

Operating System Lab

Assignment 1

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Q1. In a c program, print the address of a variable and enter into a long loop. Start 3/4 processes of the same program and observe the printed address values. Try the experiment on different architectures/OSs. Are the addresses same?

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/wait.h>
#include<sys/types.h>
#include<unistd.h>

int main(){
    int a;
    printf("Main Process ID: %d\n",getpid());
    pid_t C1 = fork();
    if(C1==0){
        printf("Address in Child C1 PID: %d , PPID: %d = %p\n",getpid(),getppid(),&a);
    } else {
        printf("Address in Parent PID: %d , PPID: %d = %p\n",getpid(),getppid(),&a);
    }
    pid_t C2 = fork();
    if(C1==0 && C2==0){
        printf("Address in C1 Child, C2 Child PID: %d , PPID: %d = %p\n",getpid(),getppid(),&a);
    } else if(C1==0 && C2!=0){
        printf("Address in C1 Child, C2 Parent PID: %d , PPID: %d = %p\n",getpid(),getppid(),&a);
    } else if(C1!=0 && C2==0){
        printf("Address in C1 Parent, C2 Child PID: %d , PPID: %d = %p\n",getpid(),getppid(),&a);
    } else {
        printf("Address in C1 Parent, C2 Parent PID: %d , PPID: %d = %p\n",getpid(),getppid(),&a);
    }
    while(1){
```

```

    //infinite loop
}
return 0;
}

```

OUTPUT:

```

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab$ gcc one.c
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab$ ./a.out
Main Process ID: 7265
Address in Parent PID: 7265 , PPID: 3823 = 0x7fff6958836c
Address in C1 Parent, C2 Parent PID: 7265 , PPID: 3823 = 0x7fff6958836c
Address in Child C1 PID: 7266 , PPID: 7265 = 0x7fff6958836c
Address in C1 Parent, C2 Child PID: 7267 , PPID: 7265 = 0x7fff6958836c
Address in C1 Child, C2 Parent PID: 7266 , PPID: 7265 = 0x7fff6958836c
Address in C1 Child, C2 Child PID: 7268 , PPID: 7266 = 0x7fff6958836c
[]

```

```

es  Terminal  Sep 6 22:10
aadi@aadi: ~/Desktop/FifthSem/Operating-System-Lab
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab$ ps -u
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
aadi      1415  0.0  0.0 164012 6556 tty2    Ssl+  21:19   0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SHELL_SESSION_MODE=ubuntu /usr/bin/gnome-session
aadi      1417  3.2  1.0 862540 81912 tty2    Sl+   21:19   1:39 /usr/lib/xorg/Xorg vt2 -displayfd 3 -auth /run/user/1000/gdm/Xauthority -background none -noreset -
aadi      1434  0.0  0.1 188084 13636 tty2    Sl+   21:19   0:00 /usr/libexec/gnome-session-binary --systemd --systemd --session=ubuntu
aadi      3823  0.0  0.0 11236 5600 pts/0    Ss   21:24   0:00 /bin/bash
aadi      5950  0.0  0.0 11100 5344 pts/1    Ss   21:47   0:00 bash
aadi      7356 99.7  0.0 2488 520 pts/0    R+   22:09   0:32 ./a.out
aadi      7357 99.9  0.0 2488 88 pts/0    R+   22:09   0:32 ./a.out
aadi      7358 99.9  0.0 2488 88 pts/0    R+   22:09   0:32 ./a.out
aadi      7359 99.9  0.0 2488 88 pts/0    R+   22:09   0:32 ./a.out
aadi      7366  0.0  0.0 11716 3528 pts/1    R+   22:10   0:00 ps -u
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab$

```

Q2. Learn the top command to display resource utilization statistics of processes. In one window, start the top command

```
top - 22:12:15 up 53 min, 1 user, load average: 1.17, 1.80, 1.37
Tasks: 265 total, 1 running, 264 sleeping, 0 stopped, 0 zombie
%Cpu(s): 6.2 us, 3.5 sy, 0.0 ni, 90.3 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 7682.5 total, 4415.7 free, 1254.2 used, 2012.6 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used, 5793.9 avail Mem

