, then 2 pts for each of the other blocks