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Branch - CBA Batch - 41
OS Practical 9

1. How to check/See Memory Allocation in your system. Also check that which users have consumed how much main and virtual memory? Also verify that:
 - A. List of users who have started a process and tried to consume memory.
 - B. Total size of the process in Virtual Memory in KB as a decimal integer.
 - C. The Resident Set Size of the process, in kilobytes as a decimal integer.
 - D. The ratio of the process's resident set size to the physical memory on the machine, expressed as a percentage.
 - E. Name of the process

Command :

top (or htop can be used if installed)

Output :

```
Fedora_YSL (Fedora_YSL_Setup2) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

top -
top - 10:48:19 up 1:11, 1 user, load average: 0.25, 0.28, 0.27
Tasks: 251 total, 2 running, 249 sleeping, 0 stopped, 0 zombie
%Cpu(s): 1.0 us, 0.2 sy, 0.0 ni, 98.3 id, 0.0 wa, 0.5 hi, 0.1 si, 0.0 st
MiB Mem : 1969.1 total, 363.0 free, 1077.6 used, 528.6 buff/cache
MiB Swap: 1969.0 total, 1263.0 free, 706.0 used, 546.5 avail Mem

  PID USER      PR  NI   VIRT   RES   SHR  S  %CPU  %MEM    TIME+  COMMAND
 1462 admin     20   0 5089596 142728 70468 S   3.0   7.1   6:47.36 cinnamon
  945 root       20   0 464708 105044 65908 S   1.0   5.2   1:23.96 Xorg
 1446 root       20   0 259636 24388  3724 S   0.3   1.2   0:02.91 sssd_kcm
 4298 admin     20   0 224856  3656  2980 R   0.3   0.2   0:00.02 top
    1 root       20   0 171500   9432  6176 S   0.0   0.5   0:01.02 systemd
    2 root       20   0      0      0      0 S   0.0   0.0   0:00.00 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
    5 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 slub_flushwq
    6 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 netns
    8 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-kblockd
    9 root       20   0      0      0      0 I   0.0   0.0   0:01.13 kworker/u8:0-flush-btrfs-1
   10 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 mm_percpu_wq
   12 root       20   0      0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_kthread
   13 root       20   0      0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_rude_kthread
   14 root       20   0      0      0      0 I   0.0   0.0   0:00.00 rcu_tasks_trace_kthread
   15 root       20   0      0      0      0 S   0.0   0.0   0:00.02 ksoftirqd/0
   16 root       20   0      0      0      0 I   0.0   0.0   0:00.71 rcu_preempt
   17 root       rt    0      0      0      0 S   0.0   0.0   0:00.00 migration/0
   19 root       20   0      0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
   20 root       20   0      0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
   21 root       rt    0      0      0      0 S   0.0   0.0   0:00.14 migration/1
   22 root       20   0      0      0      0 S   0.0   0.0   0:00.02 ksoftirqd/1
   24 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
   25 root       20   0      0      0      0 S   0.0   0.0   0:00.00 cpuhp/2
   26 root       rt    0      0      0      0 S   0.0   0.0   0:00.14 migration/2
```

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Branch - CBA Batch - 41

OS Practical 9

2. For a given Problem -1 , Design the solution after applying Banker Algorithm using C program.

Code :

```
#include "fcntl.h"
#include <unistd.h>
#include <sys/stat.h>
#include "stdio.h"
#include "stdlib.h"
#include <sys/mman.h>
int main()
{
    int fd;
    char buffer[100];
    fd = open ("ICTGUNI. txt", O_CREAT | O_RDWR, 0666) ;
    if(fd != -1)
    {
        char a[] = "I am student of ICT!!";
        write(fd, a, sizeof(a));
        struct stat st;
        stat("ICTGUNI. txt", &st) ;
        printf("File Size: %lu\n", st.st_size);
        int *value = mmap(NULL, 4*sizeof (int), PROT_READ |
PROT_WRITE, MAP_PRIVATE | MAP_ANONYMOUS, 0, 0);
        if (value == MAP_FAILED)
```

