

Programming Assignment #01

Due: Tuesday, 09/07/2021, by 11:30pm

UNIX/LINUX systems usually include some command that allows you to trace system calls made by a process. Under Linux, this command is `strace`. For example, in order to trace all the system calls made during execution of `ls`, you would type `strace ls`. If the display is too long to fit your screen, you can use `strace -o out4ls ls` to write your output into file `out4ls`. Check “`man strace`” (traditional UNIX manual pages) or “`info strace`” (GNU style manual pages) in your Linux system for details. It is a good tool for learning, either as a light-weight debugger, or as a primitive profiler.

1. (40%) **STRACE a small program.** Create and compile your own program in C (named as PA01) as follows

```
#include <stdio.h>
int main(void) {
    FILE *fd ; float pval=3.14159; int i,k;
    If ((fd= fopen("myTstFile","r+"))==NULL)
        printf("\n Program Failed, figure out why...\n");
    else {
        printf("\n Simple pie value %1.8f\n", pval);
        for (i=0; i<100; i++) {
            k = rand()%10;
            if (fprintf(fd, "%f\n",pval+i*k)==-1) perror("write err"); fflush(fd);
            printf("."); fflush(stdout);
        }
        fclose(fd); printf("\n Program successful ends\n");
    }
}
```

- a) Without creating file `myTstFile` (no such a file in your working directory), run “`strace ./PA01`”, read your output, pick the first five of most frequently invoked system calls and explain which among the five system calls caused the program to fail.
 - b) With file `myTstFile` (a dummy file) being created, run “`strace ./PA01`” again, read your output to pick the most frequently invoked system call.
 - c) Is “`fopen`” a system call? If not, which system call it mainly correlates with?
 - d) Is “`printf`” a system call? If not, which system call it mainly correlates with?
2. (30%) **STRACE a Linux utility command -- cal.** Run “`strace -c cal`”, capture the output, and then pick the top three system calls which consumed the system time and briefly describe their functionality.
 3. (30%) **STRACE/LTRACE Linux utility commands “ls”.** Command `ltrace` is another tracing tool used for tracing the library function calls. Use both `strace` and `ltrace` to Linux command `ls` to report what library functions and system calls are used to
 - a) Open the current directory
 - b) Get the list of directory entries
 - c) Print the output to your screen

You are going to submit a single PDF or MS WORD file to answer all questions asked. Please show your name(s) in every page of your submission, and name your file as “YourLastName+YourFirstNameInitial_YourLastName+YourFirstNameInitial_PA1”. For example, if Xiang Sun and Liangkun Yu work together as a group, the name of your submitted file is `SunX_YuL_PA1`.