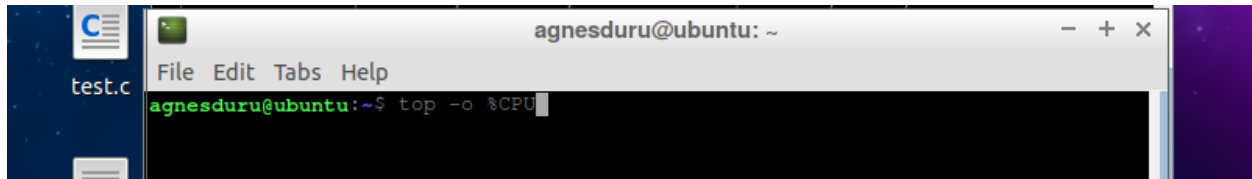


Operating Systems Assignment #2- Programming Part

- Part 1 – Explore you VM or Linux-Based Machine
 - a. Processes and Threads currently running: Task/ Processes : 115 and Threads: 205



 A screenshot of a terminal window titled 'agnesduru@ubuntu: ~'. The window contains a menu bar with 'File Edit Tabs Help'. The output of the 'top' command is displayed, showing system statistics and a list of running processes.

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
32	root	20	0	0	0	0	I	0.3	0.0	0:00.39	kworker/0:1
537	root	20	0	129564	42672	27204	S	0.3	2.1	0:05.86	Xorg
1233	agnesdu+	20	0	114760	31136	23904	S	0.3	1.5	0:04.22	x-terminal-+
1293	agnesdu+	20	0	7992	3760	3320	S	0.3	0.2	0:02.14	top
1384	agnesdu+	20	0	7992	3628	3192	R	0.3	0.2	0:00.17	top
1	root	20	0	30336	7732	6304	S	0.0	0.4	0:01.64	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthreadd
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0H
5	root	20	0	0	0	0	I	0.0	0.0	0:00.52	kworker/u2:0
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	mm_percpu_wq
7	root	20	0	0	0	0	S	0.0	0.0	0:00.10	ksoftirqd/0
8	root	20	0	0	0	0	I	0.0	0.0	0:00.21	rcu_sched
9	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_bh
10	root	rt	0	0	0	0	S	0.0	0.0	0:00.00	migration/0
11	root	rt	0	0	0	0	S	0.0	0.0	0:00.00	watchdog/0
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/0
13	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kdevtmpfs

Trash

agnesduru@ubuntu: ~

File Edit Tabs Help

top - 21:03:46 up 1 min, 1 user, load average: 1.12, 0.45, 0.17

test.c Threads: 205 total, 1 running, 169 sleeping, 0 stopped, 0 zombie

%Cpu(s): 0.7 us, 1.0 sy, 0.0 ni, 97.0 id, 1.3 wa, 0.0 hi, 0.0 si, 0.0 st

KiB Mem : 2060212 total, 1554528 free, 178052 used, 327632 buff/cache

KiB Swap: 483800 total, 483800 free, 0 used. 1669580 avail Mem

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
968	agnesdu+	20	0	8124	3612	3144	R	1.0	0.2	0:00.08	top
537	root	20	0	128984	41700	27320	S	0.7	2.0	0:00.63	Xorg
154	root	0	-20	0	0	0	I	0.3	0.0	0:00.10	kworker/0:1H
1	root	20	0	30344	7448	6000	S	0.0	0.4	0:01.47	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthreadd
3	root	20	0	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0H
5	root	20	0	0	0	0	I	0.0	0.0	0:00.35	kworker/u2:0
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	mm_percpu_wq
7	root	20	0	0	0	0	S	0.0	0.0	0:00.05	ksoftirqd/0
8	root	20	0	0	0	0	I	0.0	0.0	0:00.13	rcu_sched
9	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_bh
10	root	rt	0	0	0	0	S	0.0	0.0	0:00.00	migration/0
11	root	rt	0	0	0	0	S	0.0	0.0	0:00.00	watchdog/0
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/0
13	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kdevtmpfs
14	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	netns

agnesduru@ubu... [Software Updat... 21:03

agnesduru@ubuntu: ~

File Edit Tabs Help

* agnesdur... x agnesduru... x

agnesduru@ubuntu:~\$ top H

- b. The PID 1384 has consumed the most CPU

```

test.c  File Edit Tabs Help
agnesduru@ubuntu:~$ top -o %CPU