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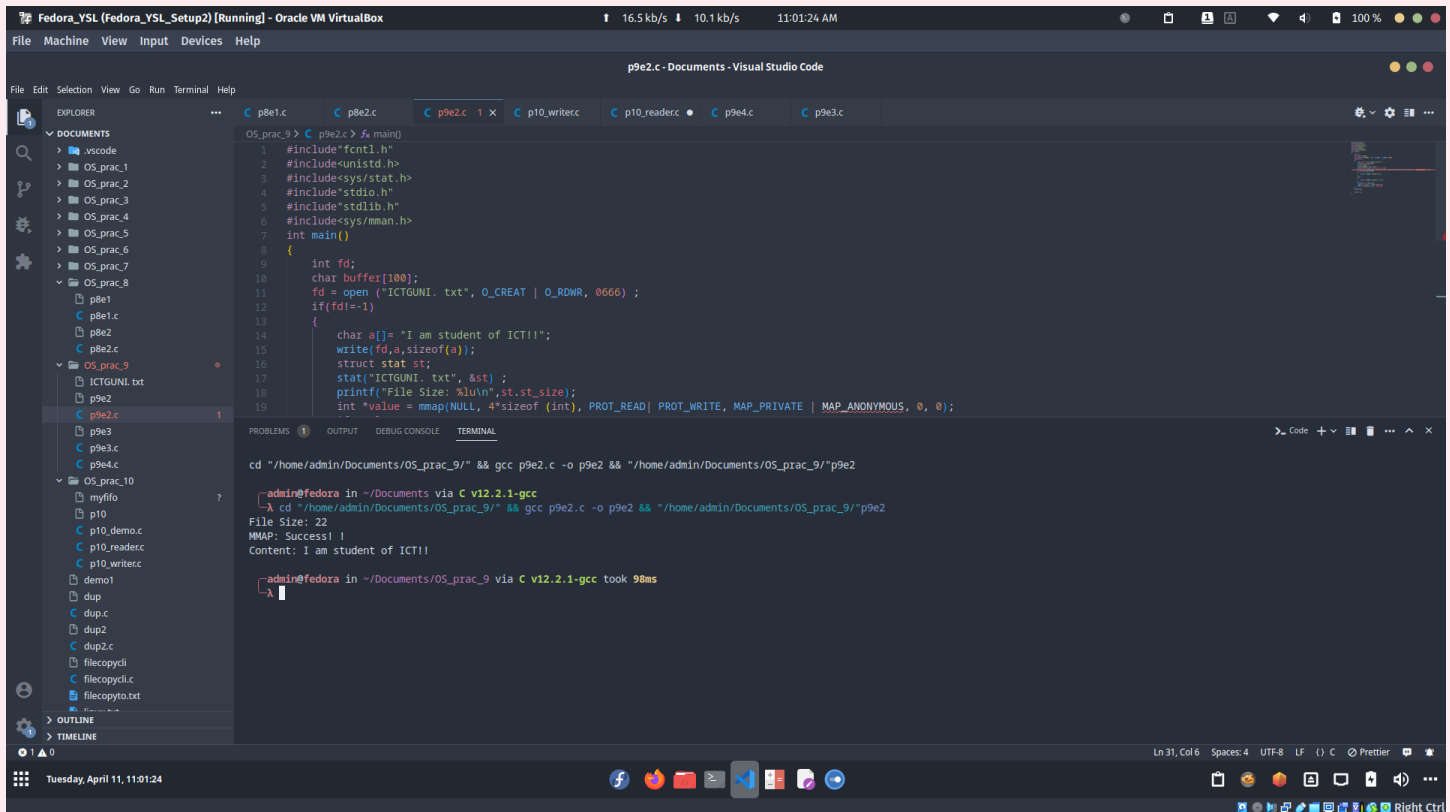
Branch - CBA Batch - 41

OS Practical 9

```
{  
    printf ("MMAP: Failed!!\n");  
}  
else  
{  
    printf ("MMAP: Success! !\n");  
}  
lseek(fd, 0, SEEK_SET);  
read (fd, buffer, sizeof (buffer)) ;  
printf ("Content: %s\n", buffer);  
}  
close(fd);  
  
return 0;  
}
```

Output :

