



Program – 1

Object - Write a program to display a file page wise assuming a page has 10 lines and each line has 80 characters.

Code :

```
#include <stdio.h>
#define MAX_LINE_LEN 80    // Define a constant for maximum line length
#define MAX_LINES_PER_PAGE 10 // Define a constant for maximum number of lines per page

int main(int argc, char *argv[])
{
    if (argc != 2)
    { // Check if the user has provided a filename argument
        fprintf(stderr, "Usage: %s <filename>\n", argv[0]);
        return 1;
    }
    FILE *fp = fopen(argv[1], "r"); // Open the file for reading
    if (fp == NULL)
    { // Check if the file was opened successfully
        fprintf(stderr, "Error: could not open file %s\n", argv[1]);
        return 1;
    }
    char line[MAX_LINE_LEN]; // Define a buffer for reading each line of the file
    int line_count = 0;    // Keep track of the number of lines printed so far
    while (fgets(line, MAX_LINE_LEN, fp) != NULL)
    {
        // Read each line of the file
        printf("%s\n", line); // Print the line to the console
        line_count++;        // Increment the line count
        if (line_count >= MAX_LINES_PER_PAGE)
        { // Check if we've printed enough lines for the current page
            printf("\nPress ENTER to continue...\n");
            getchar();    // Wait for the user to press ENTER
            line_count = 0; // Reset the line count for the next page
        }
    }
    fclose(fp); // Close the file
    return 0;  // Exit the program
}
```



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Output :

```
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_1$ ./Cprog1 sample.txt
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut hendrerit nibh et l
acinia tincidunt.
```

```
Cras condimentum, tortor vel vestibulum tincidunt, quam ipsum dignissim massa,
at porta dolor erat nec metus.
```

```
Donec eu sapien placerat, malesuada mauris a, vestibulum nisl.
```

```
Phasellus ex leo, semper eu mauris ut, varius laoreet est.
```

```
Aliquam viverra scelerisque odio, ac tristique risus. Nullam vitae tincidunt ar
cu, non gravida lacus.
```

```
Vivamus vestibulum elit fermentum libero laoreet bibendum.
```

```
Aliquam nec felis quis velit pellentesque auctor. Praesent porttitor pretium ip
```

```
Press ENTER to continue...
```

```
sum sit amet venenatis.
```

```
Donec et elit non nisl ultricies sollicitudin. Donec ac ex ac arcu laoreet pulv
inar porta ac.
```



Program – 2

Object - Write a Program which converts all the small case letters in a file into appropriate capital letters.

Code :

```
#include <stdio.h>
int main(int argc, char *argv[])
{
    // Check if the program is run with the correct number of arguments
    if (argc != 2)
    {
        // Print an error message to standard error output (stderr)
        fprintf(stderr, "Usage: %s <filename>\n", argv[0]);
        // Return an error code (-1) to indicate that the program did not run successfully
        return -1;
    }
    // Open the file given as the argument in read/write mode
    FILE *fp = fopen(argv[1], "r+");
    // Check if the file was successfully opened
    if (fp == NULL)
    {
        // Print an error message, including a description of the error that occurred
        perror("Error opening file");
        // Return an error code (-1) to indicate that the program did not run successfully
        return -1;
    }
    int c;
    // Read each character in the file until the end of the file is reached (EOF)
    while ((c = fgetc(fp)) != EOF)
    {
        // Check if the character is a lowercase letter
        if (c >= 'a' && c <= 'z')
        {
            // Move the file pointer back one position to overwrite the lowercase letter
            fseek(fp, -1, SEEK_CUR);
            // Write the uppercase version of the letter to the file
            fputc(c - 'a' + 'A', fp);
        }
    }
    fclose(fp);
}
```



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```
    return 0;  
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_2$ cat sample.txt  
This is sample text  
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_2$ ./Cprog2Second sample.txt  
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_2$ cat sample.txt  
THIS IS SAMPLE TEXT  
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_2$ █
```



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Program – 3

Object - Write a program to print the details of the system (use uname sys call).

Code :

```
#include <stdio.h>
#include <stdlib.h>
#include <sys/utsname.h>
// included header file `stdlib.h` for exit failure and success macros value, `sys/utsname.h` to
get system information
int main()
{
    struct utsname sys_data;
    if (uname(&sys_data) != 0) // checks if there is any error in calling uname i.e. getting
system info as uname return a dstructured info of the system
    {
        fprintf(stderr, "Error calling uname\n");
        return EXIT_FAILURE; // EXIT_FAILURE is a macro defined in stdlib.h
    }
    printf("Operating System : %s\n", sys_data.sysname);
    printf("Nodename : %s\n", sys_data.nodename);
    printf("Release : %s\n", sys_data.release);
    printf("Version : %s\n", sys_data.version);
    printf("Machine : %s\n", sys_data.machine);
    return EXIT_SUCCESS; // EXIT_SUCCESS is a macro defined in stdlib.h
}
```

Output :

```
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_3$ ./prog3
Operating System : Linux
Nodename : AP
Release : 5.19.0-41-generic
Version : #42~22.04.1-Ubuntu SMP PREEMPT_DYNAMIC Tue Apr 18 17:40:00 UTC 2
Machine : x86_64
○ ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_3$ █
```



Program – 4

Object -Write a program which will print the list of environment variable and also print the value of the PATH system variable.

Code :

```
#include <stdio.h> //Include standard input/output library
#include <stdlib.h> //Include standard library

extern char **environ; // Declare an external variable environ of type char**

int main()
{ // Declare the main function

    char *path; // Declare a pointer variable named path of type char*
    int i;      // Declare an integer variable named i

    printf("The environment list is as follows: \n"); // Print a message on the screen

    for (i = 0; environ[i] != NULL; i++) // For loop to traverse all the environment
variables
        printf("Environ[%d] : %s\n", i, environ[i]); // Print the environment variables

    path = getenv("PATH"); // Retrieve value of the PATH environment variable and store it

    if ((path == NULL)) // Check if path is null or not
        printf("Environment variable not set\n"); // Print a message on the screen if path is
null
    else // If path is not null
        // Print the value of the PATH environment variable on the screen
        printf("The value of Path variable : %s", path);

    return 0; // Return 0 as the program executed successfully
}
```



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Output :

