Assignment#2-2

시스템 프로그래밍 실습

제출일: 4월 12일 금요일

분 반: 화요일

담당 교수: 신영주

학 번: 2015722025

학 과: 컴퓨터정보공학부
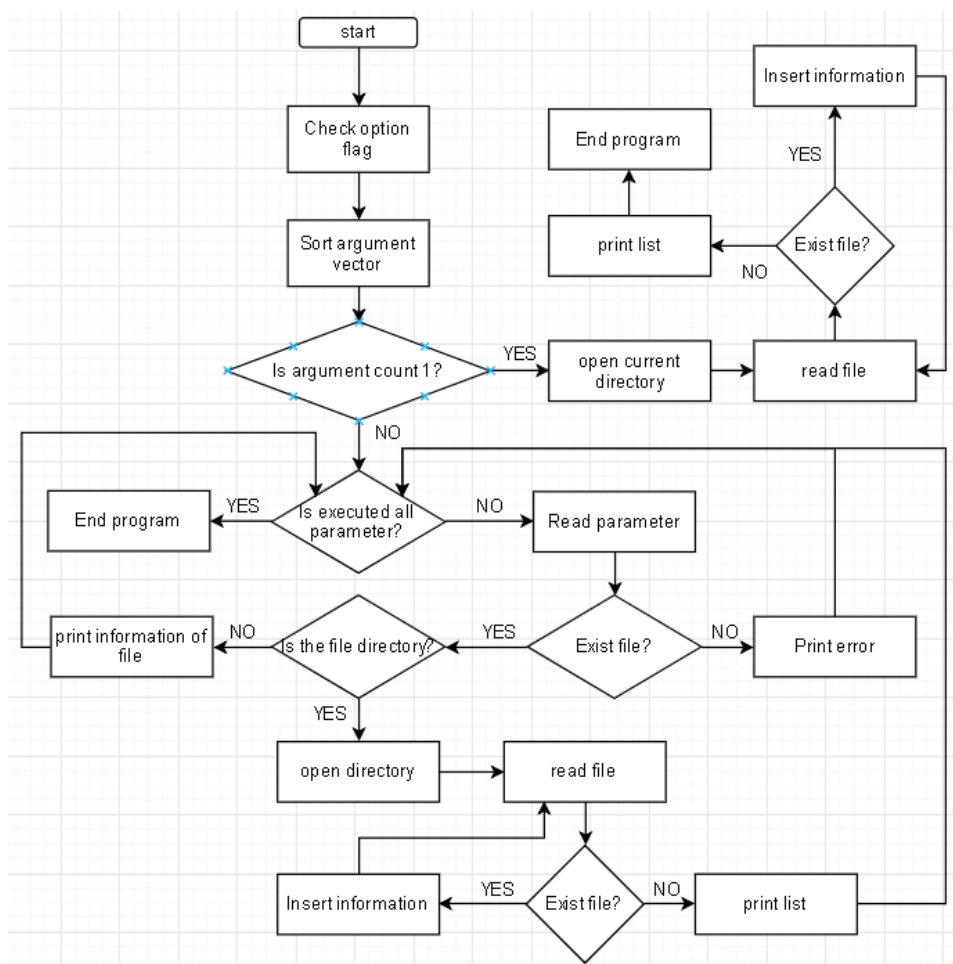
이 름: 정용훈

1. Introduction

이번 과제는 ls를 구현하는데 이어 옵션을 추가하여 구현하는 것이다. 동작은 ls의 –l과 –a를 추가하여 구현하며, 옵션의 순서 상관없이 해당 옵션이 실행되어야 하는 특징을 갖는다. 해당 과제를 수행하기 위해서는 lstat함수를 이용하여 파일을 읽은 후 파일의 정보를 출력할 수 있는 여러 함수를 사용하고, 옵션을 제어할 수 있는 getopt함수를 사용하면 된다.
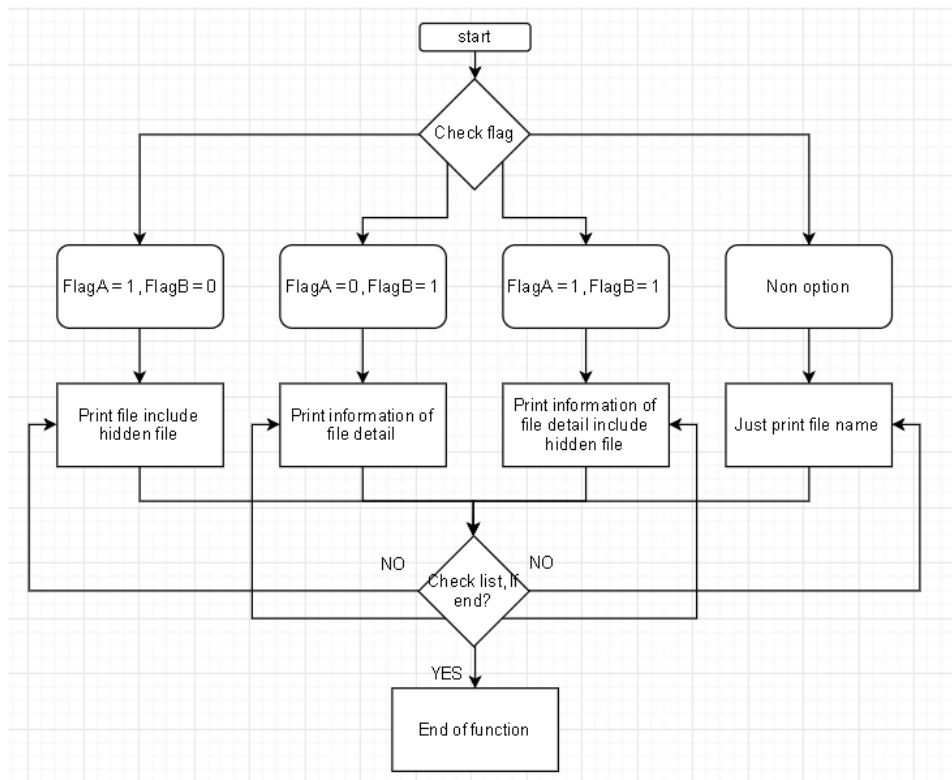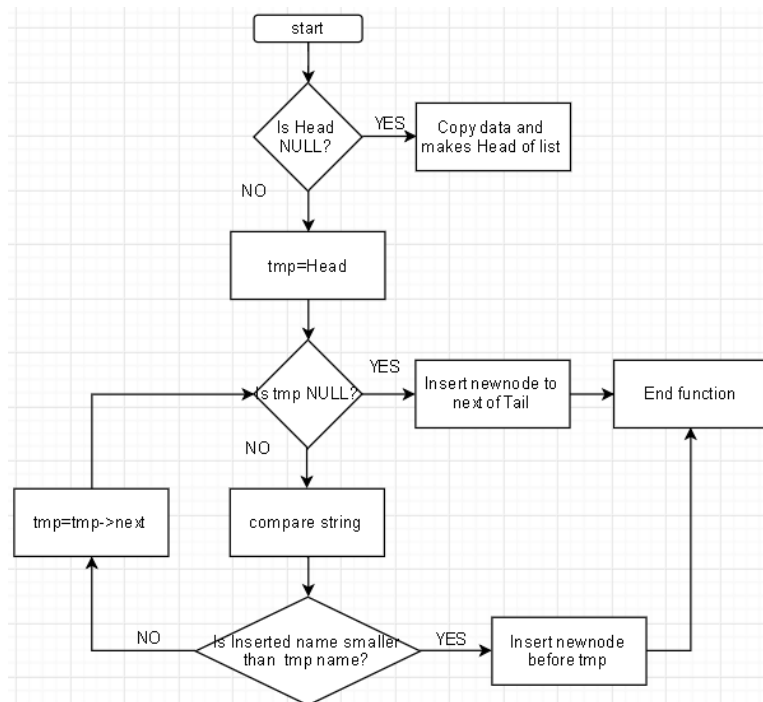
2. Flow Chart