```

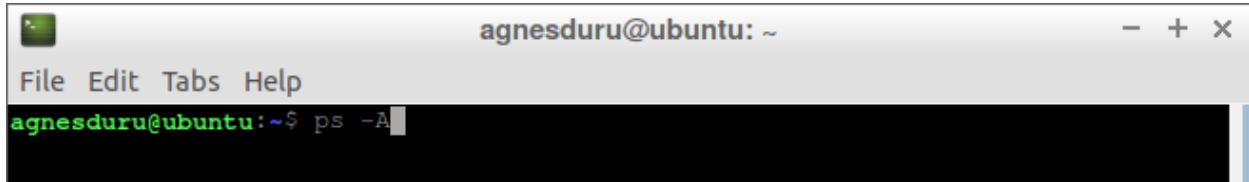
```

agnesduru@ubuntu: ~
File Edit Tabs Help
top - 20:27:44 up 26 min, 1 user, load average: 0.00, 0.04, 0.06
Tasks: 119 total, 1 running, 87 sleeping, 0 stopped, 0 zombie
%Cpu(s):  2.0 us,  1.3 sy,  0.0 ni, 96.7 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem : 2060372 total, 1294920 free, 158704 used, 606748 buff/cache
KiB Swap: 483800 total, 483800 free,  0 used. 1685912 avail Mem

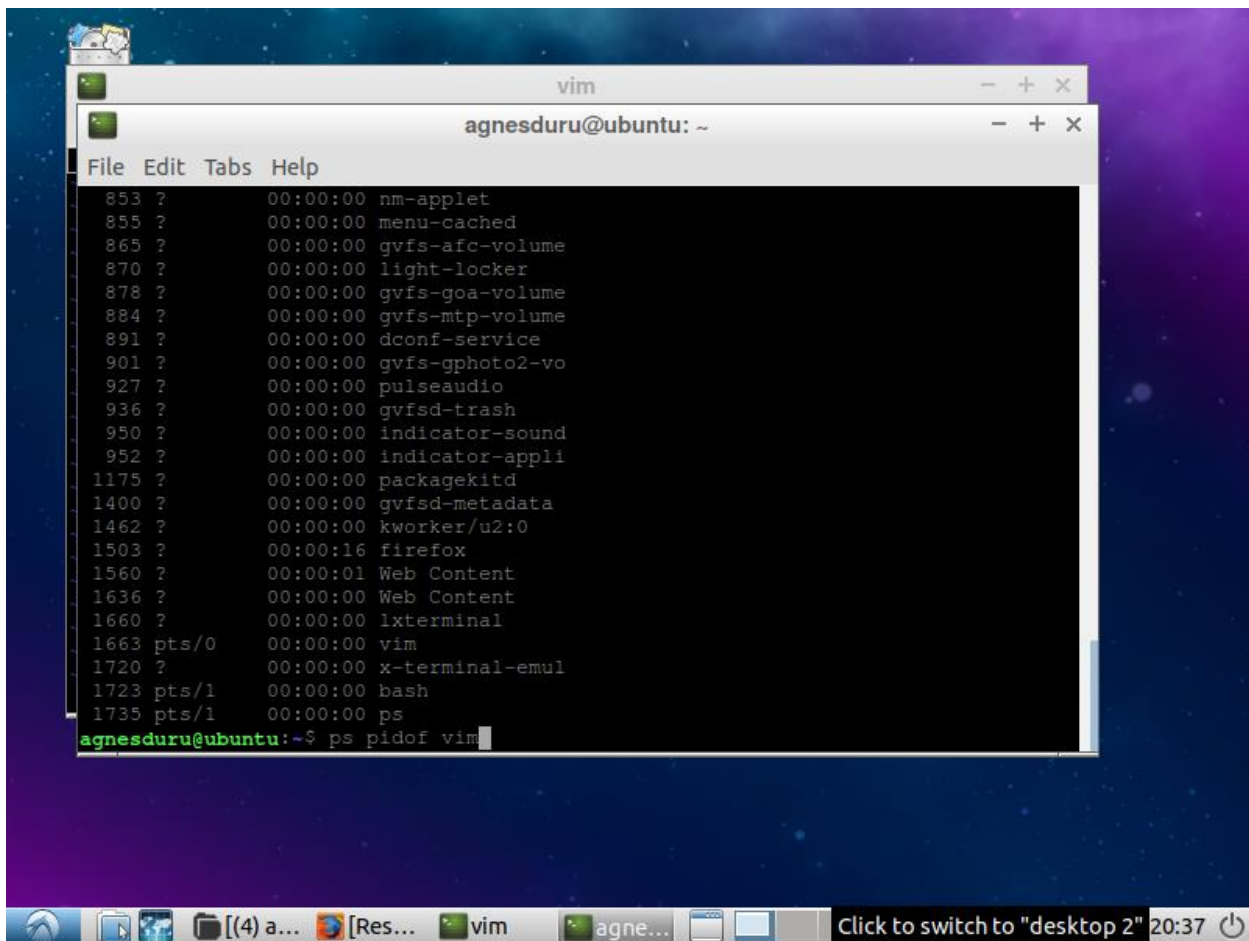
  PID USER      PR  NI  VIRT  RES  SHR S %CPU  %MEM    TIME+  COMMAND
 1384 agnesdu+  20   0   7992   3628 3192 R  1.0   0.2   0:06.77 top
 1233 agnesdu+  20   0 115852 31660 23908 S  0.7   1.5   0:11.36 x-terminal-+
 1420 agnesdu+  20   0   7992   3648 3212 S  0.7   0.2   0:03.48 top
    32 root      20   0     0     0     0 I  0.3   0.0   0:00.78 kworker/0:1
   537 root      20   0 136036 48676 27912 S  0.3   2.4   0:13.81 Xorg
 1293 agnesdu+  20   0   7992   3760 3320 S  0.3   0.2   0:06.05 top
     1 root      20   0 30336  7732  6304 S  0.0   0.4   0:01.65 systemd
     2 root      20   0     0     0     0 S  0.0   0.0   0:00.00 kthreadd
     4 root      0 -20     0     0     0 I  0.0   0.0   0:00.00 kworker/0:0H
     6 root      0 -20     0     0     0 I  0.0   0.0   0:00.00 mm_percpu_wq
     7 root      20   0     0     0     0 S  0.0   0.0   0:00.22 ksoftirqd/0
     8 root      20   0     0     0     0 I  0.0   0.0   0:00.37 rcu_sched
     9 root      20   0     0     0     0 I  0.0   0.0   0:00.00 rcu_bh
    10 root      rt    0     0     0     0 S  0.0   0.0   0:00.00 migration/0
    11 root      rt    0     0     0     0 S  0.0   0.0   0:00.00 watchdog/0
    12 root      20   0     0     0     0 S  0.0   0.0   0:00.00 cpuhp/0
    13 root      20   0     0     0     0 S  0.0   0.0   0:00.00 kdevtmpfs
    14 root      0 -20     0     0     0 I  0.0   0.0   0:00.00 netns

