Advanced Unix Programming
Lab 7

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Q1. "The child "exec" call inherits the file descriptors of parent if Close_on_exec is not set". Demonstrate with an example

Code :
(A) file ass1.c

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

int main() {
	char *buf[2];
	int pid, status;
	extern char **environ;
	int fd1 = open("test.txt", O_RDONLY);
	buf[0] = (char *)malloc(10);

	sprintf(buf[0], "%i", fd1);
	buf[1] = NULL;
	fcntl(fd1, F_SETFD, 0);
	printf("Close_on_exec not set\n");
	if ((pid = fork()) == 0)
		if (execve("/home/purva/Desktop/pracs/aup/ass7/a", buf, environ) == -1)
			exit(0);

	pid = wait(&status);
	lseek(fd1, 0, SEEK_SET);
	fcntl(fd1, F_SETFD, 1);
	printf("Close_on_exec set\n");
	if ((pid = fork()) == 0)
		if (execve("/home/purva/Desktop/pracs/aup/ass7/a", buf, environ) == -1)
			exit(0);

	pid = wait(&status);
	return 0;
}
```

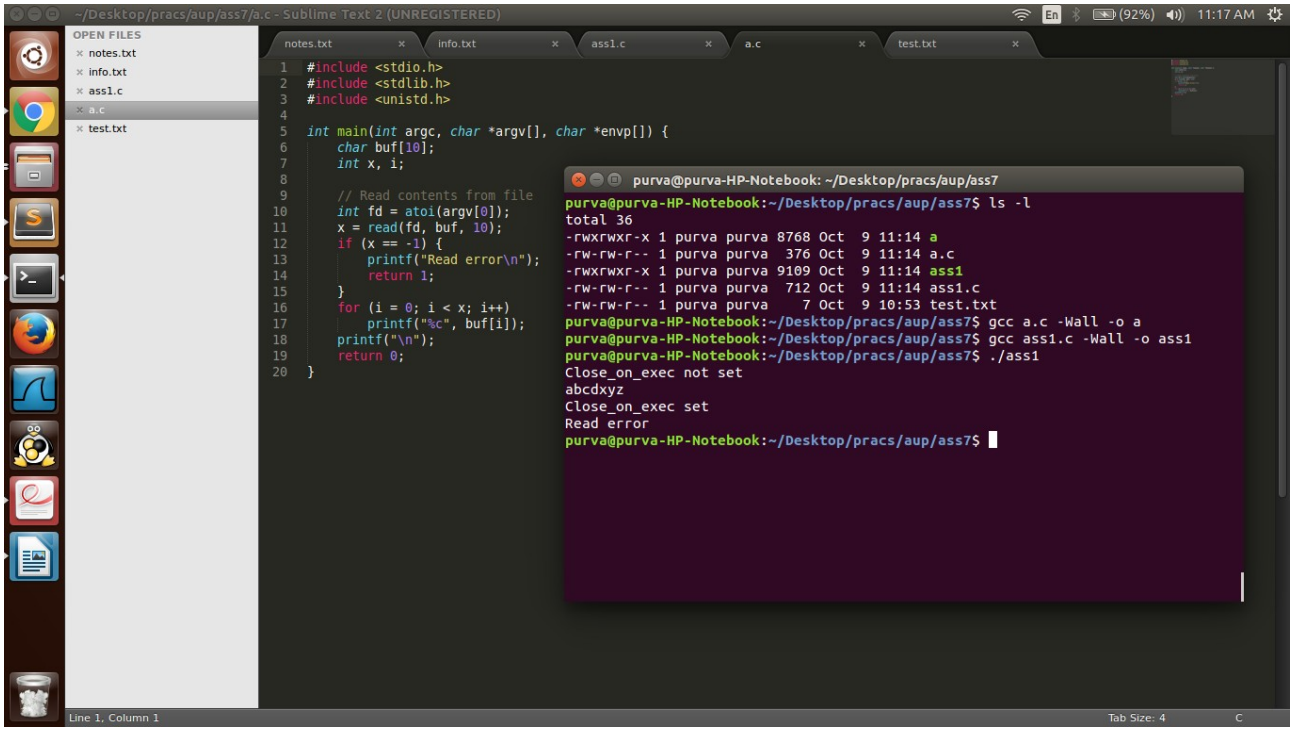
(B) File a.c

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

int main(int argc, char *argv[], char *envp[]) {
	char buf[10];
	int x, i;
```

```
    // Read contents from file
    int fd = atoi(argv[0]);
    x = read(fd, buf, 10);
    if (x == -1) {
            printf("Read error\n");
            return 1;
    }
    for (i = 0; i < x; i++)
            printf("%c", buf[i]);
    printf("\n");
            return 0;
}
```