Main

메인함수의 전체동작을 flow chart로 나타낸 것이다. 각각의 함수의 동작은 아래 자세하게 기재되어있다.

Printlist

받은 정보를 통하여 option의 flag값을 통해 어떤 정보들을 출력할지 결정한다.

Insertnode

따로 sort함수를 사용하지 않고 insert를 실행 할 때부터 sort가 되며, list가 생성된다.

Checkstring
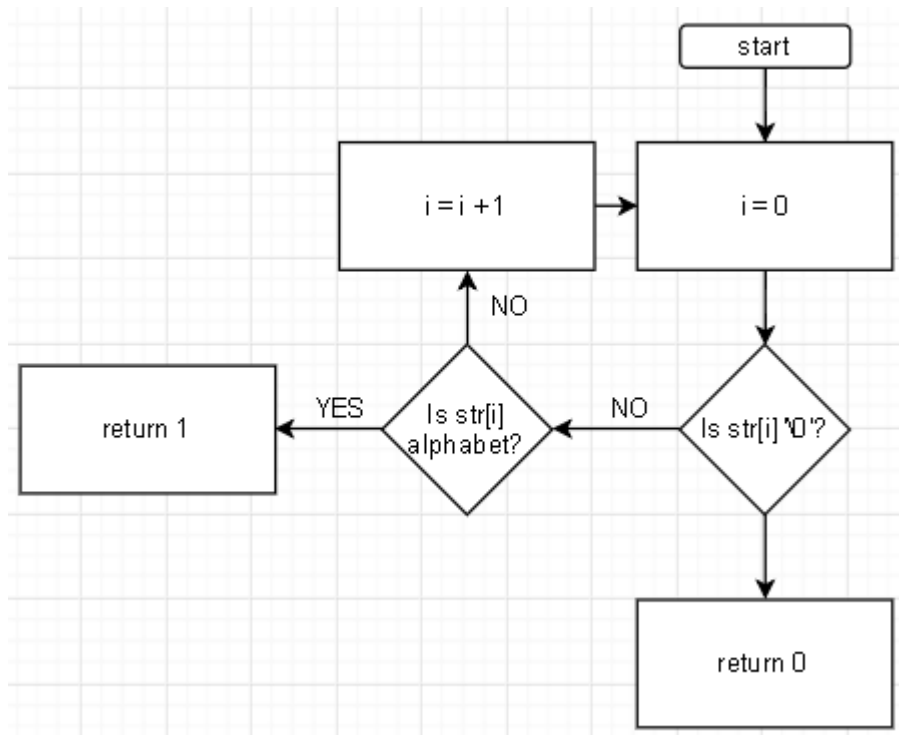
Eliminate와 연계되는 함수로써 알파벳이 아닌 문자로만 이루어진 string일 경우 '.'을 제거하지 않기 위한 함수다.

Eliminate
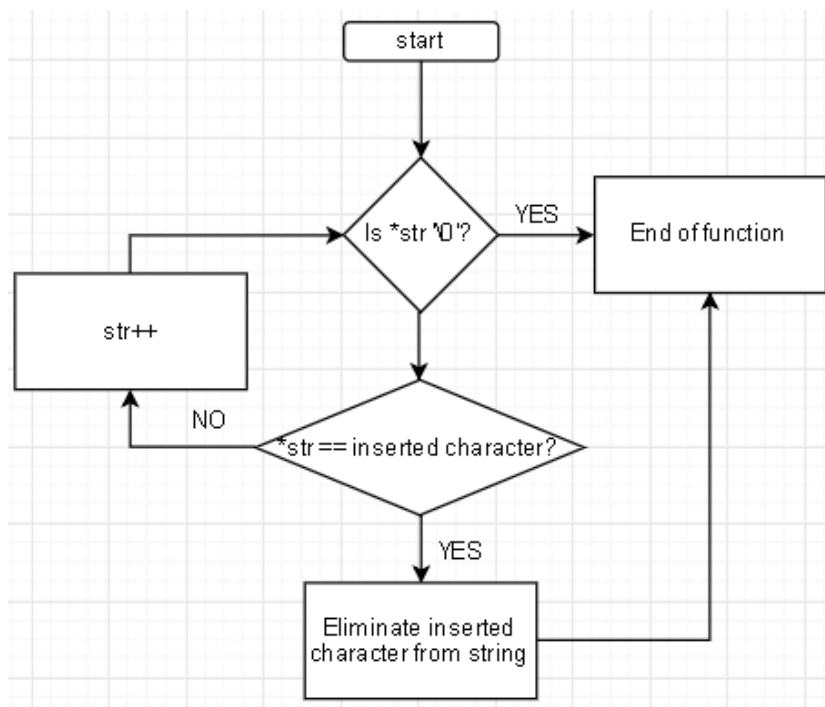
Hidden file의 이름을 비교하기 위해 '.'을 제거하는 함수다.