```

- c. The priority assigned to the user process Vim is 80.

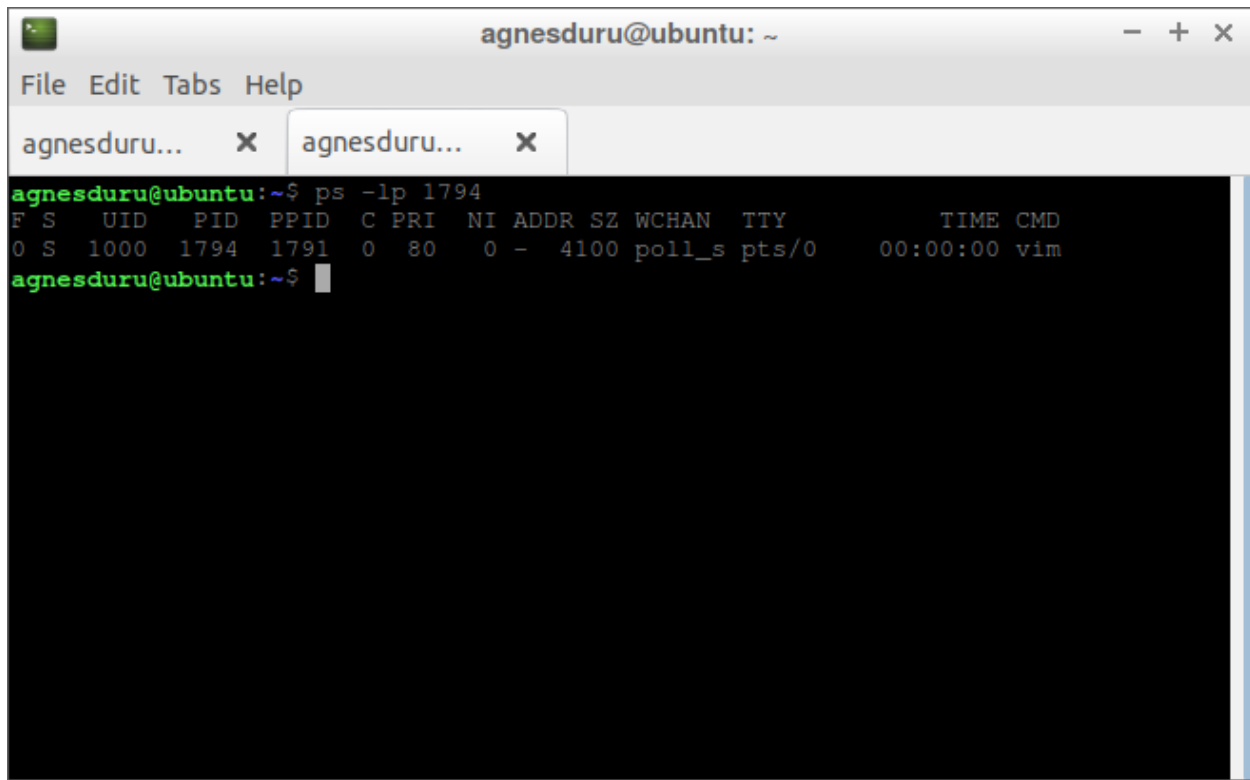


A terminal window titled 'agnesduru@ubuntu: ~' with a menu bar 'File Edit Tabs Help'. The command prompt shows 'agnesduru@ubuntu:~\$ ps -A'.



A terminal window titled 'agnesduru@ubuntu: ~' with a menu bar 'File Edit Tabs Help'. The output of the 'ps -A' command is displayed, showing various system and user processes. The command 'ps pidof vim' is entered at the bottom.

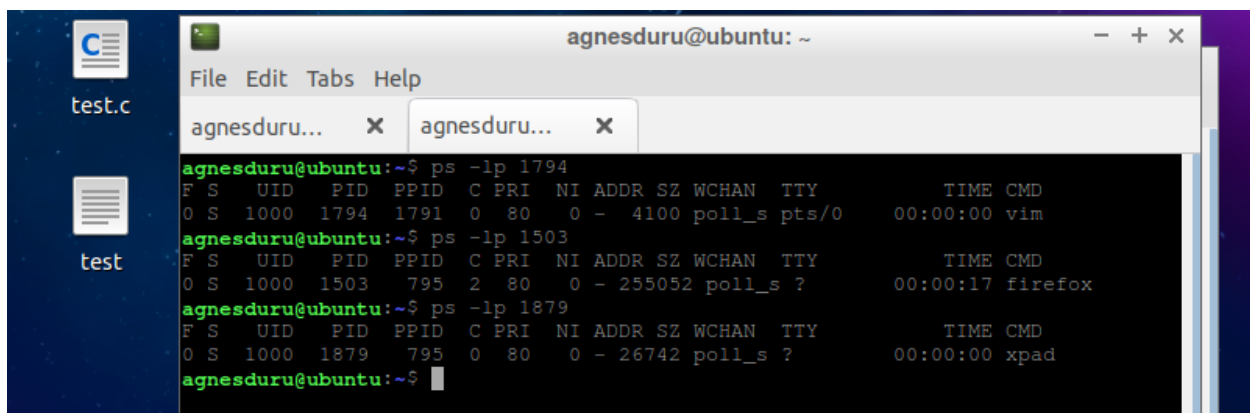
PPID	PID	USER	PR	NI	PM	VSZ	SSZ	TID	TIME	COMMAND
	853	?							00:00:00	nm-applet
	855	?							00:00:00	menu-cached
	865	?							00:00:00	gvfs-afc-volume
	870	?							00:00:00	light-locker
	878	?							00:00:00	gvfs-goa-volume
	884	?							00:00:00	gvfs-mtp-volume
	891	?							00:00:00	dconf-service
	901	?							00:00:00	gvfs-gphoto2-vo
	927	?							00:00:00	pulseaudio
	936	?							00:00:00	gvfsd-trash
	950	?							00:00:00	indicator-sound
	952	?							00:00:00	indicator-appli
	1175	?							00:00:00	packagekitd
	1400	?							00:00:00	gvfsd-metadata
	1462	?							00:00:00	kworker/u2:0
	1503	?							00:00:16	firefox
	1560	?							00:00:01	Web Content
	1636	?							00:00:00	Web Content
	1660	?							00:00:00	lxterminal
	1663	pts/0							00:00:00	vim
	1720	?							00:00:00	x-terminal-emul
	1723	pts/1							00:00:00	bash
	1735	pts/1							00:00:00	ps