(C) File test.txt
abcdxyz

Input & Output Screenshots :



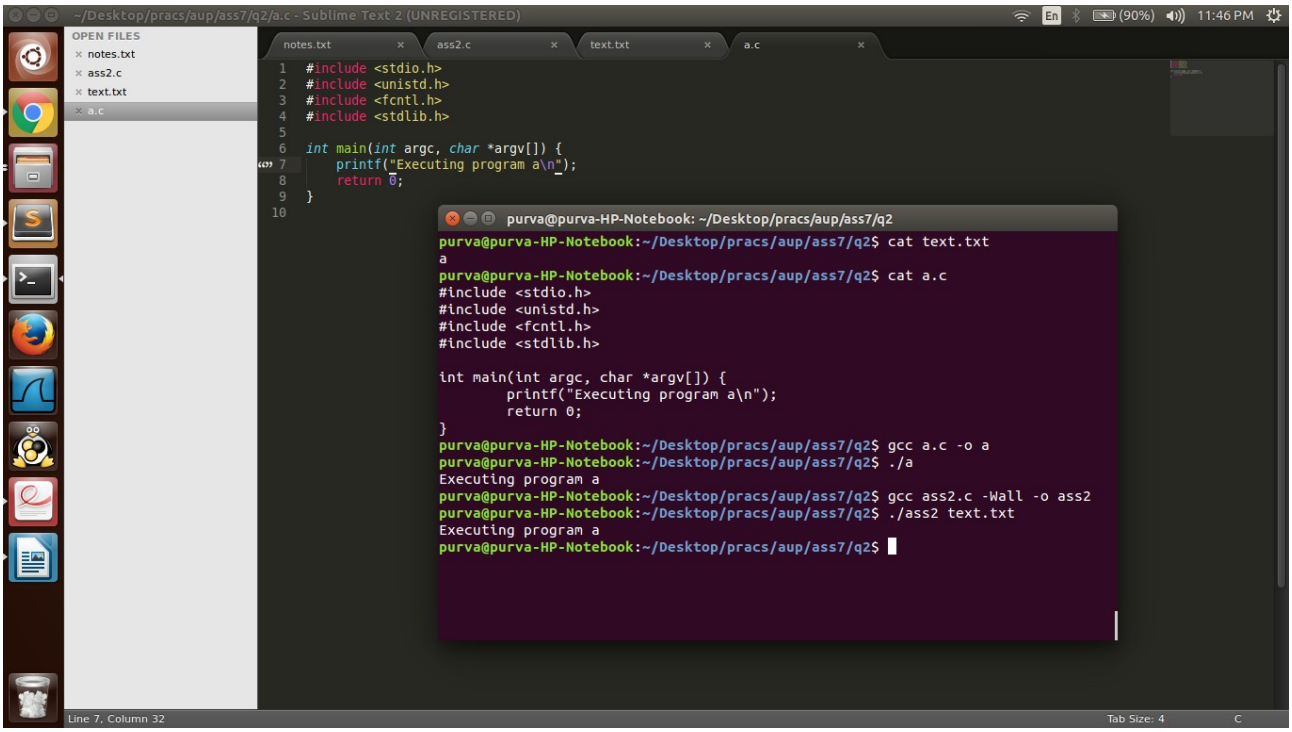
Q2. Write a program that takes a file name as an argument, opens the file, reads it and closes the file. The file should contain a string with the name of another application (e.g., 'ls' or 'ps' or any of your own applications) and the program forks a new process that executes the application named in the file.

Code :

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

```
#define NAME_MAX 50

int main() {
	char buf[NAME_MAX];
	int fd1 = open("text.txt", O_RDONLY);
	int c;
	if((c = read(fd1, buf, NAME_MAX)) < 0) {
		printf("read error\n");
		return 0;
	}
	if(buf[c - 1] == '\n')
		buf[c - 1] = '\0';
	else
		buf[c] = '\0';

	int pid;
	char *arg[2];
	arg[0] = buf;
	arg[1] = NULL;
	char cmd[NAME_MAX] = "./";
	strcat(cmd, buf);

	pid = fork();
	if (pid == 0) {
		if(execvp(cmd, arg) == -1) {
			printf("error\n");
			exit(0);
		}
	}

	return 0;
}
```

Input & Output Screenshots :

