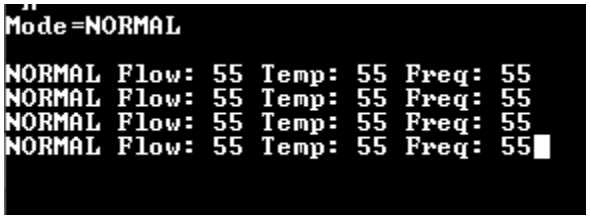
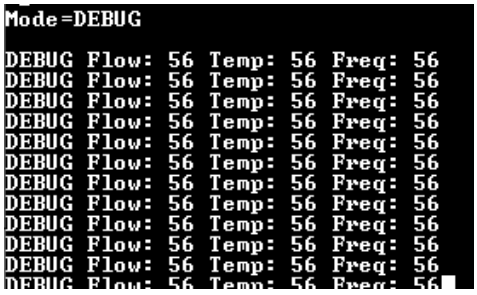
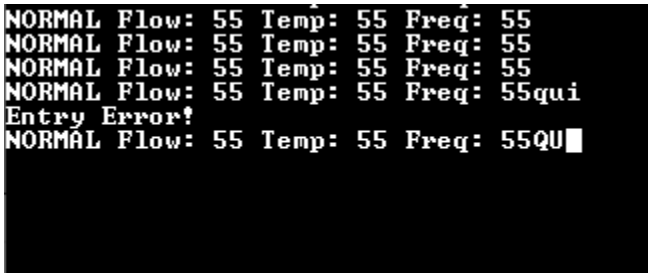
Michael Starks & Sovann Chak

Project 1 Module 5

ECEN 5803-002

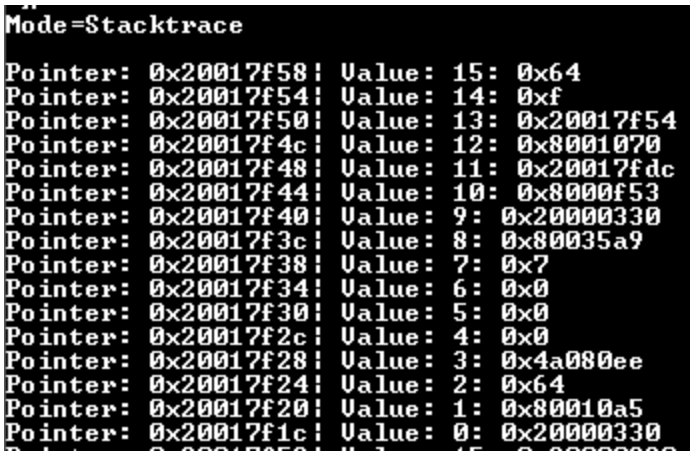
1. What is the count shown in timer0 if you let it run for 30 seconds?
    a. Timer0_count shows 4373 after ~30 seconds of operation. This is because timer0_count is incremented every time the Timer0 ISR is called.
2. How much time does the code spend in the main loop versus in interrupt service routines?
    a. The code spends about 1.45% of its time in the Timer0 ISR. This is based on the 4373 iterations of the ISR over ~30 seconds at ~100 us period.
3. Test each of the commands in the Debug Monitor and record the results. Explain anything you see that you did not expect. Are you able to display all the registers?
    a. **Normal Mode**
        i. 

    b. **Debug Mode**
        i. 

    c. **Quiet Mode**
        i. 