Name - Yash Lakhtariya
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Branch - CBA Batch - 41
OS Practical 9



```
#include<fcntl.h>
#include<unistd.h>
#include<sys/stat.h>
#include<stdio.h>
#include<stdlib.h>
#include<sys/mman.h>
int main()
{
    int fd;
    char buffer[100];
    fd = open("ICTGUNI. txt", O_CREAT | O_RDWR, 0666);
    if(fd!=1)
    {
        char a[] = "I am student of ICT!!";
        write(fd,a,sizeof(a));
        struct stat st;
        stat("ICTGUNI. txt",&st);
        printf("File Size: %lu\n",st.st_size);
        int *value = mmap(NULL,4*sizeof(int), PROT_READ| PROT_WRITE, MAP_PRIVATE | MAP_ANONYMOUS, 0, 0);
    }
}
```

```
cd ~/home/admin/Documents/OS_prac_9/" && gcc p9e2.c -o p9e2 && ~/home/admin/Documents/OS_prac_9/"p9e2
-admin@fedora in ~/Documents via C v12.2.1-gcc
~A cd ~/home/admin/Documents/OS_prac_9/" && gcc p9e2.c -o p9e2 && ~/home/admin/Documents/OS_prac_9/"p9e2
File Size: 22
MMAP: Success! I
Content: I am student of ICT!!
-admin@fedora in ~/Documents/OS_prac_9 via C v12.2.1-gcc took 98ms
~A
```

3. Using memchr() system call, perform memory searches (scanning of memory) for the first occurrence of the character given by setting the first n bytes of the string pointed to.

Code :

```
#include<stdio.h>
#include<string.h>

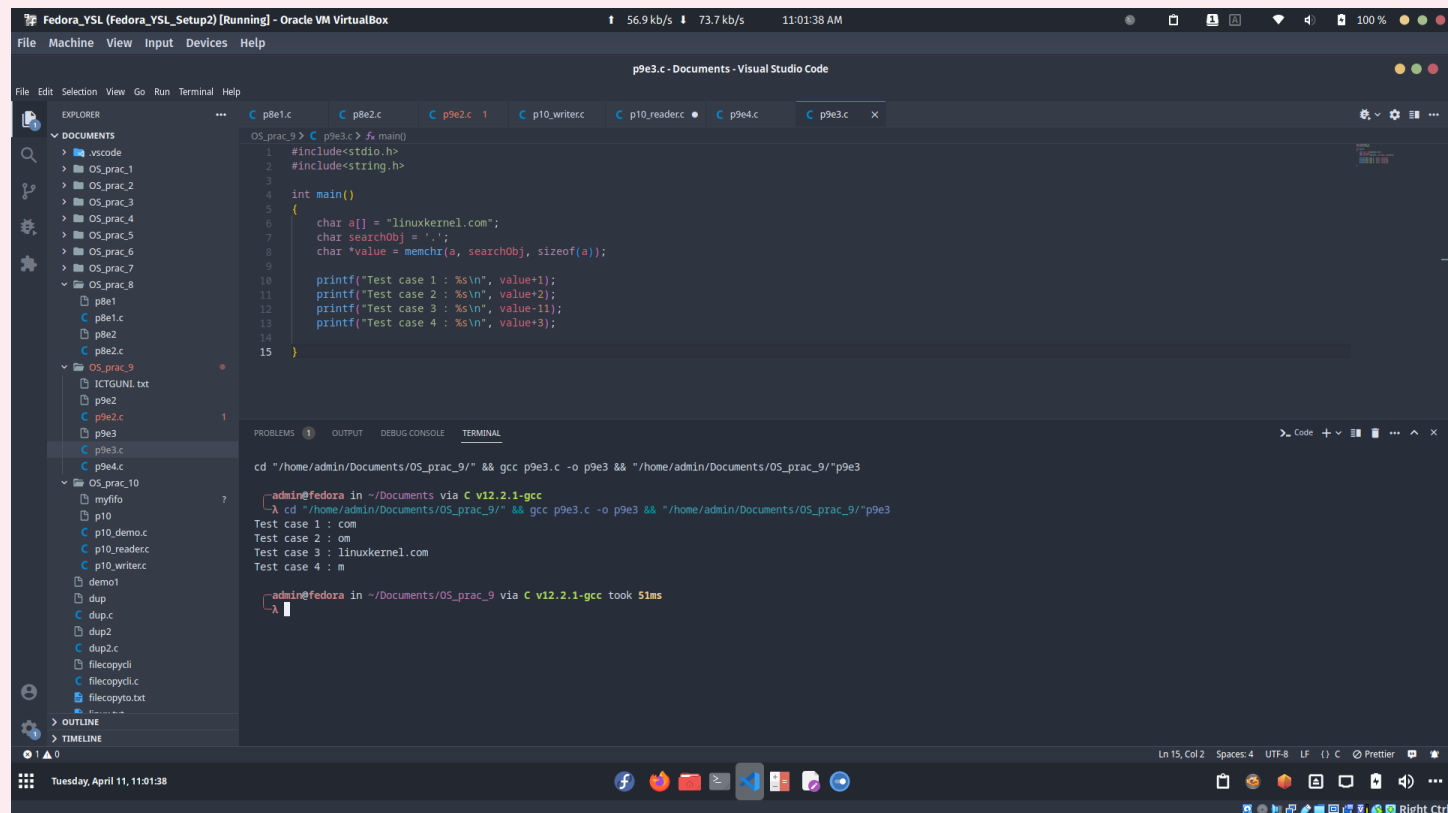
int main()
{
    char a[] = "linuxkernel.com";
    char searchObj = '.';
```

