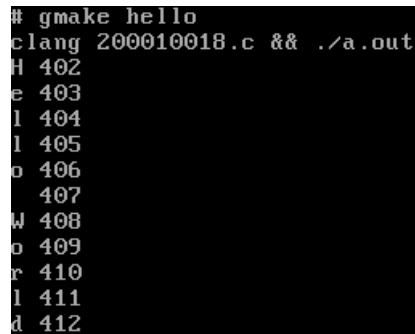# CS 314: Assignment 2

Harrithha (200010018)

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1 Part I

The minimum number of lines of C code with which I achieved the given task is **26** (including all the header files imports and a new line for opening brackets for if/for loops).

Below is the screenshot of the output obtained on running the command `gmake hello` in the **Minix3 Virtual Machine**:

2 Part II

Three programs namely **half.c, twice.c** and **square.c** were written with each program performing the operations as per their name.

We can pass as many command line arguments as we want and the evaluation order of the expression is from **left to right**. The output screenshot when the command `./twice ./square ./half ./twice ./half 10` is run in Minix3 Virtual Machine is as follows:

```
# gmake
clang twice.c -o twice
clang square.c -o square
clang half.c -o half
# ./twice ./square ./half ./twice ./half 10
Twice: Current process id: 343, Current result: 20
Square: Current process id: 343, Current result: 400
Half: Current process id: 343, Current result: 200
Twice: Current process id: 343, Current result: 400
Half: Current process id: 343, Current result: 200
```

3   Part III

We know that the processes are created in tree like fashion where parent process is created first which creates a child process and processes exit in reverse order, i.e. child process exits first and then parent process exits.

In order to perform the given task, the file **forkexit.c** was changed at **minix/servers/pm** location. The following statement was added in forkexit.c file at **line number 115** when a process is created:
```
printf("Minix:  PID %d created", rmc->mp_pid);
```

Similarly, following statement was added in **forkexit.c** at **line number 245** file when a process exited:
```
printf("Minix:  PID %d exited", mp->mp_pid);
```

These changes were made in the host machine (Windows). It was transferred to Minix3 Virtual Machine through github. Then, `make build MKUPDATE=yes` was run and the Minix3 Virtual Machine was rebooted. Upon running the `ls` command, the following output was obtained:

```
install -N /usr/src/etc -c -p -r ../minix/servers/ds/ds /boot/minix/.temp/mod01
ds
install -N /usr/src/etc -c -p -r ../minix/servers/rs/rs /boot/minix/.temp/mod02
rs
install -N /usr/src/etc -c -p -r ../minix/servers/pm/pm /boot/minix/.temp/mod03
pm
install -N /usr/src/etc -c -p -r ../minix/servers/sched/sched /boot/minix/.temp
mod04_sched
install -N /usr/src/etc -c -p -r ../minix/servers/vfs/vfs /boot/minix/.temp/mod
5_vfs
install -N /usr/src/etc -c -p -r ../minix/drivers/storage/memory/memory /boot/m
nix/.temp/mod06_memory
install -N /usr/src/etc -c -p -r ../minix/drivers/tty/tty/tty /boot/minix/.temp
mod07_tty
install -N /usr/src/etc -c -p -r ../minix/fs/mfs/mfs /boot/minix/.temp/mod08_mf
install -N /usr/src/etc -c -p -r ../minix/servers/vm/vm /boot/minix/.temp/mod09
vm
install -N /usr/src/etc -c -p -r ../minix/fs/pfs/pfs /boot/minix/.temp/mod10_pf
install -N /usr/src/etc -c -p -r ../sbin/init/init /boot/minix/.temp/mod11_init
rm /dev/c0d0p0s0:/boot/minix/3.3.0
Done.
Build started at:  Thu Jan 12 16:17:19 IST 2023
Build finished at: Thu Jan 12 16:19:46 IST 2023
```

```
# ls
Minix: PID 229 created
.git          Makefile.inc docs        include
.gitignore    bin          etc         lib
.gitreview    build.sh     external    libexec
LICENSE       common       games       log.txt
Makefile      distrib      gnu         minix
Minix: PID 229 exited
```