Deletelist
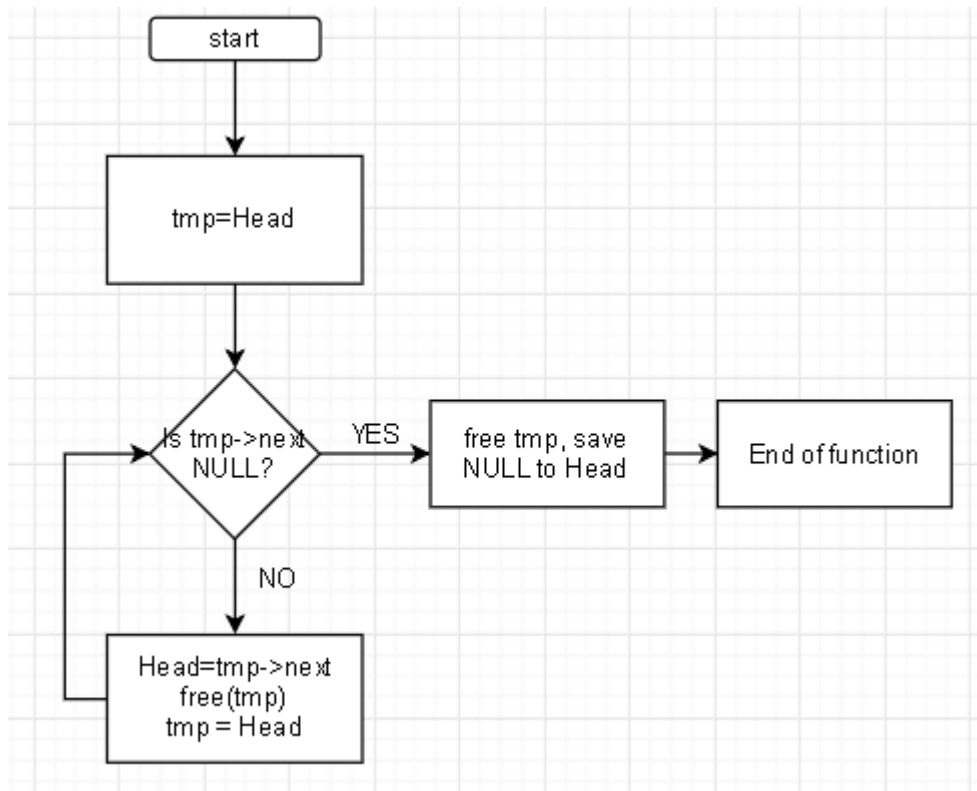
모든 정보 출력 후 linked list를 제거하는 함수다.

printType
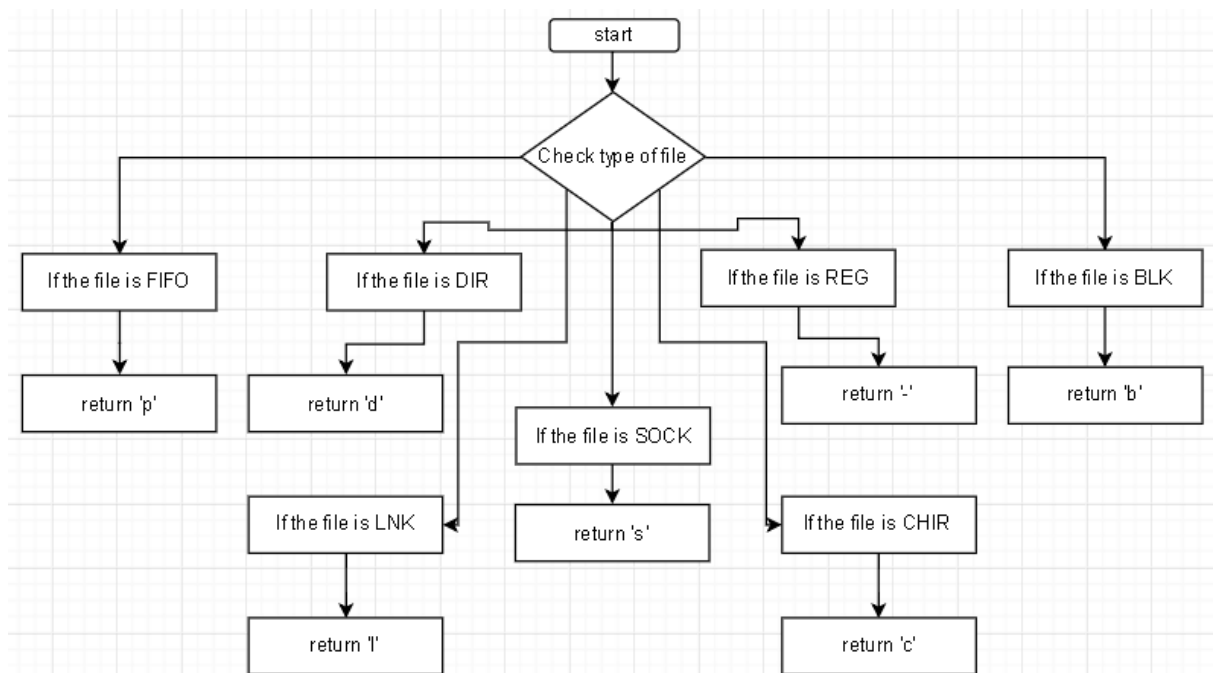
파일의 정보를 받아와 st_mode를 통하여 파일의 type을 정의하는 함수다