Name - Yash Lakhtariya
Enrollment number - 21162101012
Branch - CBA Batch - 41
OS Practical 9

```
char *value = memchr(a, searchObj, sizeof(a));

printf("Test case 1 : %s\n", value+1);
printf("Test case 2 : %s\n", value+2);
printf("Test case 3 : %s\n", value-11);
printf("Test case 4 : %s\n", value+3);
}
```

Output :



Name - Yash Lakhtariya

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Branch - CBA Batch - 41

OS Practical 9

4. The system functions `brk()`, and `sbrk()` is utilized to regulate the amount of memory allotted towards the process's data segment. Usually, these functions are invoked from a larger memory management library function like `malloc`. The program break, which identifies the end of the process's heap section, is moved about with `brk()` and `sbrk()`. `brk()` assigns the value of `addr` to the ending of the heap segment. `sbrk()` increases the heap space of the program by increment bytes. It takes you back to the earlier program break. The present location of the program break can be found by calling `sbrk()` with just a raise of 0. Implement `brk()` and `SBRK()` system call in C

Code :

```
#include<unistd.h>
#include<stdio.h>

int main()
{
    void* old_brk = sbrk(0); // get current end of heap memory
segment
    printf("Current end of heap : %p\n", old_brk);

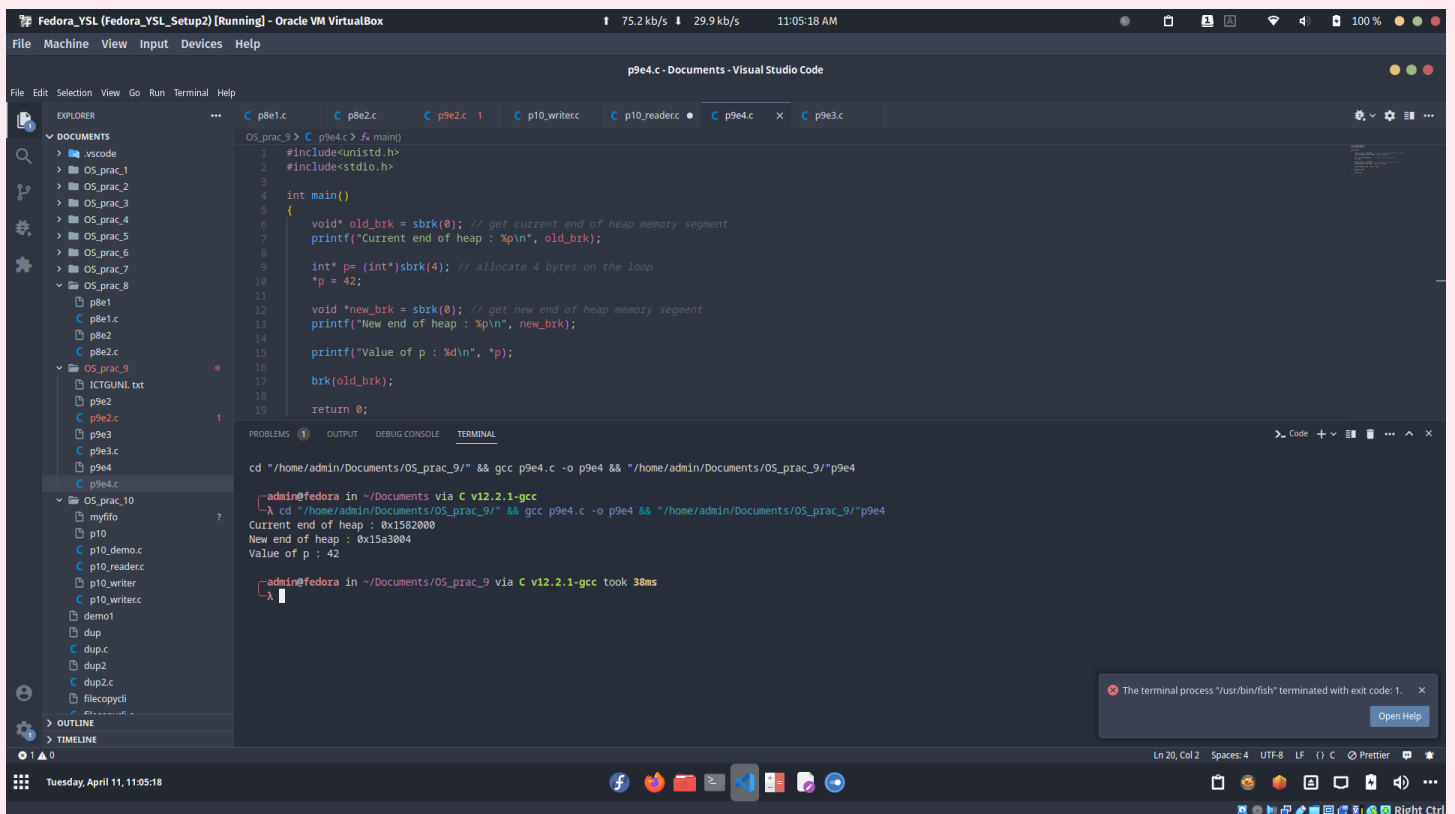
    int* p= (int*)sbrk(4); // allocate 4 bytes on the heap
    *p = 42;

    void *new_brk = sbrk(0); // get new end of heap memory
segment
    printf("New end of heap : %p\n", new_brk);
```

