1 Introduction

The purpose of this assignment is to learn x86 assembler, the PLTO binary editor, and the ptrace system call.

You can do this assignment in teams of two.

2 PLTO

Using PLTO, write a tool ftrace that annotates a program with calls to the library function backtrace, such that it prints out a stack trace whenever the function is entered. Your program should be called like this:

```
> gcc -g -static -Wl,-r ... -o program program.c
> ftrace program.r ... -o program.opt
> program.opt function-name
```

I.e., ftrace program should

1. read in the user’s program using plto;
2. build the control-flow graphs for all the functions;
3. use execinfo.h to print out a backtrace whenever function is reached (see http://www.delorie.com/gnu/docs/glibc/libc_665.html and http://www.helicontech.co.il/linuxprog.html for more information);
4. write the program back out again.

3 ptrace

Write a tool vtrace that uses ptrace to set a breakpoint on a particular function and print out the current value of a particular global integer variable. Your program should be called like this:

```
> gcc -g ... -o program program.c
> vtrace program function variable
```
In other words, \texttt{vtrace} should

1. open the program executable file and, using the \texttt{libelf.h} library (see \url{http://developers.sun.com/solaris/articles/elf.html} and \url{http://www.linuxgazette.com/issue83/sandeep.html} for more information), and look up the addresses of function and variable;

2. start up the user’s program using \texttt{ptrace};

3. set a breakpoint at the beginning of function;

4. whenever the breakpoint is reached, get the value of variable (again, using \texttt{ptrace}) and print it out.

4 Submission and Assessment

The deadline for this assignment is midnight, Mon Sep 26. It is worth 5\% of your final grade.

You should submit the assignment electronically using the Unix command

\begin{verbatim}
  turnin cs620.2 README ftrace.c vtrace.c README
\end{verbatim}

\texttt{README} should briefly describe your implementation and list the members of your team.

\begin{quote}
Don’t show your code to anyone, don’t read anyone else’s code, don’t discuss the details of your code with anyone. If you need help with the assignment see the instructor.
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