printPerm
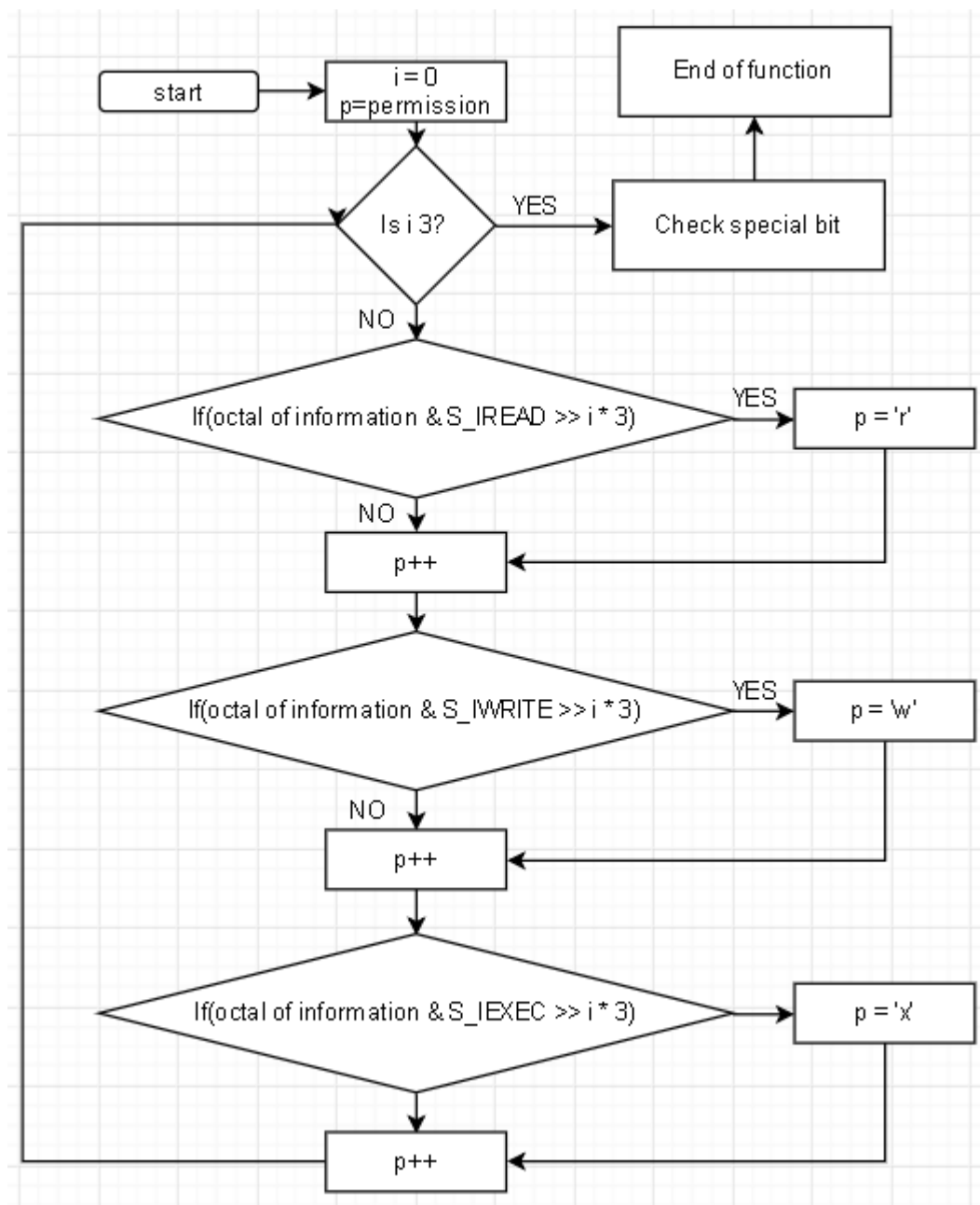
St_mode를 받아와 해당 파일의 permission을 확인하여, 최종적인 permission을 출력할 수 있도록 도와주는 함수다.

3. Pseudo code

Main

```
int main(int argc, char** argv)
{
        int c = 0;
        int height = 2;
        DIR *dirp;

        struct dirent *dir;
        struct stat buf;
        struct group *gid;
        struct passwd *uid;

        struct tm *time;
        char buff[256];

        int flagA = 0;
        int flagL = 0;
        int argcount = 0;
        int total=0;
        char swap[256];
        char Subargv[256][256]={'\0'};
        int count=1;
```

```
//////////////////////////////option//////////////////////////////
        while (befor read all option)
        {
                switch (value of option)
                {
                if option is 'a':
                        flagA = 1; and break;
                if option is 'l':
                        flagL = 1; and break;
                }
        }
////////////////////////////////////////////////////////////////////
/////////////////////move parameter///////////////////////////
        while(brfor read all argv)
        {
                if(First name of argv is '-')
                {
                        strcpy(Subargv[count],argv[i]);
                        count++;
                }
        }

        while(brfor read all argv)
        {
                if(File is not read)
                {
                        strcpy(Subargv[count],argv[i]);
                        count++;
                }
        }


        while(brfor read all argv)
        {
                Read file;
                if(File is not directory)
                {
                        strcpy(Subargv[count],argv[i]);
                        count++;
                }
        }
```

```
while(brfor read all argv)
{
        if(File is directory)
        {
                strcpy(Subargv[count],argv[i]);
                count++;
        }
}
//////////////////////////////////////////////////////////////////
        if (parameter nubmer is 1)
        {
                dirp = open current directory

                do
                {
                        dir = readdir(dirp);

                        if (File is not opended)
                                break;

                        else
                        {
                                lstat(dir->d_name,&buf);
                                InsertNode;
                        }

                } while (1);

                Print List
                return 0;
        }
```

```
while (befor read all argv)
{
        if (File is not opended)
        {
                Print error;
                continue;
        }
        else
        {
                if (File is directory)
                {
                        dirp = open directroy

                        do
                        {
                                dir = readdir(dirp);

                                if (Directory is not opended)
                                        break;
                                else
                                {
                                        lstat(dir->d_name,&buf);
                                        InsertNode;
                                }

                        } while (1);

                        Print List
                }
                else

                printfile(flagA,flagL,Subargv[i]);
        }

}
return 0;
}
```