  PID USER      PR  NI   VIRT    RES    SHR   S   %CPU  %MEM    TIME+   COMMAND
 3604 aadi       20   0   50.5g 275652 113732 S   18.8   3.5   3:09.26   code
1417 aadi       20   0 852944 88948   44984 S   12.5   1.0   1:44.79   xorg
7592 aadi       20   0  12208   4252   3496 R   12.5   0.1   0:00.03   top
1560 aadi       20   0 4967480 299864 115100 S    6.2   3.8   3:14.31   gnome-shell
3559 aadi       20   0 586204 161484 108560 S    6.2   2.1   1:25.29   code
    1 root      20   0 167560 11352   6184 S    0.0   0.1   0:00.00   systemd
    2 root      20   0      0      0      0 S    0.0   0.0   0:00.01   kthreadd
    3 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   rcu_gp
    4 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   rcu_par_gp
    6 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/0:0H-kblockd
    9 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   mm_percpu_wq
   10 root      20   0      0      0      0 S    0.0   0.0   0:00.15   ksoftirqd/0
   11 root      20   0      0      0      0 I    0.0   0.0   0:04.50   rcu_sched
   12 root      0  0      0      0      0 S    0.0   0.0   0:00.01   migration/0
   13 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/0
   14 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/0
   15 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/1
   16 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/1
   17 root      0  0      0      0      0 S    0.0   0.0   0:00.16   migration/1
   18 root      20   0      0      0      0 S    0.0   0.0   0:00.00   ksoftirqd/1
   20 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/1:0H-kblockd
   21 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/2
   22 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/2
   23 root      0  0      0      0      0 S    0.0   0.0   0:00.01   migration/2
   24 root      20   0      0      0      0 S    0.0   0.0   0:00.06   ksoftirqd/2
   26 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/2:0H-kblockd
   27 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/3
   28 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/3
   29 root      0  0      0      0      0 S    0.0   0.0   0:00.16   migration/3
   30 root      20   0      0      0      0 S    0.0   0.0   0:00.07   ksoftirqd/3
   32 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/3:0H-kblockd
   33 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/4
   34 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/4
   35 root      0  0      0      0      0 S    0.0   0.0   0:00.17   migration/4
   36 root      20   0      0      0      0 S    0.0   0.0   0:00.00   ksoftirqd/4
   38 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/4:0H-kblockd
   39 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/5
   40 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/5
   41 root      0  0      0      0      0 S    0.0   0.0   0:00.17   migration/5
   42 root      20   0      0      0      0 S    0.0   0.0   0:00.00   ksoftirqd/5
   44 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/5:0H-kblockd
   45 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/6
   46 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/6
```

Now start a browser and see the effect in the 'top' display

Opened Chrome

```
top - 22:13:17 up 54 min, 1 user, load average: 1.23, 1.70, 1.36
Tasks: 284 total, 1 running, 283 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.6 us, 0.2 sy, 0.0 ni, 99.0 id, 0.1 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 7682.5 total, 4082.8 free, 1445.0 used, 2154.7 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used, 5487.4 avail Mem

