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When compared with the program from problem 3, both programs start with the same system calls. They both open and make use of the linker and the same libraries. They both write to standard out with system calls in the same manner. The most obvious difference I can see between the two, is the abundance of rt_sigprocmask, rt_sigaction, rt_sigprocmask, and nanosleep calls made in this program, that are not made in the program from problem 3.

A signal command for SIGINT is registered near the start of the program, which causes an interrupt signal to be watched for. In the for loop, the program runs the sleep command causing a state change. When this happens rt_sigprocmask checks for an interrupt signal. If an interrupt signal is detected, then the function "f" in the program is run, then the program continues running normally. This process of sleep and checking, is why we see rt_sigprocmask, rt_sigaction, rt_sigprocmask, and nanosleep calls every time the while loop in the program enters another cycle.

```
13704 execve("./a.out", ["./a.out"], [/* 63 vars */]) = 0
13704 brk(0)                            = 0x180b000
13704 access("/etc/ld.so.nohwcap", F_OK) = -1 ENOENT (No such file or directory)
13704 mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS,
-1, 0) = 0x7fb0cd5c1000
13704 access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)
13704 open("/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
13704 fstat(3, {st_mode=S_IFREG|0644, st_size=90022, ...}) = 0
13704 mmap(NULL, 90022, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7fb0cd5ab000
13704 close(3)                          = 0
13704 access("/etc/ld.so.nohwcap", F_OK) = -1 ENOENT (No such file or directory)
13704 open("/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
13704 read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\320\37\2\0\0\0\0\0"..., 832) = 832
13704 fstat(3, {st_mode=S_IFREG|0755, st_size=1845024, ...}) = 0
13704 mmap(NULL, 3953344, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE,
3, 0) = 0x7fb0ccfdb000
13704 mprotect(0x7fb0cd196000, 2097152, PROT_NONE) = 0
13704 mmap(0x7fb0cd396000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|
MAP_DENYWRITE, 3, 0x1bb000) = 0x7fb0cd396000
13704 mmap(0x7fb0cd39c000, 17088, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|
MAP_ANONYMOUS, -1, 0) = 0x7fb0cd39c000
13704 close(3)                          = 0
13704 mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS,
-1, 0) = 0x7fb0cd5aa000
13704 mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS,
-1, 0) = 0x7fb0cd5a8000
13704 arch_prctl(ARCH_SET_FS, 0x7fb0cd5a8740) = 0
13704 mprotect(0x7fb0cd396000, 16384, PROT_READ) = 0
13704 mprotect(0x600000, 4096, PROT_READ) = 0
13704 mprotect(0x7fb0cd5c3000, 4096, PROT_READ) = 0
13704 munmap(0x7fb0cd5ab000, 90022)     = 0
13704 rt_sigaction(SIGINT, {0x4005bd, [INT], SA_RESTORER|SA_RESTART, 0x7fb0cd011c30},
{SIG_DFL, [], 0}, 8) = 0
13704 fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(136, 0), ...}) = 0
13704 mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS,
-1, 0) = 0x7fb0cd5c0000
13704 write(1, "val is: 0\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
```

```
13704 write(1, "val is: 1\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 2\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, {0, 624890838}) = ? ERESTART_RESTARTBLOCK (Interrupted by signal)
13704 --- SIGINT {si_signo=SIGINT, si_code=SI_KERNEL} ---
13704 rt_sigreturn()                    = -1 EINTR (Interrupted system call)
13704 write(1, "Sorry can\342\200\231t CTRL-Cval is: 3\n", 30) = 30
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 4\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 5\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 6\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 7\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 8\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 9\n", 10)       = 10
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 10\n", 11)      = 11
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 11\n", 11)      = 11
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, {0, 903585763}) = ? ERESTART_RESTARTBLOCK (Interrupted by signal)
```

```
13704 --- SIGINT {si_signo=SIGINT, si_code=SI_KERNEL} ---
13704 rt_sigreturn()                 = -1 EINTR (Interrupted system call)
13704 write(1, "Sorry can\342\200\231t CTRL-Cval is: 12\n", 31) = 31
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 write(1, "val is: 13\n", 11)      = 11
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, {0, 130438559}) = ? ERESTART_RESTARTBLOCK (Interrupted by signal)
13704 --- SIGINT {si_signo=SIGINT, si_code=SI_KERNEL} ---
13704 rt_sigreturn()                 = -1 EINTR (Interrupted system call)
13704 write(1, "Sorry can\342\200\231t CTRL-Cval is: 14\n", 31) = 31
13704 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
13704 rt_sigaction(SIGCHLD, NULL, {SIG_DFL, [], 0}, 8) = 0
13704 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
13704 nanosleep({1, 0}, 0x7fff297b1ab0) = 0
13704 exit_group(0)                 = ?
13704 +++ exited with 0 +++
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
 27.42    0.000556          37        15         3 nanosleep
 27.27    0.000553          18        30           rt_sigprocmask
 21.94    0.000445          30        15           write
  9.57    0.000194          12        16           rt_sigaction
  3.06    0.000062           8         8           mmap
  2.76    0.000056          19         3         3 rt_sigreturn
  1.82    0.000037          12         3         3 access
  1.33    0.000027          14         2           open
  1.28    0.000026           7         4           mprotect
  0.84    0.000017           6         3           fstat
  0.74    0.000015          15         1           execve
  0.59    0.000012           6         2           close
  0.54    0.000011          11         1           brk
  0.49    0.000010          10         1           munmap
  0.20    0.000004           4         1           read
  0.15    0.000003           3         1           arch_prctl
------ ----------- ----------- --------- --------- ----------------
100.00    0.002028                   106         9 total
```