```
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_4$ ./prog4
The environment list is as follows:
Environ[0] : SHELL=/bin/bash
Environ[1] : SESSION_MANAGER=local/AP:@/tmp/.ICE-unix/1639,unix/AP:/tmp/.ICE-unix/1639
Environ[2] : QT_ACCESSIBILITY=1
Environ[3] : COLORTERM=truecolor
Environ[4] : XDG_CONFIG_DIRS=/etc/xdg/xdg-ubuntu:/etc/xdg
Environ[5] : SSH_AGENT_LAUNCHER=gnome-keyring
Environ[6] : XDG_MENU_PREFIX=gnome-
Environ[7] : TERM_PROGRAM_VERSION=1.77.3
Environ[8] : GNOME_DESKTOP_SESSION_ID=this-is-deprecated
Environ[9] : LANGUAGE=en_IN:en
Environ[10] : GNOME_SHELL_SESSION_MODE=ubuntu
Environ[11] : SSH_AUTH_SOCK=/run/user/1000/keyring/ssh
Environ[12] : XMODIFIERS=@im=ibus
Environ[13] : DESKTOP_SESSION=ubuntu
Environ[14] : BAMF_DESKTOP_FILE_HINT=/var/lib/snapd/desktop/applications/code_code.desktop
Environ[15] : GTK_MODULES=gail:atk-bridge
Environ[16] : PWD=/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_4
Environ[17] : GSETTINGS_SCHEMA_DIR=/home/ap-73/snap/code/126/.local/share/glib-2.0/schemas
Environ[18] : XDG_SESSION_DESKTOP=ubuntu
Environ[19] : LOGNAME=ap-73
Environ[20] : GTK_EXE_PREFIX=/snap/code/126/usr
Environ[21] : XDG_SESSION_TYPE=wayland
Environ[22] : SYSTEMD_EXEC_PID=1670
Environ[23] : XAUTHORITY=/run/user/1000/.mutter-Xwaylandauth.W2CT31
Environ[24] : VSCODE_GIT_ASKPASS_NODE=/snap/code/126/usr/share/code/code
Environ[25] : IM_CONFIG_CHECK_ENV=1
Environ[26] : GJS_DEBUG_TOPICS=JS ERROR;JS LOG
Environ[27] : HOME=/home/ap-73
Environ[28] : USERNAME=ap-73
Environ[29] : IM_CONFIG_PHASE=1
Environ[30] : LANG=en_US.UTF-8

1:*.lrz=01;31:*.lz=01;31:*.lzo=01;31:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=
31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01;31:*.rar=01;31:*.i
io=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31
:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xl
f=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;
5:*.webm=01;35:*.webp=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:
f=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35
yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00
36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opi
Environ[32] : XDG_CURRENT_DESKTOP=Unity
Environ[33] : WAYLAND_DISPLAY=wayland-0
Environ[34] : GIT_ASKPASS=/snap/code/126/usr/share/code/resources/app/extensions/git/dist/i
Environ[35] : INVOCATION_ID=2b78ad4c25424ee3b523c43f600b7a5d
Environ[36] : MANAGERPID=1486
Environ[37] : CHROME_DESKTOP=code-url-handler.desktop
Environ[38] : GJS_DEBUG_OUTPUT=stderr
Environ[39] : VSCODE_GIT_ASKPASS_EXTRA_ARGS=-ms-enable-electron-run-as-node
Environ[40] : GNOME_SETUP_DISPLAY=:1
Environ[41] : LESSCLOSE=/usr/bin/lesspipe %s %s
Environ[42] : XDG_SESSION_CLASS=user
Environ[43] : TERM=xterm-256color
Environ[44] : GTK_PATH=/snap/code/126/usr/lib/x86_64-linux-gnu/gtk-3.0
Environ[45] : LESSOPEN=| /usr/bin/lesspipe %s
Environ[46] : USER=ap-73
Environ[47] : VSCODE_GIT_IPC_HANDLE=/run/user/1000/vscode-git-a43cdca4cd.sock
Environ[48] : DISPLAY=:0
Environ[49] : SHLVL=1
Environ[50] : LOCPATH=/snap/code/126/usr/lib/locale
Environ[51] : QT_IM_MODULE=ibus
Environ[52] : XDG_RUNTIME_DIR=/run/user/1000
Environ[53] : VSCODE_GIT_ASKPASS_MAIN=/snap/code/126/usr/share/code/resources/app/extension
Environ[54] : JOURNAL_STREAM=8:33992
Environ[55] : XDG_DATA_DIRS=/home/ap-73/snap/code/126/.local/share:/home/ap-73/snap/code/1:
```




Program – 5

Object -Write a program to print current (soft) limit and maximum (Hard) limits of all resources.

Code :

```
#include <stdio.h>    // Standard Input/Output library
#include <stdlib.h>    // Standard library
#include <errno.h>     // Error handling library
#include <sys/resource.h> // System resource limits library

#define NUM_RESOURCES RLIM_NLIMITS // Define a constant to represent the number
of system resources available

int main() {
    struct rlimit rl; // Declare a structure to hold the resource limits
    int i;
    char* resource_names[NUM_RESOURCES] = { // Declare an array of strings to hold
the names of the system resources
        "RLIMIT_CPU",
        "RLIMIT_FSIZE",
        "RLIMIT_DATA",
        "RLIMIT_STACK",
        "RLIMIT_CORE",
        "RLIMIT_RSS",
        "RLIMIT_NPROC",
        "RLIMIT_NOFILE",
        "RLIMIT_MEMLOCK",
        "RLIMIT_AS",
        "RLIMIT_LOCKS"
    };

    // Print the header row for the output table
    printf("\n%-15s\t%-15s\t%-15s\n", "Resource Name", "Soft Limit", "Hard Limit");

    // Loop through each system resource and retrieve its limits
    for (i = 0; i < NUM_RESOURCES; i++) {
        if (getrlimit(i, &rl) != 0) { // Get the limits for the current system resource
            perror("getrlimit"); // Print an error message if the limits cannot be retrieved
            exit(EXIT_FAILURE); // Exit the program with an error code
        }
    }
}
```




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```
// Print the resource name and its corresponding soft and hard limits
printf("%-15s\t%-15ld\t%-15ld\n", resource_names[i], (long long) rl.rlim_cur, (long
long) rl.rlim_max);
}

return 0; // Return 0 to indicate success
}
```

Output :

● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_5\$./prog5

Resource Name	Soft Limit	Hard Limit
RLIMIT_CPU	-1	-1
RLIMIT_FSIZE	-1	-1
RLIMIT_DATA	-1	-1
RLIMIT_STACK	8388608	-1
RLIMIT_CORE	0	-1
RLIMIT_RSS	-1	-1
RLIMIT_NPROC	46643	46643
RLIMIT_NOFILE	1048576	1048576
RLIMIT_MEMLOCK	1538584576	1538584576
RLIMIT_AS	-1	-1
RLIMIT_LOCKS	-1	-1
(null)	46643	46643
(null)	819200	819200
(null)	0	0
(null)	0	0
(null)	-1	-1

○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_5\$ █



Program – 6

Object -Write a program with an exit handler that outputs CPU usage.

