
CS 314 – Operating Systems Lab

Lab2 Report

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1 Part I

Minimum lines of C code with which we can print the "Hello World" with each character by a different process is 21.

The screenshot of the code in C with minimum lines

```
1 #include <stdio.h>
2 #include <sys/types.h>
3 #include <sys/wait.h>
4 #include <unistd.h>
5 #include <stdlib.h>
6
7 int main(){
8     char hello[] = "Hello World";
9     pid_t pid;
10
11     for (int i=0; i<11; i++){
12         pid = fork();
13         wait(NULL);
14         if (pid == 0){
15             printf("%c pID : %d\n",hello[i],getpid());
16             sleep(rand()%4 + 1);
17             break;
18         }
19     }
20     return 0;
21 }
```

Figure 1: Part 1 code

The screenshot of the output compiled in the guest Minix3

```
# cd Part1
# ls
Makefile Part1.c
# gmake hello
clang Part1.c -o hello
./hello
H pID : 452
e pID : 453
l pID : 454
l pID : 455
o pID : 456
pID : 457
W pID : 458
o pID : 459
r pID : 460
l pID : 461
d pID : 462
# _
```

Figure 2: Part 1 output

2 Part II

The screenshot of output for the example provided in lab2 handout compiled in the guest minix3

```
# ls
Makefile  half.c  square.c  twice.c
# make
clang half.c -o half
clang twice.c -o twice
clang square.c -o square
# ./twice ./square ./half ./twice ./half 10
Twice: Current process id: 477, Current result: 20
Square: Current process id: 477, Current result: 400
Half: Current process id: 477, Current result: 200
Twice: Current process id: 477, Current result: 400
Half: Current process id: 477, Current result: 200
# _
```

Figure 3: Part 2 Output

3 Part III

Initially the parent process is created which then creates child process and wait till the child process exits and then parent process exits. So, the order of exit of processes is reverse of that of created processes.

The Forkexit.c file in location usr/src/minix/servers/pm has been made following changes to get the desired output:

1. `printf("Minix: PID %d created\n", rmc->mp_pid)` has been added in the function "do_fork" in forkexit.c file
2. `printf("Minix: PID %d exit\n", mp->mp_pid)` has been added in the function "do_exit" in forkexit.c file.

The screenshot of build complete of OS after adding process created and exit print statments.

```
install //usr/lib/fonts
do-hdboot ==> releasetools
install -M /usr/src/etc -c -p -r ../minix/servers/ds/ds /boot/minix/.temp/mod01_
ds
install -M /usr/src/etc -c -p -r ../minix/servers/rs/rs /boot/minix/.temp/mod02_
rs
install -M /usr/src/etc -c -p -r ../minix/servers/pm/pm /boot/minix/.temp/mod03_
pm
install -M /usr/src/etc -c -p -r ../minix/servers/sched/sched /boot/minix/.temp/
mod04_sched
install -M /usr/src/etc -c -p -r ../minix/servers/vfs/vfs /boot/minix/.temp/mod0
5_vfs
install -M /usr/src/etc -c -p -r ../minix/drivers/storage/memory/memory /boot/mi
nix/.temp/mod06_memory
install -M /usr/src/etc -c -p -r ../minix/drivers/tty/tty/tty /boot/minix/.temp/
mod07_tty
install -M /usr/src/etc -c -p -r ../minix/fs/mfs/mfs /boot/minix/.temp/mod08_mfs
install -M /usr/src/etc -c -p -r ../minix/servers/vm/vm /boot/minix/.temp/mod09_
vm
install -M /usr/src/etc -c -p -r ../minix/fs/pfs/pfs /boot/minix/.temp/mod10_pfs
install -M /usr/src/etc -c -p -r ../sbin/init/init /boot/minix/.temp/mod11_init
Done.
Build started at: Sun Jan 15 22:53:29 IST 2023
Build finished at: Sun Jan 15 22:56:16 IST 2023
#
```

Figure 4: Build Complete

The screenshot of PID created, PID exited statements after building of OS with changes.

```
Minix/i386 (192.168.137.129) (console)

login: root
Password:
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2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013
The NetBSD Foundation, Inc. All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
The Regents of the University of California. All rights reserved.

For post-installation usage tips such as installing binary
packages, please see:
http://wiki.minix3.org/UsersGuide/PostInstallation

For more information on how to use MINIX 3, see the wiki:
http://wiki.minix3.org

We'd like your feedback: http://minix3.org/community/

Minix: PID 208 created
Minix: PID 208 exited
Minix: PID 209 created
Minix: PID 209 exited
# _
```

Figure 5: Print created and Print exit