Printlist

```
void printlist(DIR *dirp, int flagA, int flagL,int total)
{
            struct group *gid;
            struct passwd *uid;
            struct tm *time;
            char buff[256];
            char cwd[256];
            struct stat buf;
            struct dirent *dir;

            if (option L is on)
            {
                        Print current working directory;
                        total block;
            }

            while (befor check all node)
            {

                        if (option L is on)
                        {
                                    print file information detail;

                                    if(The file is link file)
                                            strcat(filename, realpath);
                        }
                        print file name;
            }
            return;
}

(if option A is on, print include hidden file)
```

Nodeinsert

```
void Nodeinsert(char* name)
{
        char Ename[256];
        char Etmpname[256];
        Node* tmp = Head;
        Node* prevnode;

        if (Head of list is NULL)
        {
                Makes newnode;
                strcpy(newnode->filename, name);
                newnode->next = NULL;
                newnode->prev = NULL;

                Head = newnode;
                return;
        }

        else
        {
                while (tmp is not NULL)
                {
                        strcpy(Ename, name);
                        strcpy(Etmpname, tmp->filename);

                        if (checkstring(Ename))
                                Eliminate character of '.'
                        if (checkstring(Etmpname))
                                Eliminate character of '.'

                        if Etmpname is bigger than name)
                        {
                                if (tmp is Head)
                                {
                                        Makes newnode;
                                        strcpy(newnode->filename, name);
                                        newnode->prev = NULL;

                                        newnode->next = Head;
                                        Head->prev = newnode;
                                        Head = newnode;
                                        return;
                                }
```

```
                              else
                              {
                                        Makes newnode;
                                        strcpy(newnode->filename, name);
                                        newnode->next = tmp;
                                        newnode->prev = tmp->prev;
                                        tmp->prev->next = newnode;
                                        tmp->prev = newnode;
                                        return;
                              }
                    }
                    else continue;
          }
          Move prev to Tail;
          Makes newnode;

          strcpy(newnode->filename, name);
          newnode->next = NULL;
          prevnode->next = newnode;
          newnode->prev = prevnode;
          Tail = newnode;
          return;


          }
}
```

Function of others

```
void Eliminate(char *str, char ch)
{
        while (;befor check all character of string;str++)
        {
                if (*str == ch)
                {
                        strcpy(str, str + 1);
                        str--;
                        return;
                }
        }
}

void deletelist()
{
        Node* tmp = Head;
        for (; tmp->next != NULL;)
        {
                Head = tmp->next;
                free(tmp);
                tmp = Head;
        }
        free(tmp);
        Head = NULL;
}
```

```c
char printType(mode_t mode)
{
        switch (mode & S_IFMT)
        {
        case S_IFREG:
                return('-');
        case S_IFDIR:
                return('d');
        case S_IFCHR:
                return('c');
        case S_IFBLK:
                return('b');
        case S_IFLNK:
                return('l');
        case S_IFIFO:
                return('p');
        case S_IFSOCK:
                return('s');
        }

        return('?');
}

char *printPerm(mode_t mode)
{
        int i;
        char *p;
        static char perms[10];
        p = perms;
        strcpy(perms, "---------");

        for (i = 0; i < 3; i++)
        {
                if (mode & (S_IREAD >> i * 3))
                        *p = 'r';
                p++;

                if (mode & (S_IWRITE >> i * 3))
                        *p = 'w';
                p++;

                if (mode & (S_IEXEC >> i * 3))
                        *p = 'x';
                p++;
        }
        if ((mode & S_ISUID) != 0)
                perms[2] = 's';

        if ((mode & S_ISGID) != 0)
                perms[5] = 's';

        if ((mode & S_ISVTX) != 0)
                perms[8] = 't';

        return(perms);
}
```

4. Result

PDF 예시

존재하지 않는 파일이나 디렉토리

```
sp20157522025@ubuntu:~$ ./spls_advanced -la dkfsji
cannot access dkfsji: No such file or directory
```

존재하지 않는 파일이나 디렉토리와 올바른 파일 혹은 디렉토리 명이 입력으로 같이 들어온 경우

```
sp20157522025@ubuntu:~$ ./spls_advanced -l dkfhsji test
cannot access dkfhsji: No such file or directory
Directory path: /home/sp20157522025/test
total: 780
-rw-rw-r-- 1    sp20157522025    sp20157522025    38       Apr 01 04:36    Makefile
-rw-rw-r-- 1    sp20157522025    sp20157522025    179      Apr 07 05:26    simple_ls.c
-rwxrw-rw- 1    sp20157522025    sp20157522025    365912   Apr 02 05:35    tue_2-1_2015722025 (1).tar.gz
-rwxrw-rw- 1    sp20157522025    sp20157522025    419771   Apr 02 03:39    tue_2-1_2015722025.pdf
```