  PID USER      PR  NI   VIRT    RES    SHR   S   %CPU  %MEM    TIME+   COMMAND
 8189 aadi       20   0   20.4g 99284   77652 S    1.7   1.3   0:00.27   chrome
 3604 aadi       20   0   50.5g 280204 113424 S    1.3   3.6   3:17.60   code
 8030 aadi       20   0   16.6g 199692 144224 S    1.0   2.5   0:01.78   chrome
 3559 aadi       20   0   563992 158488 105396 S    0.7   2.0   1:28.37   code
 8110 aadi       20   0   20.4g 158136 134444 S    0.7   2.0   0:00.65   chrome
    1 root      20   0      0      0      0 I    0.3   0.0   0:04.60   rcu_sched
   670 message+   20   0  10104   6636   4116 S    0.3   0.1   0:01.51   dbus-daemon
  6452 root      20   0      0      0      0 I    0.3   0.0   0:00.05   kworker/7:0-mm_percpu_wq
  8075 aadi       20   0   16.3g 97980   82684 S    0.3   1.2   0:00.28   chrome
  8076 aadi       20   0   16.3g 45380   34180 S    0.3   0.6   0:00.02   chrome
  8151 aadi       20   0   20.4g 92040   73124 S    0.3   1.2   0:00.19   chrome
    1 root      20   0 167560 11352   8184 S    0.0   0.1   0:08.21   systemd
    2 root      20   0      0      0      0 S    0.0   0.0   0:00.01   kthreadd
    3 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   rcu_gp
    4 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   rcu_par_gp
    6 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/0:0H-kblockd
    9 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   mm_percpu_wq
   10 root      20   0      0      0      0 S    0.0   0.0   0:00.15   ksoftirqd/0
   12 root      0  0      0      0      0 S    0.0   0.0   0:00.01   migration/0
   13 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/0
   14 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/0
   15 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/1
   16 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/1
   17 root      0  0      0      0      0 S    0.0   0.0   0:00.16   migration/1
   18 root      20   0      0      0      0 S    0.0   0.0   0:00.00   ksoftirqd/1
   20 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/1:0H-kblockd
   21 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/2
   22 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/2
   23 root      0  0      0      0      0 S    0.0   0.0   0:00.01   migration/2
   24 root      20   0      0      0      0 S    0.0   0.0   0:00.06   ksoftirqd/2
   26 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/2:0H-kblockd
   27 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/3
   28 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/3
   29 root      0  0      0      0      0 S    0.0   0.0   0:00.16   migration/3
   30 root      20   0      0      0      0 S    0.0   0.0   0:00.07   ksoftirqd/3
   32 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/3:0H-kblockd
   33 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/4
   34 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/4
   35 root      0  0      0      0      0 S    0.0   0.0   0:00.17   migration/4
   36 root      20   0      0      0      0 S    0.0   0.0   0:00.00   ksoftirqd/4
   38 root      0 -20      0      0      0 I    0.0   0.0   0:00.00   kworker/4:0H-kblockd
   39 root      20   0      0      0      0 S    0.0   0.0   0:00.00   cpuhp/5
   40 root     -51   0      0      0      0 S    0.0   0.0   0:00.00   idle_inject/5
```

Compile a program and observe the effects

How much memory is free in the system?

Ans: 4082.8 MB

Which process is taking the most of the CPU?

Ans: 1.7%

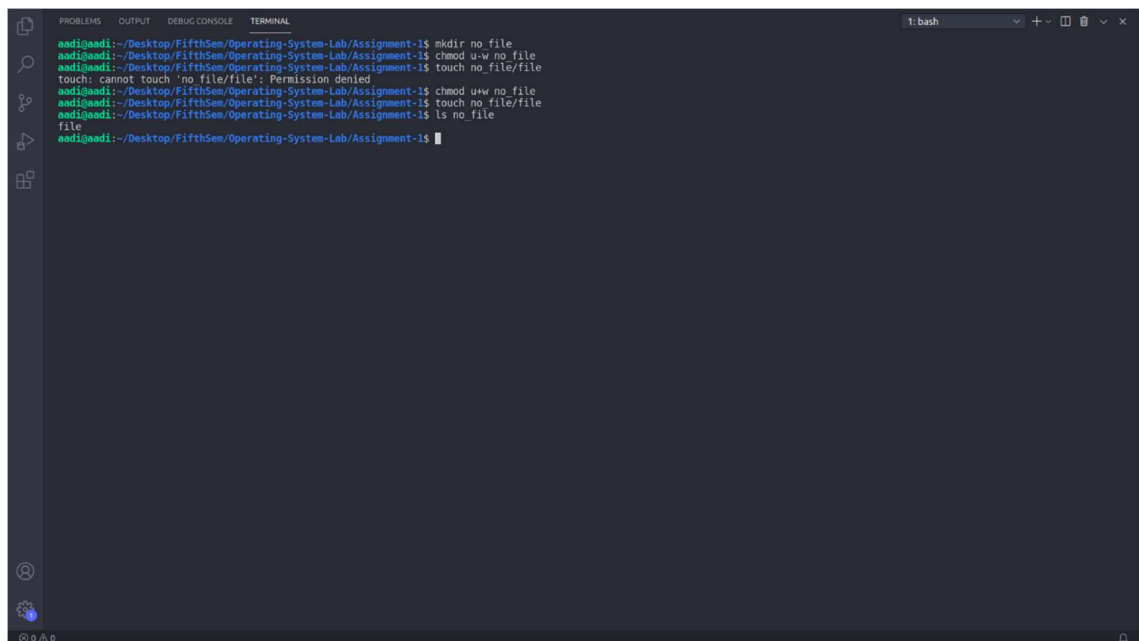
Which process has got the maximum memory share?

Ans: code

Q3. Use change mod command to

A) Allow/Disallow a user to create a file in a directory

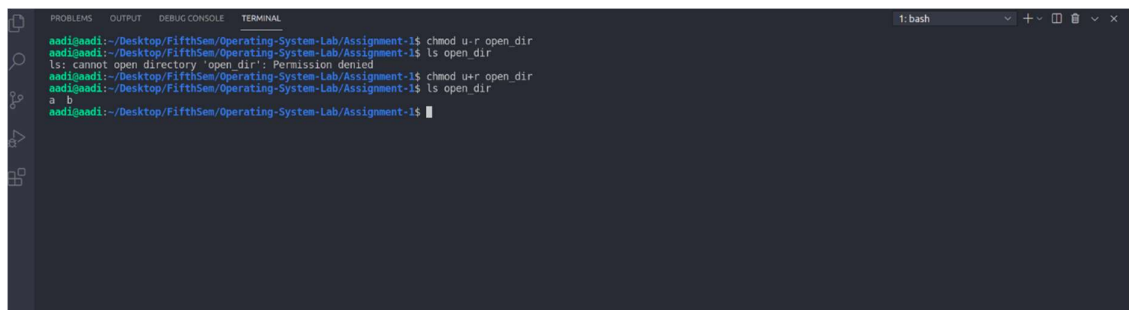
`chmod u-w {dir}` and `chmod u+w {dir}`