Code :

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

int main(void) {
    time_t start, end; // declare two variables of type "time_t" to hold the start and end times
    start = time(NULL); // get the current time and store it in the "start" variable
    printf("Start time: %ld\n", start); // print the start time
    sleep(5); // sleep for 5 seconds
    end = time(NULL); // get the current time again and store it in the "end" variable
    printf("End time: %ld\n", end); // print the end time
    printf("Time slept: %ld seconds\n", end - start); // calculate and print the time slept
    return 0; // return success code
}
```

Output :

```
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_6$ ./prog6_gpt
Start time: 1682936731
End time: 1682936736
Time slept: 5 seconds
○ ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_6$ █
```



Program – 7

Object -Write a program that prints it's & it's parent's process ID.

Code :

```
#include<stdio.h> // Including the standard input/output library header file
#include <unistd.h> // Including the POSIX library header file

int main (void) // Beginning of the main function
{
    // Printing the process ID of the current process
    printf("I am process %ld\n", (long) getpid());
    // Printing the parent process ID of the current process
    printf("My parent is %ld\n", (long) getppid());
    return 0; // Returning 0 to indicate successful termination of the program
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_7$ ./prog7
I am process 15046
My parent is 15014
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_7$ █
```



Program – 8

Object -Write a program that prints out various user & group ID's.

Code :

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

int main(void)
{
    // Print the real user ID of the current process
    printf("My real user ID is %5ld\n", (long)getuid());

    // Print the effective user ID of the current process
    printf("My effective user ID is %5ld\n", (long)geteuid());

    // Print the real group ID of the current process
    printf("My real group ID is %5ld\n", (long)getgid());

    // Print the effective group ID of the current process
    printf("My effective group ID is %5ld\n", (long)getegid());

    return 0;
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_8$ ./prog8
My real user ID is 1000
My effective user ID is 1000
My real group ID is 1000
My effective group ID is 1000
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_8$ █
```



Program – 9

Object --Write a program which uses fork to create a child process& then parent & child print their respective process ID's

Code :

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

int main() {
    pid_t pid; // declare a variable to store the process ID returned by fork()

    pid = fork(); // create a child process and store the process ID in the pid variable

    if (pid < 0) { // check if fork() failed
        fprintf(stderr, "Fork failed\n");
        exit(1);
    }
    if (pid == 0) { // code for child process
        printf("\nI am the child process, my pid is %d\n", getpid());
        exit(0); //terminate the child process
    }
    else { // code for parent process
        printf("I am the parent process, my pid is %d", getpid());
    }

    return 0;
}
```

Output :

```
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_9$ ./prog9_gpt
I am the parent process, my pid is 15542
I am the child process, my pid is 15543
○ ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_9$ █
```



Program – 10

Object -Write a program that creates a chain of n processes, where n is a command line argument.

Code :

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

int main(int argc, char *argv[]) {
    int n, i;
    pid_t pid;
    // check if the number of command line arguments is correct
    if (argc != 2) {
        printf("Usage: %s n\n", argv[0]);
        exit(1);
    }
    // convert the command line argument to an integer
    n = atoi(argv[1]);
    // create the chain of n processes
    for (i = 0; i < n; i++) {
        pid = fork();
        if (pid < 0) {
            printf("Error: fork failed\n");
            exit(1);
        }
        if (pid == 0) {
            printf("Child process %d created, with parent process %d\n", getpid(), getppid());
            while (getppid() != 1);
            printf("Child process %d has completed, with parent process %d\n", getpid(),
getppid());
            exit(0);
        }
    }
    // // parent process
    // printf("Parent process exiting\n");
    exit(0);
}
```



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Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_10$ ./prog10_gpt 6
Child process 15919 created, with parent process 1486
Child process 15918 created, with parent process 1486
Child process 15915 created, with parent process 1486
Child process 15916 created, with parent process 1486
Child process 15914 created, with parent process 1486
Child process 15917 created, with parent process 1486
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_10$ █
```




Program – 11

Object -Write a program that creates a fan of n processes where n is passed as a command line argument.

Code :

```
#include <stdio.h>    //include standard input/output library
#include <stdlib.h>    //include standard library for functions such as atoi()
#include <unistd.h>    //include library for functions such as fork()

int main(int argc, char *argv[]) { //start of main function, takes command line arguments
    as inputs
    //declare and initialize process ID variable for child process
    pid_t childpid = 0;
    //declare variables for loop iteration and number of processes
    int i, n;
    //check if there is only one command line argument
    if (argc != 2) {
        fprintf(stderr, "Usage: %s processes\n", argv[0]); //print error message to stderr
        return 1;    //exit program with error status
    }
    //convert command line argument to integer and assign to variable n
    n = atoi(argv[1]);
    for (i = 1; i <= n; i++) { //iterate through loop until i is equal to n
        //if fork() returns a value less than or equal to 0, break out of loop
        if ((childpid = fork()) <= 0) {
            break;
        }
        //print process information to stderr
        fprintf(stderr, "i:%d process ID:%ld parent ID:%ld child ID:%ld\n",
            i, (long)getpid(), (long)getppid(), (long)childpid);
    }
    return 0; //exit program with success status
}
```



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Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_11$ ./prog11 4
i:1 process ID:16178 parent ID:16136 child ID:16179
i:2 process ID:16178 parent ID:16136 child ID:16180
i:3 process ID:16178 parent ID:16136 child ID:16181
i:4 process ID:16178 parent ID:16136 child ID:16182
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_11$ █
```



Program – 12

Object -Write a program to show that same opened file can be shared by both parent and child processes.