-l 옵션 실행

```
sp20157522025@ubuntu:~$ ./spls_advanced -l
Directory path: /home/sp20157522025
total: 180
-rw-rw-r-- 1    sp20157522025    sp20157522025    0        Apr 03 07:10    !
-rw-rw-r-- 1    sp20157522025    sp20157522025    0        Apr 03 07:10    1
drwxrwxr-x 2    sp20157522025    sp20157522025    4096     Apr 04 21:06    A
-rw-rw-r-- 1    sp20157522025    sp20157522025    8368     Apr 08 03:02    A.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    1215     Apr 06 09:40    B.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    0        Apr 04 21:05    C
-rw-rw-r-- 1    sp20157522025    sp20157522025    0        Apr 04 21:05    d
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Desktop
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Documents
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Downloads
drwxrwxr-x 2    sp20157522025    sp20157522025    4096     Apr 02 03:22    ET
-rw-r--r-- 1    sp20157522025    sp20157522025    8980     Mar 15 19:55    examples.desktop
-rw-rw-r-- 1    sp20157522025    sp20157522025    0        Apr 04 21:06    H
drwxrwxr-x 3    sp20157522025    sp20157522025    4096     Mar 29 18:41    J
-rw-rw-r-- 1    sp20157522025    sp20157522025    46       Apr 08 02:56    Makefile
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Music
-rw-rw-r-- 1    sp20157522025    sp20157522025    7403     Apr 02 03:33    optionsample.c
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Pictures
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Public
-rwxrwxr-x 1    sp20157522025    sp20157522025    24112    Apr 08 02:55    run
-rwxrwxr-x 1    sp20157522025    sp20157522025    17312    Apr 03 06:47    run2
-rw-rw-r-- 1    sp20157522025    sp20157522025    7390     Apr 02 18:09    simple_ls.c
-rwxrwxr-x 1    sp20157522025    sp20157522025    24144    Apr 08 03:11    spls_advanced
-rw-rw-r-- 1    sp20157522025    sp20157522025    8366     Apr 08 03:11    spls_advanced.c
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Templates
drwxrwxr-x 2    sp20157522025    sp20157522025    4096     Apr 07 05:26    test
drwxrwxr-x 4    sp20157522025    sp20157522025    4096     Mar 29 18:15    test2
drwxr-xr-x 2    sp20157522025    sp20157522025    4096     Mar 15 20:33    Videos
-rw-rw-r-- 1    sp20157522025    sp20157522025    0        Apr 04 21:06    X
```

-a 옵션 실행

```
sp20157522025@ubuntu:~$ ./spls_advanced -a
!
.
..
...
1
A
A.c
.ACD.swp
.bash_history
.bash_logout
.bashrc
B.c
C
.cache
.compiz
.config
d
Desktop
.dmrc
Documents
Downloads
ET
examples.desktop
.gconf
.gnupg
H
.hello.swo
.hello.swp
.ICEauthority
J
.JJEONG
.local
Makefile
.Makefile.swo
.mozilla
```

옵션 –la 실행

```
sp20157522025@ubuntu:~$ ./spls_advanced -la
Directory path: /home/sp20157522025
total: 336
-rw-rw-r-- 1    sp20157522025   sp20157522025   0       Apr 03 07:10   !
drwxr-xr-x 23   sp20157522025   sp20157522025   4096    Apr 08 03:11   .
               root    root    4096    Mar 15 19:55   ..
drwxrwxr-x 2    sp20157522025   sp20157522025   4096    Apr 03 22:54   ...
-rw-rw-r-- 1    sp20157522025   sp20157522025   0       Apr 03 07:10   1
drwxrwxr-x 2    sp20157522025   sp20157522025   4096    Apr 04 21:06   A
-rw-rw-r-- 1    sp20157522025   sp20157522025   8368    Apr 08 03:02   A.c
-rw-r--r-- 1    sp20157522025   sp20157522025   12288   Mar 29 09:14   .ACD.swp
-rw------- 1    sp20157522025   sp20157522025   18469   Apr 07 21:08   .bash_history
-rw-r--r-- 1    sp20157522025   sp20157522025   220     Mar 15 19:55   .bash_logout
-rw-r--r-- 1    sp20157522025   sp20157522025   3771    Mar 15 19:55   .bashrc
-rw-rw-r-- 1    sp20157522025   sp20157522025   1215    Apr 06 09:40   B.c
-rw-rw-r-- 1    sp20157522025   sp20157522025   0       Apr 04 21:05   C
drwx------ 16   sp20157522025   sp20157522025   4096    Apr 02 03:20   .cache
drwx------ 3    sp20157522025   sp20157522025   4096    Mar 21 01:45   .compiz
drwx------ 15   sp20157522025   sp20157522025   4096    Mar 18 20:15   .config
-rw-rw-r-- 1    sp20157522025   sp20157522025   0       Apr 04 21:05   d
drwxr-xr-x 2    sp20157522025   sp20157522025   4096    Mar 15 20:33   Desktop
-rw-r--r-- 1    sp20157522025   sp20157522025   25      Mar 15 20:33   .dmrc
drwxr-xr-x 2    sp20157522025   sp20157522025   4096    Mar 15 20:33   Documents
drwxr-xr-x 2    sp20157522025   sp20157522025   4096    Mar 15 20:33   Downloads
drwxrwxr-x 2    sp20157522025   sp20157522025   4096    Apr 02 03:22   ET
-rw-r--r-- 1    sp20157522025   sp20157522025   8980    Mar 15 19:55   examples.desktop
drwx------ 2    sp20157522025   sp20157522025   4096    Mar 15 22:08   .gconf
drwx------ 3    sp20157522025   sp20157522025   4096    Apr 08 02:45   .gnupg
-rw-rw-r-- 1    sp20157522025   sp20157522025   0       Apr 04 21:06   H
-rw------- 1    sp20157522025   sp20157522025   4096    Mar 16 08:42   .hello.swo
-rw------- 1    sp20157522025   sp20157522025   12288   Mar 16 08:40   .hello.swp
-rw------- 1    sp20157522025   sp20157522025   18444   Apr 08 02:45   .ICEauthority
drwxrwxr-x 3    sp20157522025   sp20157522025   4096    Mar 29 18:41   J
```