A terminal window titled 'agnesduru@ubuntu: ~' with a menu bar (File, Edit, Tabs, Help) and two tabs. The command 'ps -lp 1794' has been executed, displaying process information for PID 1794.

```
agnesduru@ubuntu:~$ ps -lp 1794
F S    UID    PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1000    1794 1791   0  80   0  -  4100 poll_s pts/0    00:00:00 vim
agnesduru@ubuntu:~$
```

- o d. The priority assigned to user processes on my computer is 80. I opened many user systems including Firefox and found that they all share this priority. The default priority assigned to user processes on my system is 20. I found this by using the command and it displayed the default processes and default priority.



A terminal window titled 'agnesduru@ubuntu: ~' with a menu bar (File, Edit, Tabs, Help) and two tabs. Three 'ps -lp' commands have been executed to show process details for PIDs 1794, 1503, and 1879.

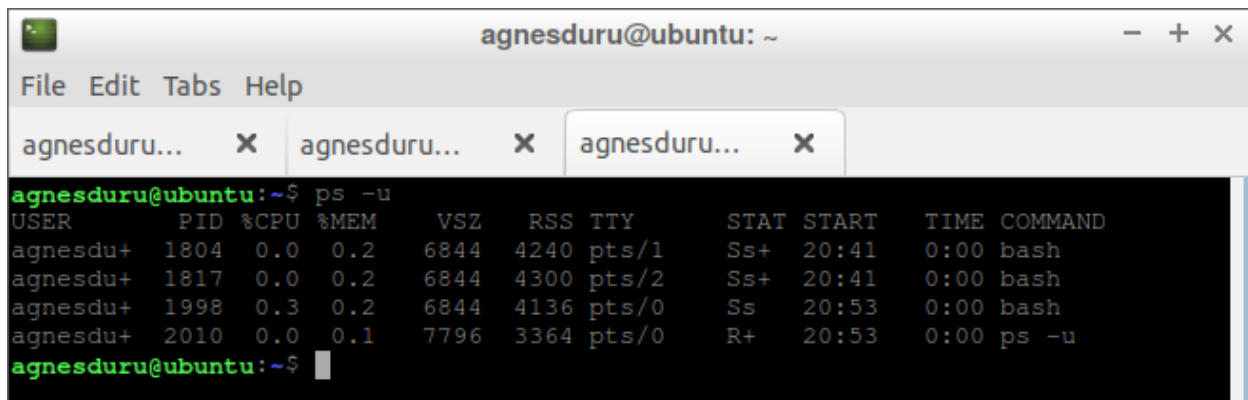
```
agnesduru@ubuntu:~$ ps -lp 1794
F S    UID    PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1000    1794 1791   0  80   0  -  4100 poll_s pts/0    00:00:00 vim
agnesduru@ubuntu:~$ ps -lp 1503
F S    UID    PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1000    1503   795   2  80   0  -  255052 poll_s ?        00:00:17 firefox
agnesduru@ubuntu:~$ ps -lp 1879
F S    UID    PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1000    1879   795   0  80   0  -  26742 poll_s ?        00:00:00 xpad
agnesduru@ubuntu:~$
```

```

agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ ps ecl
F  UID    PID  PPID  PRI  NI     VSZ   RSS WCHAN    STAT TTY        TIME COMMAND
0  1000   1804   1801   20   0    6844   4240 wait     Ss   pts/1      0:00 bash
0  1000   1817   1801   20   0    6844   4300 poll_s   Ss+  pts/2      0:00 bash
0  1000   1998   1801   20   0    6844   4136 poll_s   Ss+  pts/0      0:00 bash
0  1000   2055   1804   20   0    7252   1920  -       R+   pts/1      0:00 ps
agnesduru@ubuntu:~$ 

```

- e. The processes running on my system by me are:



```

agnesduru@ubuntu:~$ ps -u
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
agnesdu+  1804  0.0  0.2   6844   4240 pts/1    Ss+   20:41   0:00 bash
agnesdu+  1817  0.0  0.2   6844   4300 pts/2    Ss+   20:41   0:00 bash
agnesdu+  1998  0.3  0.2   6844   4136 pts/0    Ss    20:53   0:00 bash
agnesdu+  2010  0.0  0.1   7796   3364 pts/0    R+    20:53   0:00 ps -u
agnesduru@ubuntu:~$ 