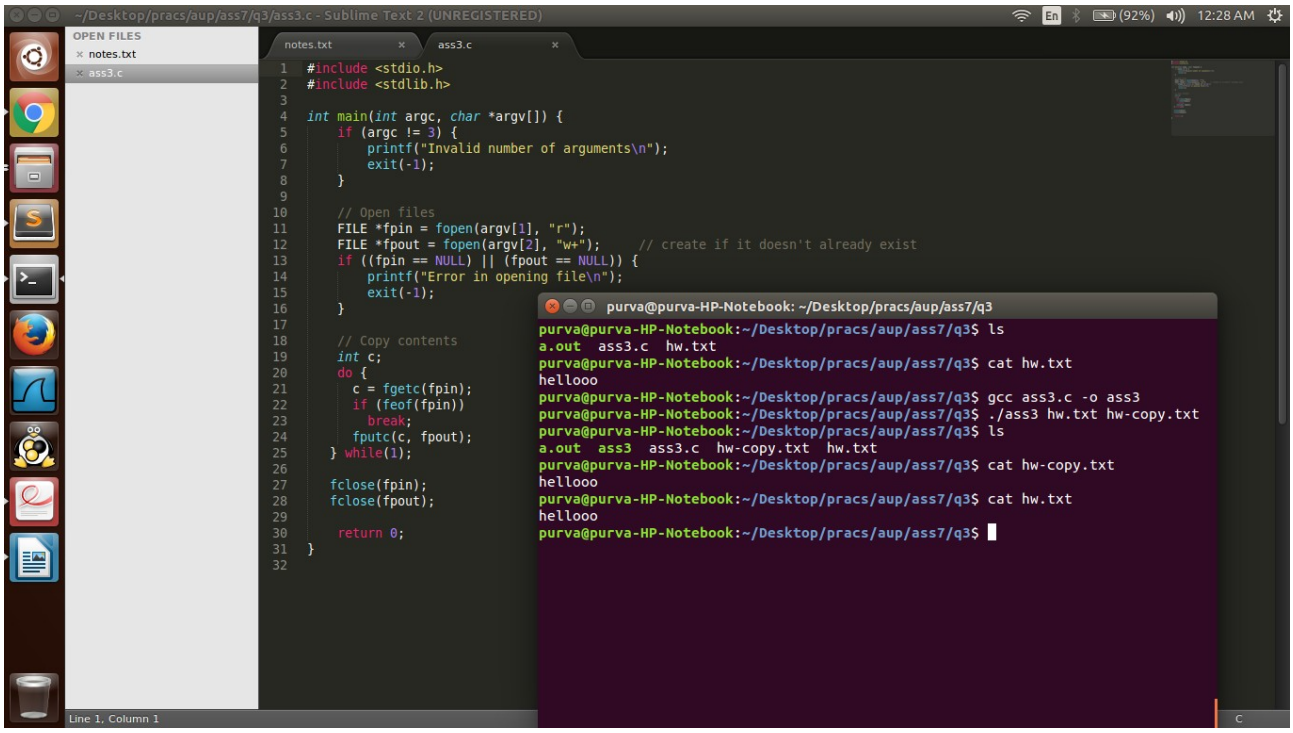


Q3. Implement cat < hw.txt > hw-copy.txt

Code :

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

int main(int argc, char *argv[]) {
        if (argc != 3) {
                printf("Invalid number of arguments\n");
                exit(-1);
        }

        // Open files
        FILE *fpin = fopen(argv[1], "r");
        FILE *fpout = fopen(argv[2], "w+");          // create if it doesn't already exist
        if ((fpin == NULL) || (fpout == NULL)) {
                printf("Error in opening file\n");
                exit(-1);
        }

        // Copy contents
        int c;
        do {
    c = fgetc(fpin);
    if (feof(fpin))
        break;
    fputc(c, fpout);
  } while(1);

  fclose(fpin);
  fclose(fpout);

        return 0;
}
```

Input & Output Screenshots :



Q4. Bob works for an auditing agency needs to be able to read all the files in the system. The system admin has to protect the integrity of the system and should not allow Bob to modify or delete any file. Write a special SETUID program for the admin so that he can gave the executable permission of it to Bob. This program requires Bob to type a file name at the command line and then it will run /bin/cat to display the specified file. Can Bob compromise the integrity (by adding/modifying/deleting files) of this system? How?

Code :

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

int main(int argc, char *argv[]) {
	char *vec[3];
	if (argc < 2) {
		printf("Please type a file name.\n");
		return 1;
	}

	vec[0] = "/bin/cat"; vec[1] = argv[1]; vec[2] = 0;
	if (execve(vec[0], vec, 0) < 0) {
		printf("exec error\n");
		return 0;
	}

	return 0;
}
```

Contents of file temp.txt:
This is file temp.txt

Input & Output :
gcc ass4.c -Wall
./a.out temp.txt
This is file temp.txt

Explanation :
Bob can replace the "cat" executable in the bin directory and with his own malicious executable (with instructions to modify or delete files) with same name (i.e. cat). So when the program is run, it will execute the malicious cat file. Since the process has superuser privileges, the malicious cat program will also gain superuser privilege and can modify or delete any files on the system.