Programming Assignment #01

Due: 09/09/2024, by 11:59pm

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>
#include <stdlib.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. (20%) 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

   Note that ltrace may not give you the outputs in some Linux OSs. It is fine if "ltrace ls" does not provide the outputs and you can still get all the points for this question by providing the snapshot(s). But, you can try to explore the reasons and possibly to fix that, which are not mandatory for this question.

(10%) **Submission requirement**

- If submitting as a group, please include a paragraph detailing each member's assigned tasks. For example,

  We both ran and discussed the codes for Q1-Q3. Xiang took the lead in writing the answers for Q1 in the report, while Hieu led the writing for Q2 and Q3. We also discussed why 'ltrace ls' did not produce outputs…

  Failure to provide this paragraph or to include any member's contribution will result in a 10% deduction from your assignment grade.
- 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 Hieu Quang work together as a group, the name of your submitted file is SunX_QuangH_PA1.