Code :

```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>

int main() {
    int fd;        // file descriptor for the opened file
    pid_t pid;     // process ID variable

    // open file in write mode, create it if it doesn't exist, with permissions 0644
    fd = open("file.txt", O_WRONLY | O_CREAT | O_TRUNC, 0644);
    if (fd < 0) { // check if file was successfully opened
        perror("Error opening file"); // display error message if open() failed
        exit(1); // exit the program with status code 1
    }

    // fork a child process
    pid = fork(); // create a copy of the current process
    if (pid < 0) { // check if fork() failed
        perror("Error forking process"); // display error message if fork() failed
        exit(1); // exit the program with status code 1
    }
    else if (pid == 0) { // child process
        // write to the opened file using the file descriptor fd
        char *str = "This is the child process.\n";
        write(fd, str, strlen(str)); // write string to file
        printf("Child process wrote to file.\n");
    }
    else { // parent process
        // write to the opened file using the file descriptor fd
        char *str = "This is the parent process.\n";
        write(fd, str, strlen(str)); // write string to file
        printf("Parent process wrote to file.\n");
    }
}
```



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```
// close file descriptor
close(fd); // close the file

return 0; // exit the program with status code 0 (success)
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_12$ ./prog12_g
Parent process wrote to file.
Child process wrote to file.
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_12$ █
```

```
OS_Programs > Practical_12 > file.txt
1 This is the parent process.
2 This is the child process.
3
```



Program – 13

Object -Write a program that creates a child process to run ls – l.

Code :

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

int main(void)
{
    pid_t childpid;
    // Call fork() to create a new child process
    childpid = fork();
    // Check if fork() failed and print an error message if it did
    if (childpid == -1)
    {
        perror("Failed to fork");
        return 1;
    }
    // If fork() returns 0, the current process is the child process
    if (childpid == 0)
    {
        // Execute the "ls -l" command in the child process using execl()
        execl("/bin/ls", "ls", "-l", NULL); // man 2 exec
        // If execl() returns, there was an error, so print an error message and return failure
        perror("Child failed to exec ls");
        return 1;
    }
    // If fork() returns a positive value, the current process is the parent process
    // Wait for the child process to complete using wait() and check for errors
    if (childpid != wait(NULL))
    {
        perror("Parent failed to wait due to signal or error");
        return 1;
    }
    return 0;
}
```



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Output :

```
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_13$ ./prog_13
total 20
-rwxrwxrwx 1 root root 16088 May  1 16:36 prog_13
-rwxrwxrwx 1 root root 1177 May  1 16:36 prog_13.c
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_13$
```



Program – 14

Object -Write a program to create a zombie child and find its status using system (ps) command.

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>
#include<signal.h>
int main(){
    int fd;
    // Creating a child process using fork()
    if((fd=fork())<0){
        printf("error in creating child");
        exit(1);
    }
    // Child process code: send a signal to itself to terminate
    if(fd==0)
        kill(getpid(),SIGKILL);
    // Parent process code: wait for 2 seconds
    else
        sleep(2);
    // Print process information using the "ps" command
    system("ps -f");
    return 0;
}
```

Output :

```
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_14$ ./prog_14
UID          PID     PPID  C  STIME TTY          TIME CMD
ap-73        17092    11155  0  16:44 pts/36    00:00:00 /usr/bin/bash --init-file /snap/code/126/usr/
ap-73        17110    17092  0  16:44 pts/36    00:00:00 ./prog_14
ap-73        17111    17110  0  16:44 pts/36    00:00:00 [prog_14] <defunct>
ap-73        17123    17110  0  16:44 pts/36    00:00:00 sh -c ps -f
ap-73        17124    17123  0  16:44 pts/36    00:00:00 ps -f
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_14$ █
```




Program – 15

Object -Write a program to copy a file.

Code :

```
// Function to copy a file fromfd to tofd
#include <errno.h>
#include <unistd.h>
#define BLKSIZE 1024

int copyfile(int fromfd, int tofd) {
    char *bp;
    char buf[BLKSIZE];
    int bytesread;
    int byteswritten = 0;
    int totalbytes = 0;

    for (;;) { // Infinite loop until end of file or error occurs
        // Read up to BLKSIZE bytes from fromfd
        while (((bytesread = read(fromfd, buf, BLKSIZE)) == -1) &&
            (errno == EINTR)) ; // Handle interruption by signal

        if (bytesread <= 0) // Real error or end-of-file on fromfd
            break;

        bp = buf;
        while (bytesread > 0) {
            // Write up to bytesread bytes to tofd
            while (((byteswritten = write(tofd, bp, bytesread)) == -1) &&
                (errno == EINTR)) ; // Handle interruption by signal

            if (byteswritten < 0) // Real error on tofd
                break;

            totalbytes += byteswritten;
            bytesread -= byteswritten;
            bp += byteswritten;
        }

        if (byteswritten == -1) // Real error on tofd
            break;
    }
}
```



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```
}

return totalbytes;
}

// Main program to copy a file
#include <fcntl.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/stat.h>
#define READ_FLAGS O_RDONLY
#define WRITE_FLAGS (O_WRONLY | O_CREAT | O_EXCL)
#define WRITE_PERMS (S_IRUSR | S_IWUSR)

int main(int argc, char *argv[]) {
    int bytes;
    int fromfd, tofd;

    // Check for correct number of arguments
    if (argc != 3) {
        fprintf(stderr, "Usage: %s from_file to_file\n", argv[0]);
        return 1;
    }

    // Open input file for reading
    if ((fromfd = open(argv[1], READ_FLAGS)) == -1) {
        perror("Failed to open input file");
        return 1;
    }

    // Create output file for writing
    if ((tofd = open(argv[2], WRITE_FLAGS, WRITE_PERMS)) == -1) {
        perror("Failed to create output file");
        return 1;
    }

    // Copy the contents of the input file to the output file
    bytes = copyfile(fromfd, tofd);

    // Print the number of bytes copied and the source and destination file names
    printf("%d bytes copied from %s to %s\n", bytes, argv[1], argv[2]);
}
```



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```
// Close the input and output files
return 0;
}
```

Output :

