This is a take-home quiz. This will be quiz#4.
This is an individual assignment.
You will be required to provide **READABLE** screen captures in a PDF file.

You will be using the gdb debugger to pause your program at specific places in your program. We have discussed how to do this in class multiple times.

You will use my c code below to create a function in ARM assembly that will concatenate your first name and last name into a single string based on the definition of the external 'strCat'.

```
#// CSE 2312 Computer Org and Assembly Language Programming
// strings concatenate
// YOUR NAME

#include <stdlib.h>    // EXIT_ macro
#include <stdio.h>     // printf
#include <inttypes.h> // PRI macro
#include <stdint.h>    // C99 uintX_t and intX_t types

extern void strCat(const char first[], const char last[]);

int main(void)
{
    char last[] = "Lastname";
    char str[] = "Hello World!";
    char first[30] = "Firstname ";  // with a 'space' at the end
    strCat(first, last);
    printf("Full Name = %s\n", first);
 return EXIT_SUCCESS;
}
```

1. You will place a breakpoint where strCat is called.
2. You will 'step' in to the assembly function.
3. You will need to list your assembly function to find the BX LR line.
4. You will place a breakpoint at the BX LR line.
5. DO NOT Continue Yet!
6. You must use the debugger to display the memory location of the string "first"
7. the command is:
8.   x/64cb $r#
9. Replace the # with the correct register number, note the first address printed, you will need this later.
10. Now 'continue' the program.
11. When it pauses at BX LR, you will need to display the memory as before, but replace '$r#' with the address noted earlier.
12. Now 'continue' again.
13. The program should now be complete and c should have printed the full name.
14. Take a screenshot of the window showing all the debugger output.
15. **You may have to repeat the process flawlessly to get all the data on one screen**
16. You will also provide a screenshot of the assembly code. Y**our name must be in a comment at the top of the file.**

```
14          LDRSB   R2, [R1], #1
15          STRB    R2, [R0], #1
16          CMP     R2, #0
17          BNE     str_copy
18          BX LR
(gdb) b 18
Breakpoint 2 at 0x10428: file strcat.s, line 18.
(gdb) x/64cb $r0
0x7efff454:     70 'F'  105 'i' 114 'r' 115 's' 116 't' 110 'n' 97 'a'   109 'm'
0x7efff45c:     101 'e' 32 ' '  0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'
0x7efff464:     0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'
0x7efff46c:     0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        -6 '\372'       118 'v'
0x7efff474:     72 'H'  101 'e' 108 'l' 108 'l' 111 'o' 32 ' '  87 'W'  111 'o'
0x7efff47c:     114 'r' 108 'l' 100 'd' 33 '!'  0 '\000'        3 '\003'        1 '\001'        0 '\000'
0x7efff484:     76 'L'  97 'a'  115 's' 116 't' 110 'n' 97 'a'  109 'm' 101 'e'
0x7efff48c:     0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'
(gdb) c
Continuing.

Breakpoint 2, str_copy () at strcat.s:18
18          BX LR
(gdb) x/64cb 0x7efff454
0x7efff454:     70 'F'  105 'i' 114 'r' 115 's' 116 't' 110 'n' 97 'a'   109 'm'
0x7efff45c:     101 'e' 32 ' '  76 'L'  97 'a'  115 's' 116 't' 110 'n' 97 'a'
0x7efff464:     109 'm' 101 'e' 0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'
0x7efff46c:     0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        -6 '\372'       118 'v'
0x7efff474:     72 'H'  101 'e' 108 'l' 108 'l' 111 'o' 32 ' '  87 'W'  111 'o'
0x7efff47c:     114 'r' 108 'l' 100 'd' 33 '!'  0 '\000'        3 '\003'        1 '\001'        0 '\000'
0x7efff484:     76 'L'  97 'a'  115 's' 116 't' 110 'n' 97 'a'  109 'm' 101 'e'
0x7efff48c:     0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'        0 '\000'
(gdb) c
Continuing.
Full Name = Firstname Lastname
[Inferior 1 (process 8887) exited normally]
(gdb) q
pi@pi-tar:~/cse2312/2022/F22/TH_Quiz $
```

strcat.s - /home/pi/cse2312/2022/F22/TH_Quiz - Geany (on pi-tar)

File   Edit   Search   View   Document   Project   Build   Tools   Help

Documents

~/cse23...TH_Quiz
    strcat.c
    strcat.s

strcat.c   strcat.s

```
1   // CSE 2312
2   // Quiz 4
3   // Student name
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
```

Status
```
21:52:49: File /home/pi/cse2312/2022/F22/TH_Quiz/strings.c saved.
08:21:19: File /home/pi/cse2312/2022/F22/TH_Quiz/strcat.c saved.
08:21:41: File /home/pi/cse2312/2022/F22/TH_Quiz/strcat.s saved.
09:56:15: File /home/pi/cse2312/2022/F22/TH_Quiz/strcat.s saved.
10:05:06: File /home/pi/cse2312/2022/F22/TH_Quiz/strcat.c saved.
10:20:20: File /home/pi/cse2312/2022/F22/TH_Quiz/strcat.s saved.
```

line: 8 / 19   col: 8   sel: 0   INS   SP   mode: LF   encoding: UTF-8   filetype: ASM   scope: unknown