```

- f. A system process with command bash and pid 1 had priority is 80 and I found this by getting the pid of a command in brackets and using the ps -lp command to display its priority

```

agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ ps -lp 1
F S  UID    PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY        TIME CMD
4 S   0      1     0   0  80   0  -  7584  -   ?          00:00:01 systemd
agnesduru@ubuntu:~$ 

```

- g. The maximum user processes allowed on my virtual machine is: unlimited
SCREENSHOT

```

agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ 
agnesduru@ubuntu:~$ ulimit
unlimited
agnesduru@ubuntu:~$ ulimit
unlimited
agnesduru@ubuntu:~$ 

```

• Part 2 – Nthreads:

➤ Output:

- Same N:

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ for((n=0;n<3;n++)); do ./Nthreads 3; done  
Thread 0 : drew 11  
Thread 1 : drew 50  
Thread 2 : drew 50  
All threads completed!Thread 0 : drew 64  
Thread 1 : drew 50  
Thread 2 : drew 12  
All threads completed!Thread 0 : drew 4  
Thread 1 : drew 4  
Thread 2 : drew 32  
All threads completed!agnesduru@ubuntu:~/Downloads$
```

- Different N:

```
agnesduru@ubuntu: ~/Downloads  
File Edit Tabs Help  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 2  
Thread 0 : drew 55  
Thread 1 : drew 2  
All threads completed!agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 8  
Thread 0 : drew 4  
Thread 1 : drew 6  
Thread 2 : drew 6  
Thread 3 : drew 6  
Thread 4 : drew 4  
Thread 5 : drew 12  
Thread 6 : drew 50  
Thread 7 : drew 12  
All threads completed!agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 3  
Thread 0 : drew 64  
Thread 1 : drew 11  
Thread 2 : drew 100  
All threads completed!agnesduru@ubuntu:~/Downloads$
```


- User Error:
 - Out of Range:

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads -9  
Your seccond Argument must be in the following range from 1 to 9  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 0  
Your seccond Argument must be in the following range from 1 to 9  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads dog  
Your seccond Argument must be in the following range from 1 to 9  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 10  
Your seccond Argument must be in the following range from 1 to 9  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 100  
Your seccond Argument must be in the following range from 1 to 9  
agnesduru@ubuntu:~/Downloads$
```

- No input:

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads  
usage:./Nthreads <integer value>  
agnesduru@ubuntu:~/Downloads$
```


• Part 3 – Drawing Straws:

➤ Output:

○ Same N:

```
agnesduru@ubuntu: ~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ for((n=0;n<3;n++)); do ./drawingStraws 3; done  
Thread 0: drew 11  
Thread 1: drew 100  
Thread 2: drew 50  
Loser: Thread 0 drew the smallest straw!  
All threads completed!  
Thread 0: drew 6  
Thread 1: drew 4  
Thread 2: drew 2  
Loser: Thread 2 drew the smallest straw!  
All threads completed!  
Thread 0: drew 2  
Thread 1: drew 6  
Thread 2: drew 12  
Loser: Thread 0 drew the smallest straw!  
All threads completed!  
agnesduru@ubuntu:~/Downloads$
```

○ Different N:

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ gcc -g -Wall -pthread Nthreads.c -o Nthreads  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 2  
Thread 0 : drew 55  
Thread 1 : drew 2  
All threads completed! agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 8  
Thread 0 : drew 4  
Thread 1 : drew 6  
Thread 2 : drew 6  
Thread 3 : drew 6  
Thread 4 : drew 4  
Thread 5 : drew 12  
Thread 6 : drew 50  
Thread 7 : drew 12  
All threads completed! agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./Nthreads 3  
Thread 0 : drew 64  
Thread 1 : drew 11  
Thread 2 : drew 100  
All threads completed! agnesduru@ubuntu:~/Downloads$
```

- User Error:
 - Out of Range:

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./drawingStraws 0  
Your second Argument must be in the following range from 1 to 9 agnesduru@ubuntu  
:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./drawingStraws -5  
Your second Argument must be in the following range from 1 to 9 agnesduru@ubuntu  
:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./drawingStraws 100  
Your second Argument must be in the following range from 1 to 9 agnesduru@ubuntu  
:~/Downloads$  
agnesduru@ubuntu:~/Downloads$
```

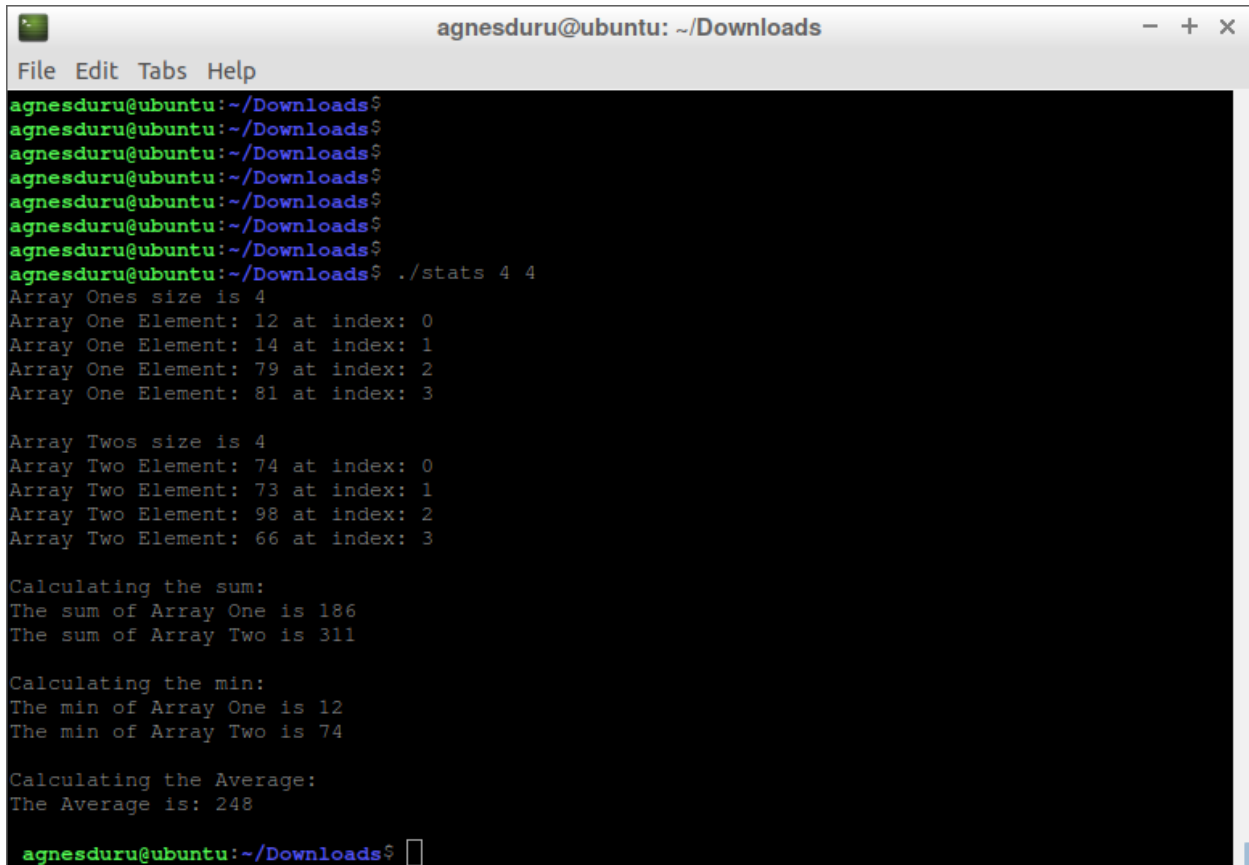
- No input:

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./drawingStraws  
usage:./Nthreads <integer value>  
agnesduru@ubuntu:~/Downloads$
```

Answer: No two numbers from the global array would get picked twice . This is so because I stored the index of the array that was randomly picked. After it had been used accordingly I set the value of array at that index to 0. I then added that it would continue to search for a new index while the array value at that index is not equal to 0.

● Part 4 – Stats:

- Output:
 - Same N: Using 4



```
agnesduru@ubuntu: ~/Downloads
File Edit Tabs Help
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$ ./stats 4 4
Array Ones size is 4
Array One Element: 12 at index: 0
Array One Element: 14 at index: 1
Array One Element: 79 at index: 2
Array One Element: 81 at index: 3

Array Twos size is 4
Array Two Element: 74 at index: 0
Array Two Element: 73 at index: 1
Array Two Element: 98 at index: 2
Array Two Element: 66 at index: 3

Calculating the sum:
The sum of Array One is 186
The sum of Array Two is 311

Calculating the min:
The min of Array One is 12
The min of Array Two is 74

Calculating the Average:
The Average is: 248

agnesduru@ubuntu:~/Downloads$
```

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./stats 4 4  
Array Ones size is 4  
Array One Element: 58 at index: 0  
Array One Element: 12 at index: 1  
Array One Element: 34 at index: 2  
Array One Element: 25 at index: 3  
  