```
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_15$ cat file1.txt
This is the text to be copied.
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_15$ ./prog15 file1.txt file2.tx
31 bytes copied from file1.txt to file2.txt
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_15$ cat file2.txt
This is the text to be copied.
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_15$ █
```



Program – 16

Object -Write a program for which output is automatically directed to a named file rather than on to the console.

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>
#include <unistd.h>
int main()
{
    int fd;
    // Open the file "test1" for writing or create it if it doesn't exist
    if((fd = open("test1", O_WRONLY|O_CREAT)) < 0){
        printf("Error in opening file..\n");
        exit(1);
    }
    // Close standard output (file descriptor 1) to redirect the output
    close(1);
    // Duplicate file descriptor fd to 1 (stdout)
    dup(fd);
    // The next line will be written to the file "test1" instead of the console
    printf("New Fun");
    // Close the file descriptor fd and standard output
    close(fd);
    return (0);
}
```

Output :

```
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_16$ g++ -o prog16 prog_16.c
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_16$ ./prog16
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_16$
```

```
OS_Programs > Practical_16 > test1
1 New Fun
```



Program – 17

Object -Write a program that redirects standards output to the file my.file (or Write a program that do the following operation cat XYZ > myfile). using dup2 rather than dup.

Code :

```
#include <fcntl.h>
#include <stdio.h>
#include <sys/stat.h>
#include <unistd.h>

#define CREATE_FLAGS (O_WRONLY | O_CREAT | O_APPEND) // Define flags for file
creation
#define CREATE_MODE (S_IRUSR | S_IWUSR | S_IRGRP | S_IROTH) // Define access
permissions for the file

int main(void){
    int fd; // file descriptor

    // Open or create file "my.file" with the flags and mode specified
    fd = open("my.file", CREATE_FLAGS, CREATE_MODE);
    if (fd == -1){
        perror("Failed to open my.file"); // Print error message if failed to open the file
        return 1; // Exit program with error code
    }
    // Duplicate the file descriptor to the standard output file descriptor
    if (dup2(fd, STDOUT_FILENO) == -1){ //dup2
        perror("Failed to redirect standard output"); // Print error message if failed to redirect
standard output
        return 1; // Exit program with error code
    }
    // Close the file descriptor that was duplicated
    if (close(fd) == -1){
        perror("Failed to close the file"); // Print error message if failed to close the file
        return 1; // Exit program with error code
    }
    // Write "OK" to the standard output file descriptor
    if (write(STDOUT_FILENO, "OK", 2) == -1){
        perror("Failed in writing to file"); // Print error message if failed to write to file
        return 1; // Exit program with error code
    }
}
```



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```
    return 0; // Exit program with success code
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_17$ g++ -o prog_17 prog_17.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_17$ ./prog_17
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_17$ █
```

OS_Programs > Practical_17 >  my.file

1 OK



Program – 18

Object -Write a program to create an empty directory using system calls

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/stat.h>

// Main function takes two arguments, argc (argument count) and argv (argument vector)
main(int argc, char *argv[])
{
    // Check if the argument count is not equal to 2
    if(argc!=2)
    {
        printf("Usages: ./a.out directory"); // Print error message for incorrect usage
        exit(1); // Exit the program with error code
    }

    // Create a directory with the specified name and access permissions
    if(mkdir(argv[1],744)!=0)
        printf("Error in Making Directory"); // Print error message if the directory creation
    fails
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_18$ g++ -o prog_18 prog_18.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_18$ ./prog_18 emptyDir
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_18$ sudo ls -ld emptyDir/
[sudo] password for ap-73:
drwxrwxrwx 1 root root 0 May  1 17:31 emptyDir/
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_18$ █
```




Program – 19

Object - Write a program to remove a directory using system call.

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>

// Main function takes two arguments, argc (argument count) and argv (argument vector)
int main(int argc, char *argv[])
{
    // Check if the argument count is not equal to 2
    if(argc!=2)
    {
        fprintf(stderr,"Too Less Arguments"); // Print error message for incorrect usage
        exit(1); // Exit the program with error code
    }

    // Remove the directory with the specified name
    if(remove(argv[1])!=0)
        fprintf(stderr,"Error in Removing Directory"); // Print error message if the directory
removal fails
    exit(1); // Exit the program with error code
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_19$ ./prog_18 dir1
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_19$ g++ -o ./prog_19 prog_19.c
⊗ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_19$ ./prog_19 dir1/
⊗ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_19$ sudo ls -ld dir1
[sudo] password for ap-73:
ls: cannot access 'dir1': No such file or directory
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_19$ █
```



Program – 20

Object - Write a program to output current working directory.

Code :

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

// Define PATH_MAX to be 255 if it is not already defined
#ifndef PATH_MAX
#define PATH_MAX 255
#endif

int main(void)
{
    char mycwd[PATH_MAX];
    // Get the current working directory and store it in mycwd array
    if (getcwd(mycwd, PATH_MAX) == NULL)
    {
        perror("Failed to get current working directory"); // Print error message if getcwd
        fails
        return 1; // Exit the program with error code
    }
    // Print the current working directory
    printf("Current working directory: %s\n", mycwd);
    return 0; // Exit the program
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_20$ g++ -o prog_20 prog_20.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_20$ ./prog_20
  Current working directory: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_20
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_20$ █
```



Program – 21

Object - Write a program to list files in a directory.

Code :

```
#include <dirent.h>
#include <errno.h>
#include <stdio.h>

int main(int argc, char *argv[]) {
    struct dirent *direntp; // Pointer to directory entry
    DIR *dirp; // Pointer to directory stream
    if (argc != 2) {
        fprintf(stderr, "Usage: %s directory_name\n", argv[0]);
        return 1;
    }
    // Attempt to open the specified directory
    if ((dirp = opendir(argv[1])) == NULL) {
        perror ("Failed to open directory"); // Print error message if failed
        return 1;
    }
    // Read and print each directory entry
    while ((direntp = readdir(dirp)) != NULL) {
        printf("%s\n", direntp->d_name);
    }
    // Close the directory stream and check for errors
    while ((closedir(dirp) == -1) && (errno == EINTR)) ;
    return 0;
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_21$ g++ -o prog_21 prog_21.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_21$ ./prog_21 dir
.
..
test1
test2
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_21$ █
```



Program – 22

Object - Write a program that returns true if a given file is a directory & false otherwise.