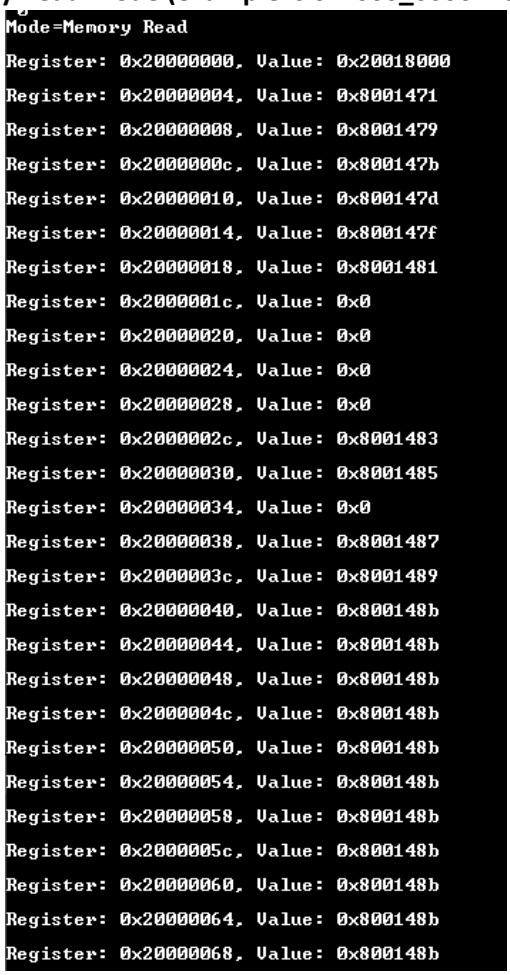
    d. **Stacktrace Mode**

i.



e. Memory Read Mode (example is 0x2000_0000 – 0x2000_1000)

i.



```
Register: 0x20000fc8, Value: 0xad21caac
Register: 0x20000fcc, Value: 0xde9bf93f
Register: 0x20000fd0, Value: 0x3901791a
Register: 0x20000fd4, Value: 0xd15b19e3
Register: 0x20000fd8, Value: 0x7517b2ea
Register: 0x20000fdc, Value: 0xe3bf6d58
Register: 0x20000fe0, Value: 0x54ef8f2d
Register: 0x20000fe4, Value: 0x697bc5dc
Register: 0x20000fe8, Value: 0x4e8481d1
Register: 0x20000fec, Value: 0x558b59b9
Register: 0x20000ff0, Value: 0x0
Register: 0x20000ff4, Value: 0x0
Register: 0x20000ff8, Value: 0x0
Register: 0x20000ffc, Value: 0x20000001
Register: 0x20001000, Value: 0xa3e405a
```

ii.

f. **General Mode**

```
GENERAL
Error Count: 0
Sensor 0: 4
Sensor 1: 5
R0: 536969149
R1: 0
R2: 1073759236
R3: 536969153
R4: 536871728
R5: 134222001
R6: 100
R7: 2156860
R8: 0
R9: 0
R10: 0
R13: 536969048
R14: 134221349
R15: 134221368
```

i.

ii. We were not able to display the information in registers 11 or 12.

g. **Version Mode**

```
->
2.0 2023/10/15
Select
```

i.

h. One issue we did not expect was getting stuck in an infinite loop due to the overrun error bit being set. This was caused by the user trying to input a command while information was being put in the UART TX buffer.

4. What is the new command you added to the debug menu, and what does it do? Capture a screenshot of the new monitor window

```
Select  HEL
Mode=HELP

Select Mode
 Hit NOR - Normal
 Hit QUI - Quiet
 Hit DEB - Debug
 Hit MEM start_hexaddr end_hexaddr - Memory Read
 Hit STK - Stacktrace
 Hit GEN - General
 Hit V - Version#
 Hit HEL - Help

Select:
```

a.

b. We added a help command to reprint the available options.

5. A GPIO pin is driven high at the beginning of the Timer ISR and low at the end. What purpose could this serve?
    a. This will allow you to monitor the Timer ISR. This GPIO could function as a 100 us clock source and a way to validate that the ISR is running.
6. Estimate the % of CPU cycles used for the main background process, assuming a 100-millisecond operating cycle.
    a. IF the main background process takes 100 milliseconds to complete it takes approximately 10% of the CPU cycles.
7. What is your DMIPS estimate for the ST STM32F401RE MCU?
    a. After funning the Dhrystone test for over an hour, the STM32F401RE used has a benchmark of 191247 DMIPS.

b.

```
Dhrystone Benchmark Program C/1 12/01/84
60.001
Dhrystone time for 11474944 passes = 60.001 sek
This machine average benchmarks at 191247 dhrystones/second
```