/home /var

```
sp20157522025@ubuntu:~$ ./spls_advanced -la /home /var
Directory path: /home
total: 12
drwxr-xr-x 3    root     root     4096     Mar 15 19:55    .
drwxr-xr-x 24   root     root     4096     Apr 02 17:10    ..
drwxr-xr-x 23   sp20157522025    sp20157522025    4096    Apr 08 03:11    sp20157522025
Directory path: /var
total: 56
drwxr-xr-x 14   root     root     4096     Jul 30 17:50    .
drwxr-xr-x 24   root     root     4096     Apr 02 17:10    ..
drwxr-xr-x 2    root     root     4096     Apr 04 07:26    backups
drwxr-xr-x 16   root     root     4096     Mar 15 20:00    cache
drwxrwsrwt 2    root     whoopsie     4096    Apr 07 05:25    crash
drwxr-xr-x 66   root     root     4096     Mar 15 20:33    lib
drwxrwsr-x 2    root     staff    4096     Apr 12 13:14    local
lrwxrwxrwx 1    root     root     9        Mar 15 19:54    lock->lock
drwxrwxr-x 13   root     syslog   4096     Apr 08 02:50    log
drwxrwsr-x 2    root     mail     4096     Jul 30 17:30    mail
drwxrwsrwt 2    root     whoopsie     4096    Jul 30 17:40    metrics
drwxr-xr-x 2    root     root     4096     Jul 30 17:30    opt
lrwxrwxrwx 1    root     root     4        Mar 15 19:54    run->run
drwxr-xr-x 2    root     root     4096     Jul 19 03:48    snap
drwxr-xr-x 7    root     root     4096     Jul 30 17:37    spool
drwxrwxrwt 5    root     root     4096     Apr 08 02:47    tmp
```

Makefile   simple_ls.c

```
sp20157522025@ubuntu:~$ ./spls_advanced Makefile simple_ls.c
Makefile
simple_ls.c
```

No parameter

```
sp20157522025@ubuntu:~$ ./spls_advanced
!
1
A
A.c
B.c
C
d
Desktop
Documents
Downloads
ET
examples.desktop
H
J
Makefile
Music
optionsample.c
Pictures
Public
```

PDF외의 예시

옵션 순서 변경

```
sp20157522025@ubuntu:~/test2$ ./spls_advanced -l -a
Directory path: /home/sp20157522025/test2
total: 84
drwxrwxr-x 4    sp20157522025    sp20157522025    4096    Apr 08 03:22    .
drwxr-xr-x 23   sp20157522025    sp20157522025    4096    Apr 08 03:11    ..
drwxrwxr-x 3    sp20157522025    sp20157522025    4096    Mar 29 18:17    A
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 28 22:44    AA
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    AB
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 26 04:16    aBcd
drwxrwxr-x 2    sp20157522025    sp20157522025    4096    Mar 29 18:06    ABCD
-rw-rw-r-- 1    sp20157522025    sp20157522025    73      Mar 29 06:28    A.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 26 04:16    ACbd
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    BB
-rw-rw-r-- 1    sp20157522025    sp20157522025    73      Mar 22 05:37    B.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    CA
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    CC
-rw-rw-r-- 1    sp20157522025    sp20157522025    2425    Mar 28 23:42    ls.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    46      Apr 08 02:56    Makefile
-rwxrwxr-x 1    sp20157522025    sp20157522025    13544   Mar 28 04:04    spls
-rwxrwxr-x 1    sp20157522025    sp20157522025    24144   Apr 08 03:11    spls_advanced
-rw-rw-r-- 1    sp20157522025    sp20157522025    8366    Apr 08 03:11    spls_advanced.c
sp20157522025@ubuntu:~/test2$ ./spls_advanced -la
Directory path: /home/sp20157522025/test2
total: 84
drwxrwxr-x 4    sp20157522025    sp20157522025    4096    Apr 08 03:22    .
drwxr-xr-x 23   sp20157522025    sp20157522025    4096    Apr 08 03:11    ..
drwxrwxr-x 3    sp20157522025    sp20157522025    4096    Mar 29 18:17    A
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 28 22:44    AA
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    AB
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 26 04:16    aBcd
drwxrwxr-x 2    sp20157522025    sp20157522025    4096    Mar 29 18:06    ABCD
-rw-rw-r-- 1    sp20157522025    sp20157522025    73      Mar 29 06:28    A.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 26 04:16    ACbd
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    BB
-rw-rw-r-- 1    sp20157522025    sp20157522025    73      Mar 22 05:37    B.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    CA
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Mar 25 23:06    CC
-rw-rw-r-- 1    sp20157522025    sp20157522025    2425    Mar 28 23:42    ls.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    46      Apr 08 02:56    Makefile
-rwxrwxr-x 1    sp20157522025    sp20157522025    13544   Mar 28 04:04    spls
-rwxrwxr-x 1    sp20157522025    sp20157522025    24144   Apr 08 03:11    spls_advanced
-rw-rw-r-- 1    sp20157522025    sp20157522025    8366    Apr 08 03:11    spls_advanced.c
```

/bin -l

```
sp20157522025@ubuntu:~/test2$ ./spls_advanced /bin -l
Directory path: /bin
total: 13156
-rwxr-xr-x 1    root    root    1037528 May 16 05:49    bash
-rwxr-xr-x 1    root    root    150792  Aug 21 15:47    bsd-csh
-rwxr-xr-x 1    root    root    31288   May 19 22:10    bunzip2
-rwxr-xr-x 1    root    root    1984584 Mar 07 07:12    busybox
-rwxr-xr-x 1    root    root    31288   May 19 22:10    bzcat
lrwxrwxrwx 1    root    root    6       Mar 16 04:51    bzcmp->bzdiff
-rwxr-xr-x 1    root    root    2140    May 19 22:10    bzdiff
lrwxrwxrwx 1    root    root    6       Mar 16 04:51    bzegrep->bzgrep
-rwxr-xr-x 1    root    root    4877    May 19 22:10    bzexe
lrwxrwxrwx 1    root    root    6       Mar 16 04:51    bzfgrep->bzgrep
```