```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ mkdir no_file
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ chmod u-w no_file
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ touch no_file/file
touch: cannot touch 'no_file/file': Permission denied
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ chmod u+w no_file
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ touch no_file/file
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ ls no_file
file
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$
```

B) Allow/disallow an user to open an existing directory

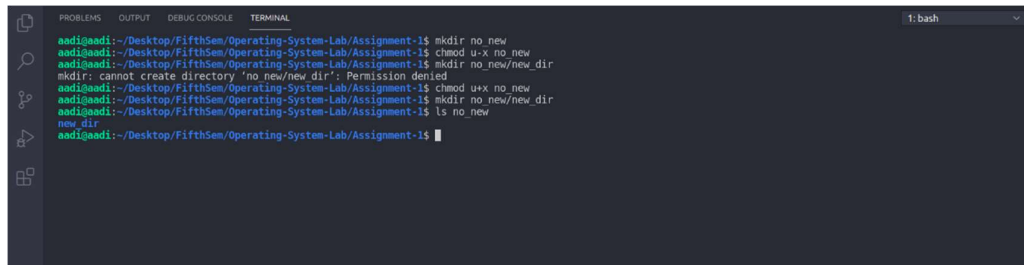
`chmod u-r {dir}` and `chmod u+r {dir}`



```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ chmod u-r open_dir
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ ls open_dir
ls: cannot open directory 'open_dir': Permission denied
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ chmod u+r open_dir
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ ls open_dir
a b
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$
```

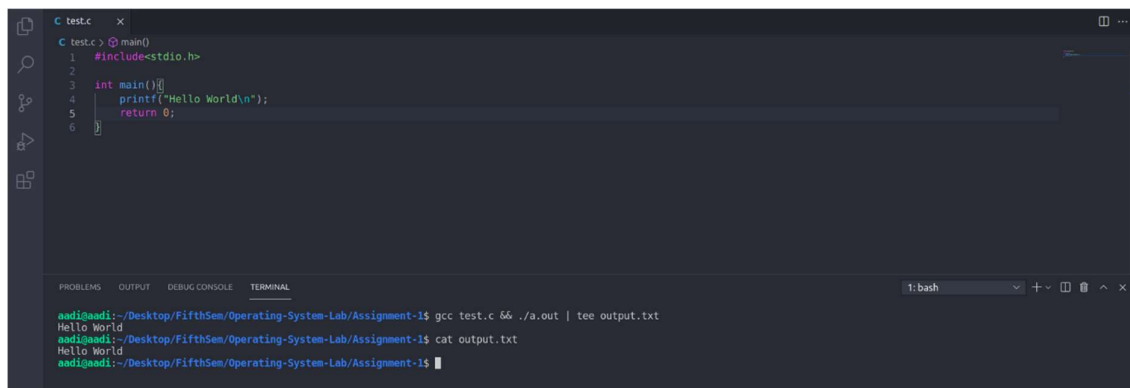
C) Allow/Disallow an user to open any new directory

`chmod u-x {dir}` and `chmod u+x {dir}`