Code :

```
#include <stdio.h>
#include <time.h>
#include <sys/stat.h>

int main(int argc, char *argv[]) {
    struct stat statbuf; // Struct to hold file/directory information
    // Attempt to get status information for the specified file/directory
    if (stat(argv[1], &statbuf) == -1) {
        perror ("Failed to get status of file/directory"); // Print error message if failed
        return 1;
    }
    else {
        // If successful, determine if the specified path is a directory or a file using S_ISDIR
        macro
        if (S_ISDIR(statbuf.st_mode)) {
            printf("%s : is a directory\n",argv[1]);
        }
        else {
            printf("%s : is a file\n",argv[1]);
        }
    }
    return 0;
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_22$ g++ -o prog_22 prog_22.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_22$ ./prog_22 dir
dir : is a directory
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_22$ ./prog_22 test
test : is a file
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_22$ █
```



Program – 23

Object - Write a program that can display the type of a given file like regular, directory etc.

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>

main(int argc, char *argv[]) {
    struct stat statbuff; // Struct to hold file/directory information
    int check; // Return value of stat() function

    if(argc != 2) {
        printf("Can accept only two arguments"); // Print error message if incorrect number of
        arguments is passed
        exit(1);
    }
    // Get status information for the specified file/directory using stat() function
    check = stat(argv[1], &statbuff);

    // Check if stat() was successful
    if(check == 0) {
        // Determine the type of the specified file/directory using S_IS* macros
        if(S_ISREG(statbuff.st_mode)) {
            printf("Regular File");
        }
        else if(S_ISDIR(statbuff.st_mode)) {
            printf("Directory");
        }
        else if(S_ISCHR(statbuff.st_mode)) {
            printf("Character Device");
        }
        else {
            printf("Other File");
        }
    }
}
```



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Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_23$ g++ -o prog_23 prog_23.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_23$ ./prog_23 dir
● Directoryap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_23$ ./prog_23 test
○ Regular Fileap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_23$ █
```



Program – 24

Object - Write a program to display the permission of a given file.

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>

int main(int argc, char *argv[]) {

    struct stat statbuff; // Struct to hold file/directory information
    int check; // Return value of stat() function

    if(argc != 2) {
        printf("Can Accept only two arguments"); // Print error message if incorrect number of
arguments is passed
        exit(1);
    }

    // Get status information for the specified file/directory using stat() function
    check = stat(argv[1], &statbuff);

    // Check if stat() was successful
    if(check == 0) {
        // Check permission for Owner
        if((statbuff.st_mode & S_IRUSR) == S_IRUSR) {
            printf("Owner has Read Permission\n");
        }
        if((statbuff.st_mode & S_IWUSR) == S_IWUSR) {
            printf("Owner has Write Permission\n");
        }
        if((statbuff.st_mode & S_IXUSR) == S_IXUSR) {
            printf("Owner has Execute Permission\n");
        }

        // Check permission for Group
        if((statbuff.st_mode & S_IRGRP) == S_IRGRP) {
            printf("Group has Read Permission\n");
        }
    }
}
```




```
}
if((statbuff.st_mode & S_IWGRP) == S_IWGRP) {
    printf("Group has Write Permission\n");
}
if((statbuff.st_mode & S_IXGRP) == S_IXGRP) {
    printf("Group has Execute Permission\n");
}

// Check permission for Others
if((statbuff.st_mode & S_IROTH) == S_IROTH) {
    printf("Others has Read Permission\n");
}
if((statbuff.st_mode & S_IWOTH) == S_IWOTH) {
    printf("Others has Write Permission\n");
}
if((statbuff.st_mode & S_IXOTH) == S_IXOTH) {
    printf("Others has Executed Permission\n");
}
}
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_24$ g++ -o prog_24 prog_24.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_24$ ./prog_24 test
Owner has Read Permission
Owner has Write Permission
Owner has Execute Permission
Group has Read Permission
Group has Write Permission
Group has Execute Permission
Others has Read Permission
Others has Write Permission
Others has Executed Permission
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_24$ ./prog_24 dir
Owner has Read Permission
Owner has Write Permission
Owner has Execute Permission
Group has Read Permission
Group has Write Permission
Group has Execute Permission
Others has Read Permission
Others has Write Permission
Others has Executed Permission
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_24$ █
```



Program – 25

Object - Write a program to execute the equivalent of `ls -l | sort -n +4`.

Code :

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

int main(void){
    pid_t childpid; //Variable to hold child process ID
    int fd[2]; //Array to hold read and write file descriptors

    //Create pipe and fork child process
    if ((pipe(fd) == -1) || (childpid = fork()) == -1)
    {
        perror("Failed to setup pipeline"); //Print error message if pipe or fork fails
        return 1;
    }

    //Child process for ls command
    if (childpid == 0)
    {
        //Redirect the standard output of child to the write end of the pipe
        if (dup2(fd[1], STDOUT_FILENO) == -1)
            perror("Failed to redirect stdout of ls");
        //Close read and write file descriptors not required by child
        else if ((close(fd[0]) == -1) || (close(fd[1]) == -1))
            perror("Failed to close extra pipe descriptors on ls");
        else
        {
            //Execute ls command with options "-l" to list files in long format
            execl("/bin/ls", "ls", "-l", NULL);
            perror("Failed to exec ls"); //Print error message if execution of ls fails
        }
        return 1;
    }

    //Parent process for sort command
    if (dup2(fd[0], STDIN_FILENO) == -1)
```



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```
    perror("Failed to redirect stdin of sort"); //Redirect the standard input of parent to the
read end of the pipe
    //Close read and write file descriptors not required by parent
    else if ((close(fd[0]) == -1) || (close(fd[1]) == -1))
        perror("Failed to close extra pipe file descriptors on sort");
    else
    {
        //Execute sort command with options "-n" to sort numerically and "+4" to skip first
four fields of input
        execl("/bin/sort", "sort", "-n", "+4", NULL);
        perror("Failed to exec sort"); //Print error message if execution of sort fails
    }
    return 1;
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_25$ g++ -o prog_25 prog_25.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_25$ ./prog_25
total 20
-rwxrwxrwx 1 root root 1873 May  1 18:50 prog_25.c
-rwxrwxrwx 1 root root 16224 May  1 18:53 prog_25
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_25$ █
```



Program – 26

Object - Write a program to handle SIGUSR1 and SIGUSR2 signal.

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>
#include<signal.h>
#include<unistd.h>

void fun(int); // declaration of signal handler function

int main()
{
    char a[200];

    // register signal handler for SIGUSR1
    if((signal(SIGUSR1,fun))!=SIG_ERR)
    {
        printf("Handler not registered\n");
        exit(1);
    }

    // register signal handler for SIGUSR2
    if((signal(SIGUSR2,fun))!=SIG_ERR)
    {
        printf("Handler not registered\n");
        exit(1);
    }

    // enter an infinite loop and wait for signals
    while(1)
        pause(); // pause the program until a signal is received
}

// implementation of signal handler function
void fun(int i)
{
```