Array Twos size is 4  
Array Two Element: 83 at index: 0  
Array Two Element: 68 at index: 1  
Array Two Element: 25 at index: 2  
Array Two Element: 48 at index: 3  
  
Calculating the sum:  
The sum of Array One is 129  
The sum of Array Two is 224  
  
Calculating the min:  
The min of Array One is 12  
The min of Array Two is 83  
  
Calculating the Average:  
The Average is: 176  
  
agnesduru@ubuntu:~/Downloads$
```

```
agnesduru@ubuntu: ~/Downloads  
File Edit Tabs Help  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./stats 4 4  
Array Ones size is 4  
Array One Element: 12 at index: 0  
Array One Element: 14 at index: 1  
Array One Element: 79 at index: 2  
Array One Element: 81 at index: 3  
  
Array Twos size is 4  
Array Two Element: 74 at index: 0  
Array Two Element: 73 at index: 1  
Array Two Element: 98 at index: 2  
Array Two Element: 66 at index: 3  
  
Calculating the sum:  
The sum of Array One is 186  
The sum of Array Two is 311  
  
Calculating the min:  
The min of Array One is 12  
The min of Array Two is 74  
  
Calculating the Average:  
The Average is: 248  
  
agnesduru@ubuntu:~/Downloads$
```

- Different N:

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./stats 3 4  
Array Ones size is 3  
Array One Element: 87 at index: 0  
Array One Element: 52 at index: 1  
Array One Element: 39 at index: 2  
  
Array Twos size is 4  
Array Two Element: 72 at index: 0  
Array Two Element: 3 at index: 1  
Array Two Element: 36 at index: 2  
Array Two Element: 72 at index: 3  
  
Calculating the sum:  
The sum of Array One is 178  
The sum of Array Two is 183  
  
Calculating the min:  
The min of Array One is 39  
The min of Array Two is 72  
  
Calculating the Average:  
The Average is: 180  
  
agnesduru@ubuntu:~/Downloads$
```

```
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$  
agnesduru@ubuntu:~/Downloads$ ./stats 5 6  
Array Ones size is 5  
Array One Element: 23 at index: 0  
Array One Element: 34 at index: 1  
Array One Element: 67 at index: 2  
Array One Element: 80 at index: 3  
Array One Element: 51 at index: 4  
  
Array Twos size is 6  
Array Two Element: 99 at index: 0  
Array Two Element: 97 at index: 1  
Array Two Element: 48 at index: 2  
Array Two Element: 22 at index: 3  
Array Two Element: 53 at index: 4  
Array Two Element: 80 at index: 5  
  
Calculating the sum:  
The sum of Array One is 255  
The sum of Array Two is 399  
  
Calculating the min:  
The min of Array One is 23  
The min of Array Two is 99  
  
Calculating the Average:  
The Average is: 327  
  
agnesduru@ubuntu:~/Downloads$
```

```
agnesduru@ubuntu: ~/Downloads
File Edit Tabs Help
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$ ./stats 6 7
Array Ones size is 6
Array One Element: 58 at index: 0
Array One Element: 29 at index: 1
Array One Element: 82 at index: 2
Array One Element: 1 at index: 3
Array One Element: 93 at index: 4
Array One Element: 11 at index: 5

Array Twos size is 7
Array Two Element: 100 at index: 0
Array Two Element: 80 at index: 1
Array Two Element: 92 at index: 2
Array Two Element: 73 at index: 3
Array Two Element: 54 at index: 4
Array Two Element: 23 at index: 5
Array Two Element: 34 at index: 6

Calculating the sum:
The sum of Array One is 274
The sum of Array Two is 456

Calculating the min:
The min of Array One is 1
The min of Array Two is 100

Calculating the Average:
The Average is: 365

agnesduru@ubuntu:~/Downloads$
```

- User Error:
 - Out of Range:

```
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$ ./stats 0
usage:./stats <integer value> <integer value>
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$ ./stats -4
usage:./stats <integer value> <integer value>
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$ ./stats 3
usage:./stats <integer value> <integer value>
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
```

- No input:

```
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$ ./stats
usage:./stats <integer value> <integer value>
agnesduru@ubuntu:~/Downloads$
agnesduru@ubuntu:~/Downloads$
```

Answer: The restrictions if any that I had set was including `pthread_joins` so that I main could retrieve the return value. The other restriction is that I added `pthread_exit` so that the main thread would not exit and thus terminate all the other threads.