```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL 1: bash
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ mkdir no_new
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ chmod u-x no_new
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ mkdir no_new/new_dir
mkdir: cannot create directory 'no_new/new_dir': Permission denied
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ chmod u+x no_new
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ mkdir no_new/new_dir
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ ls no_new
new_dir
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$
```

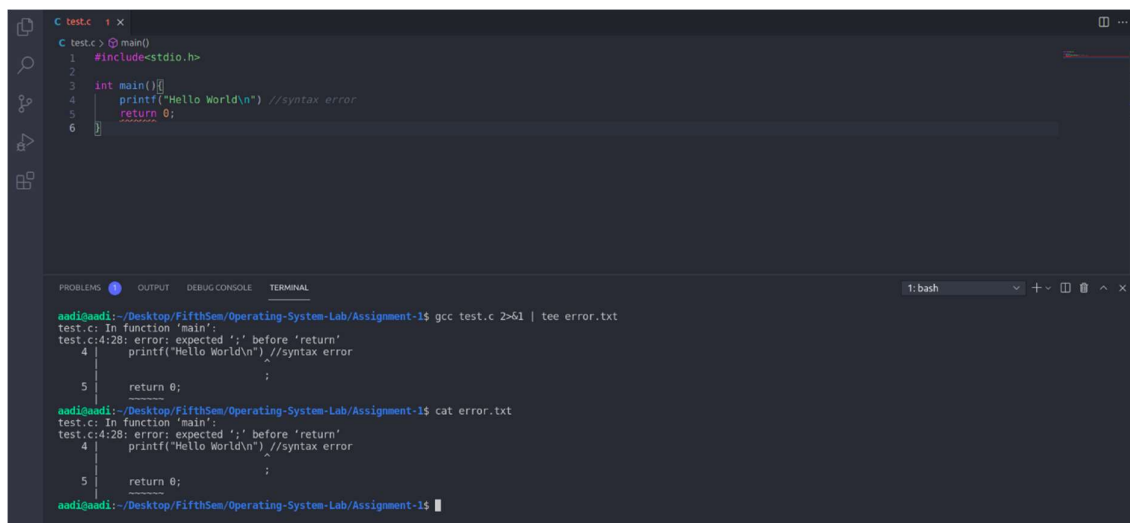
Q4. Use pipe command to write all of your program output to an output.txt file



```
C test.c x
C test.c > main()
1 #include<stdio.h>
2
3 int main(){
4     printf("Hello World\n");
5     return 0;
6 }

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL 1: bash
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ gcc test.c -o a.out | tee output.txt
Hello World
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ cat output.txt
Hello World
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$
```

Q5. Use pipe command to write all your compilation error to a file error.txt



```
C test.c x
C test.c > main()
1 #include<stdio.h>
2
3 int main(){
4     printf("Hello World\n") //syntax error
5     return 0;
6 }

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL 1: bash
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ gcc test.c 2>&1 | tee error.txt
test.c: In function 'main':
test.c:4:28: error: expected ';' before 'return'
4 |     printf("Hello World\n") //syntax error
  |                             ^
5 |     return 0;
  |     ~~~~~~
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$ cat error.txt
test.c: In function 'main':
test.c:4:28: error: expected ';' before 'return'
4 |     printf("Hello World\n") //syntax error
  |                             ^
5 |     return 0;
  |     ~~~~~~
aadi@aadi:~/Desktop/FifthSem/Operating-System-Lab/Assignment-1$
```