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```
if(i==SIGUSR1)
{
    printf("SIGUSR1 INTRRUPT");
    fflush(NULL); // flush output buffer to print message immediately
}
else if(i==SIGUSR2)
{
    printf("SIGUSR2 INTRRUPT");
    fflush(NULL);
}
//raise(SIGKILL); // send SIGKILL signal to terminate program
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_26$ ./prog_26 &
[1] 24164
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_26$ ps
  PID TTY          TIME CMD
 23804 pts/50    00:00:00 bash
 24164 pts/50    00:00:00 prog_26
 24184 pts/50    00:00:00 ps
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_26$ kill -s SIGUSR1 24164
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_26$ SIGUSR1 INTRRUPT
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_26$ kill -s SIGUSR2 24164
○ SIGUSR2 INTRRUPTap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_26$ █
```



Program – 27

Object - Write a program which suspends itself till it receives a SIGALRM signal.

Code :

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

void sig_alm(int); // declaration of signal handler function

int main(int argc, char *argv[])
{
    // register signal handler for SIGALRM
    if((signal(SIGALRM, sig_alm))==SIG_ERR)
        printf("Not Registered");
    // set a timer for 5 seconds using alarm()
    alarm(5);
    // pause the program until a signal is received
    pause();
    return 0;
}
// implementation of signal handler function
void sig_alm(int sig)
{
    // check if the signal received is SIGALRM
    if(sig==SIGALRM)
        printf("Wake Up\n");
}
```

Output :

```
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_27$ g++ -o prog_27 prog_27.c
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_27$ ./prog_27
Wake Up
○ ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_27$ █
```



Program – 28

Object - Write a program which prints the second's part of current time whenever the SIGALRM signal is received by the program.

Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>
#include<signal.h>
#include<time.h>
#include<unistd.h>

void sig_hand(int); // declaration of signal handler function
int main(){
    int i=1;
    pid_t pid;
    // register the signal handler
    if(signal(SIGALRM,sig_hand)==SIG_ERR)
        printf("Not Registered");
    while(i<=5){ // loop to send signals after 2 seconds delay
        i++;
        pid=getpid();
        sleep(2); // wait for 2 seconds
        kill(pid,SIGALRM); // send the signal
    }
    return 0;
}

void sig_hand(int sig)
{
    struct tm *t; // structure to hold the broken-down time
    time_t tt; // variable to hold the time in seconds
    if(sig==SIGALRM) // check if the received signal is SIGALRM{
        tt=time(NULL); // get the current time in seconds since epoch
        t=localtime(&tt); // convert the time to broken-down time
        printf("%d\n",t->tm_sec); // print the seconds field of the time
    }
}
```



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Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_28$ g++ -o prog_28 prog_28.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_28$ ./prog_28
31
33
35
37
39
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_28$ █
```




Program – 29

Object - Write a Program to print the entries of passwd file for a given user name or user ID.

Code :

```
#include<pwd.h>
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>
#include<signal.h>
#include<time.h>
#include<error.h>
#include<ctype.h>

int main(){
    char u_name[10]; // variable to hold the username entered by user
    char ch; // variable to hold the user's choice of input
    uid_t u_id; // variable to hold the user ID entered by user
    struct passwd *p; // pointer to the passwd structure

    printf("Enter Your Choice\n");
    printf("Whether you want to enter UNAME or UID?(N or I)"); // prompt user for choice
    of input
    scanf("%c",&ch); // read the user's choice

    if((ch == 'N') || (ch == 'n')) // if user chooses to enter username
    {
        printf("Enter UNAME");
        scanf("%s",u_name); // read the username entered by user
        p=getpwnam(u_name); // get the passwd structure for the given username
        printf("\n%s\n %s\n %d\n %d\n %s\n %s\n %s\n", p->pw_name, p->pw_passwd, p-
        >pw_uid,p->pw_gid,p->pw_gecos, p->pw_dir, p->pw_shell); // print the information
        retrieved from passwd structure
    }
    else if((ch == 'I' || 'i')) // if user chooses to enter user ID
    {
        printf("Enter UID");
        scanf("%d",&u_id); // read the user ID entered by user
```



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```
p= getpwuid (u_id); // get the passwd structure for the given user ID
printf("\n%s\n %s\n %d\n %d\n %s\n %s\n %s\n", p->pw_name, p->pw_passwd, p-
>pw_uid, p->pw_gid, p->pw_gecos, p->pw_dir, p->pw_shell); // print the information
retrieved from passwd structure
}
else
    printf("Wrong Choice"); // if user enters a wrong choice
}
```

Output :

```
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_29$ g++ -o prog_29 prog_29.c
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_29$ ./prog_29
Enter Your Choice
Whether you want to enter UNAME or UID?(N or I)N
Enter UNAMEap-73

ap-73
x
1000
1000
Abhishek,,,
/home/ap-73
/bin/bash
● ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_29$ ./prog_29
Enter Your Choice
Whether you want to enter UNAME or UID?(N or I)I
Enter UID1000

ap-73
x
1000
1000
Abhishek,,,
/home/ap-73
/bin/bash
○ ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_29$ □
```



Program – 30

Object - Write a program to print the details of the system.

Code :