Name - Yash Lakhtariya
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Branch - CBA Batch - 41
OS Practical 9

```
printf("Value of p : %d\n", *p);  
  
brk(old_brk);  
  
return 0;  
}
```

Output :



The screenshot shows a Visual Studio Code editor window titled "p9e4.c - Documents - Visual Studio Code". The editor displays a C program in a file named "p9e4.c". The program includes `<unistd.h>` and `<stdio.h>`. It defines a `main` function that uses `brk` to manage heap memory. The program prints the current end of heap, allocates 4 bytes, prints the value of `p` (which is 42), and then prints the new end of heap. The terminal output shows the execution of the program, with the current end of heap at `0x1582000`, the new end of heap at `0x15a3004`, and the value of `p` as `42`. The terminal also shows the compilation command `gcc p9e4.c -o p9e4` and the execution command `./p9e4`. A notification at the bottom right states: "The terminal process 'usr/bin/fish' terminated with exit code: 1." The status bar at the bottom indicates "Ln 20, Col 2, Spaces: 4, UTF-8, LF, C, Prettier".

```
1 #include<unistd.h>  
2 #include<stdio.h>  
3  
4 int main()  
5 {  
6     void* old_brk = brk(0); // get current end of heap memory segment  
7     printf("Current end of heap : %p\n", old_brk);  
8  
9     int* p= (int*)brk(4); // allocate 4 bytes on the heap  
10    *p = 42;  
11  
12    void* new_brk = brk(0); // get new end of heap memory segment  
13    printf("New end of heap : %p\n", new_brk);  
14  
15    printf("Value of p : %d\n", *p);  
16  
17    brk(old_brk);  
18  
19    return 0;  
}
```

cd "/home/admin/Documents/OS_prac_9/" && gcc p9e4.c -o p9e4 && "/home/admin/Documents/OS_prac_9/"p9e4

admin@fedora in ~/Documents via C v12.2.1-gcc
-A cd "/home/admin/Documents/OS_prac_9/" && gcc p9e4.c -o p9e4 && "/home/admin/Documents/OS_prac_9/"p9e4
Current end of heap : 0x1582000
New end of heap : 0x15a3004
Value of p : 42

admin@fedora in ~/Documents/OS_prac_9 via C v12.2.1-gcc took 38ms
-A
^

The terminal process "usr/bin/fish" terminated with exit code: 1.