Lab Assignment 1

50 points (5% of entire grade)

Due: 11:59pm, Monday, March 8, 2021

The goal of this lab is to get familiar with how the program described in high-level language (particularly C) is translated into MIPS assembly language. We will eventually build our own simulator in the next lab assignment. For this lab assignment, we don't have a simulator to run MIPS assembly, so we will use an existing one, called MARS[1]. A basic MARS tutorial will be provided separately.

Specifically, translate the following C procedure into MIPS Assembly. You are required to follow the conventional use for registers such as temporary vs. saved registers, maintaining procedure call stacks, proper parameter passing and returns, etc. Note that this procedure calls another (`strchr`) which is assumed to also comply with those conventions.

```
char firstmatch (char *s1, char *s2)        /* find the first character in string s1 that is also in s2 */
  {
  char *temp;
  temp = s1;
  do {
    if (strchr( s2, *temp ) != 0)   /* if this character is there  */
          return *temp;                     /*    return where we found it */
    temp++;                                 /* else look again                 */
    } while (*temp != 0);
  return 0;                                 /* found none of these chars   */
  }

char * strchr (register const char *s, int c)
{
 do {
   if (*s == c)
     {
          return (char*)s;
     }
 } while (*s++);
 return (0);
}
```

These are additional instructions to complete this lab assignment.

- The program should consist of two segments: .data and .text segments.
- Define two strings, str1 and str2, in the data segment.
- Use `lb` (load byte) as you manipulate strings not integers.
- The code segment, labeled as ".text", should begin with "main:" because the MARS simulator begins the execution from there.
- In the main code, you should start with load addresses of the defined str1 and str2.
- You need to write two procedures, firstmatch and strchr, in the code segment, each is labeled as the procedure name.
- After loading string addresses, you pass both strings to firstmatch as in the above C code.
- Within the firstmatch procedure, you need to call the strchr procedure.

[1] MARS (MIPS Assembler and Runtime Simulator). http://courses.missouristate.edu/KenVollmar/mars/

- When each procedure gets called, you need to follow the procedure calling conventions.
- After returning from the firstmatch procedure, you need to print out the found character in the output. Use syscall functions available in MARS (https://courses.missouristate.edu/KenVollmar/mars/Help/SyscallHelp.html).
- The program should end by calling exit syscall. See the syscall services.

BONUS (10 points)

Write your firstmatch procedure, so the do-while loop contains six or less number of instructions. Any bonus points count only if the program works correctly. The pseudo instruction will be counted as one.

Grading Guidelines

- Program compiles without errors on MARS (and appears on the surface to be correct): 30 pts.
    - Submit only one assembly file (with a file extension of .s or .asm) including all your comments.
- Program executes correctly: 45 pts.
    - Should pass rigorous test cases.
- Documentation and comment on the program: 25 pts
    - Have a commented program header with each group member's name and lab assignment
    - The program should be well commented so much so the TA can understand what you are doing without you there to explain it.

Submission Guidelines:

- All program submissions should be made to Blackboard.
- One submission per group will suffice.
- Submissions must be time stamped by midnight on the due date.
- There will be 10% late penalty per day with up to two days. No late submission after that is not allowed.