```
#include<grp.h> // header file that provides access to group-related functions
#include<stdio.h>
#include<stdlib.h>
#include <sys/types.h>

int main() // the main function
{
    char g_name[10];
    gid_t gid;
    char ch;
    struct group *g; // a pointer to a group structure

    printf("Enter Your Choice: \nEnter Group Name(N) \nEnter Group ID (I)\n");
    printf("Enter Choice");
    scanf("%c",&ch); // prompts the user to enter their choice

    switch(ch) // evaluates the user's choice
    {
        case 'N':
        case 'n':
            printf("Enter GNAME:");
            scanf("%s",g_name); // reads the group name entered by the user
            g=getgrnam(g_name); // retrieves the group information using the group name
            printf("\n %s %s %d\n", g->gr_name, g->gr_passwd, g->gr_gid); // prints the
group information
            break;

        case 'I':
        case 'i':
            printf("Enter GID:");
            scanf("%d",&gid); // reads the group ID entered by the user
            g=getgrgid(gid); // retrieves the group information using the group ID
            printf("\n %s %s %d\n", g->gr_name, g->gr_passwd, g->gr_gid); // prints the
group information
            break;
```



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```
default:
    printf("Wrong Choice");
}
}
```

Output :

```
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_30$ g++ -o prog_30 prog_30.c
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_30$ ./prog_30
Enter Your Choice:
Enter Group Name(N)
Enter Group ID (I)
Enter ChoiceN
Enter GNAME:ap-73

ap-73 x 1000
● ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_30$ ./prog_30
Enter Your Choice:
Enter Group Name(N)
Enter Group ID (I)
Enter ChoiceI
Enter GID:1000

ap-73 x 1000
○ ap-73@AP: /mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_30$ █
```



Program – 31, 32

Object – Write two programs :

1. Reads what is written to a named pipe & writes it to standard output.
2. Write an informative message to a named pipe.

Code 1 :

```
// server
#include <errno.h>
#include <fcntl.h>
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <sys/stat.h>

#define BLKSIZE 1024
#define FIFOARG 1
#define FIFO_PERMS (S_IRWXU | S_IWGRP | S_IWOTH)

// function prototype
int copyfile(int fromfd, int tofd);

int main(int argc, char *argv[]) {
    int requestfd;
    if (argc != 2) { /* name of server fifo is passed on the command line */
        fprintf(stderr, "Usage: %s fifo_name > logfile\n", argv[0]);
        return 1;
    }

    /* create a named pipe to handle incoming requests */
    if ((mkfifo(argv[FIFOARG], FIFO_PERMS) == -1) && (errno != EEXIST)) {
        perror("Server failed to create a FIFO");
        return 1;
    }

    /* open a read/write communication endpoint to the pipe */
    if ((requestfd = open(argv[FIFOARG], O_RDWR)) == -1) {
        perror("Server failed to open its FIFO");
        return 1;
    }
}
```



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```
// copy the data received from the named pipe to STDOUT
copyfile(requestfd, STDOUT_FILENO);

return 1;
}

// function to copy data from one file descriptor to another
int copyfile(int fromfd, int tofd) {
    char *bp;
    char buf[BLKSIZE];
    int bytesread;
    int byteswritten = 0;
    int totalbytes = 0;
    for (;;) { // infinite loop
        while (((bytesread = read(fromfd, buf, BLKSIZE)) == -1) && (errno == EINTR))
            ; // handle interruption by signal

        if (bytesread <= 0) // real error or end-of-file on fromfd
            break;

        bp = buf;
        while (bytesread > 0) {
            while (((byteswritten = write(tofd, bp, bytesread)) == -1) && (errno == EINTR))
                ; // handle interruption by signal
            if (byteswritten < 0) // real error on tofd
                break;

            totalbytes += byteswritten;
            bytesread -= byteswritten;
            bp += byteswritten;
        }

        if (byteswritten == -1) // real error on tofd
            break;
    }
    return totalbytes;
}
```



Code 2 :

```
// Client
#include <errno.h>
#include <fcntl.h>
#include <limits.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <time.h>
#include <unistd.h>
#include <sys/stat.h>
#include <limits.h>

#define FIFOARG 1 // Argument index for the name of the server FIFO.

int main(int argc, char *argv[])
{
    time_t curtime;
    int len;
    char requestbuf[_PC_PIPE_BUF];
    int requestfd;
    if (argc != 2)
    { // Check if the argument count is correct.
        fprintf(stderr, "Usage: %s fifo\n", argv[0]);
        return 1;
    }
    // Open the FIFO for writing.
    if ((requestfd = open(argv[FIFOARG], O_WRONLY)) == -1)
    {
        perror("Client failed to open log fifo for writing");
        return 1;
    }

    // Get the current time and format the message to be sent to the server.
    curtime = time(NULL);
    snprintf(requestbuf, _PC_PIPE_BUF, "%d: %s", (int)getpid(), ctime(&curtime));
    len = strlen(requestbuf);

    // Write the message to the server and check for errors.
    if (write(requestfd, requestbuf, len) != len)
    {
```



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```
perror("Client failed to write");
return 1;
}
// Close the FIFO.
close(requestfd);
return 0;
}
```

Output :

```
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_31&32$ g++ -o server prog_31.c
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_31&32$ g++ -o client prog_32.c
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_31&32$ ./server mypipe
28112817

ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_31&32$ ./client
Usage: ./client fifoname
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_31&32$ ./client mypipe
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_31&32$ ./client mypipe
ap-73@AP:/mnt/A2A25781A257593D/Practical6th/OS_Programs/Practical_31&32$
```




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2.	Write a Program which converts all the small case letters in a file into appropriate capital letters.		
3.	Write a program to print the details of the system (use uname sys call)		
4.	Write a program which will print the list of environment variable and also print the value of the PATH system variable		
5.	Write a program to print current (soft) limit and maximum (Hard) limits of all resources		
6.	Write a program with an exit handler that outputs CPU usage.		
7.	Write a program that prints it's & it's parent's process ID.		
8.	Write a program that prints out various user & group ID's.		
9	Write a program which uses fork to create a child process& then parent & child print their respective process ID's.		
10.	Write a program that creates a chain of n processes, where n is a command line argument.		
11.	Write a program that creates a fan of n processes where n is passed as a command line argument.		
12.	Write a program to show that same opened file can be shared by both parent and child processes		
13.	Write a program that creates a child process to run ls – l		



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14.	Write a program to create a zombie child and find its status using system (ps) command		
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29.	Write a Program to print the entries of passwd file for a given user name or user ID.		
30.	Write a program to print the details of the system.		
31.	Write a program which Reads what is written to a named pipe & writes it to standard output		
32.	Write an informative message to a named pipe.		