파일, 디렉토리, 존재하지 않는 파일 순서

```
sp20157522025@ubuntu:~$ ./spls_advanced B.c NOFILE test
cannot access NOFILE: No such file or directory
B.c
Makefile
simple_ls.c
tue_2-1_2015722025 (1).tar.gz
tue_2-1_2015722025.pdf
```

절대경로 옵션 –l 절대경로

```
sp20157522025@ubuntu:~$ ./spls_advanced /home -l /boot
Directory path: /home
total: 4
drwxr-xr-x 23   sp20157522025   sp20157522025   4096    Apr 08 03:53    sp20157522025
Directory path: /boot
total: 198040
-rw-r--r-- 1    root    root    1537161 Jul 18 05:24    abi-4.15.0-29-generic
-rw-r--r-- 1    root    root    216815  Jul 18 05:24    config-4.15.0-29-generic
-rw-r--r-- 1    root    root    217004  Feb 12 12:25    config-4.15.0-46-generic
-rw-r--r-- 1    root    root    217004  Mar 15 11:40    config-4.15.0-47-generic
drwxr-xr-x 5    root    root    4096    Apr 02 17:10    grub
-rw-r--r-- 1    root    root    54489711        Mar 28 17:58    initrd.img-4.15.0-29-generic
-rw-r--r-- 1    root    root    54515906        Mar 28 17:58    initrd.img-4.15.0-46-generic
-rw-r--r-- 1    root    root    54515220        Apr 02 17:10    initrd.img-4.15.0-47-generic
-rw-r--r-- 1    root    root    184840  Jan 28 04:44    memtest86+_multiboot.bin
-rw-r--r-- 1    root    root    182704  Jan 28 04:44    memtest86+.bin
-rw-r--r-- 1    root    root    184380  Jan 28 04:44    memtest86+.elf
-rw-r--r-- 1    root    root    0       Jul 18 05:24    retpoline-4.15.0-29-generic
-rw------- 1    root    root    4039561 Jul 18 05:24    System.map-4.15.0-29-generic
-rw------- 1    root    root    4049376 Feb 12 12:25    System.map-4.15.0-46-generic
-rw------- 1    root    root    4049889 Mar 15 11:40    System.map-4.15.0-47-generic
-rw-r--r-- 1    root    root    8101496 Jul 30 18:08    vmlinuz-4.15.0-29-generic
-rw------- 1    root    root    8125784 Feb 15 04:18    vmlinuz-4.15.0-46-generic
-rw------- 1    root    root    8130328 Mar 18 07:23    vmlinuz-4.15.0-47-generic
```

절대경로 옵션 –a

```
sp20157522025@ubuntu:~$ ./spls_advanced /home -a
.
..
sp20157522025
```

상대경로 옵션 절대경로

```
sp20157522025@ubuntu:~$ ./spls_advanced test -al /boot
Directory path: /home/sp20157522025/test
total: 800
drwxrwxr-x 2    sp20157522025    sp20157522025    4096    Apr 07 05:26    .
drwxr-xr-x 23   sp20157522025    sp20157522025    4096    Apr 08 03:53    ..
-rw-------  1   sp20157522025    sp20157522025    12288   Mar 27 17:43    .A.swp
-rw-rw-r--  1   sp20157522025    sp20157522025    38      Apr 01 04:36    Makefile
-rw-rw-r--  1   sp20157522025    sp20157522025    179     Apr 07 05:26    simple_ls.c
-rwxrw-rw-  1   sp20157522025    sp20157522025    365912  Apr 02 05:35    tue_2-1_2015722025 (1).tar.gz
-rwxrw-rw-  1   sp20157522025    sp20157522025    419771  Apr 02 03:39    tue_2-1_2015722025.pdf
Directory path: /boot
total: 198048
drwxr-xr-x 3    root    root    4096        Apr 02 17:10    .
drwxr-xr-x 24   root    root    4096        Apr 02 17:10    ..
-rw-r--r--  1   root    root    1537161 Jul 18 05:24    abi-4.15.0-29-generic
-rw-r--r--  1   root    root    216815  Jul 18 05:24    config-4.15.0-29-generic
-rw-r--r--  1   root    root    217004  Feb 12 12:25    config-4.15.0-46-generic
-rw-r--r--  1   root    root    217004  Mar 15 11:40    config-4.15.0-47-generic
drwxr-xr-x 5    root    root    4096        Apr 02 17:10    grub
-rw-r--r--  1   root    root    54489711    Mar 28 17:58    initrd.img-4.15.0-29-generic
-rw-r--r--  1   root    root    54515906    Mar 28 17:58    initrd.img-4.15.0-46-generic
-rw-r--r--  1   root    root    54515220    Apr 02 17:10    initrd.img-4.15.0-47-generic
-rw-r--r--  1   root    root    184840  Jan 28 04:44    memtest86+_multiboot.bin
-rw-r--r--  1   root    root    182704  Jan 28 04:44    memtest86+.bin
-rw-r--r--  1   root    root    184380  Jan 28 04:44    memtest86+.elf
-rw-r--r--  1   root    root    0           Jul 18 05:24    retpoline-4.15.0-29-generic
-rw-------  1   root    root    4039561 Jul 18 05:24    System.map-4.15.0-29-generic
-rw-------  1   root    root    4049376 Feb 12 12:25    System.map-4.15.0-46-generic
-rw-------  1   root    root    4049889 Mar 15 11:40    System.map-4.15.0-47-generic
-rw-r--r--  1   root    root    8101496 Jul 30 18:08    vmlinuz-4.15.0-29-generic
-rw-------  1   root    root    8125784 Feb 15 04:18    vmlinuz-4.15.0-46-generic
-rw-------  1   root    root    8130328 Mar 18 07:23    vmlinuz-4.15.0-47-generic
```

상대경로의 파일, 상대경로

```
sp20157522025@ubuntu:~$ ./spls_advanced test/Makefile test2
test/Makefile
A
AA
AB
aBcd
ABCD
A.c
ACbd
BB
B.c
CA
CC
ls.c
Makefile
spls
spls_advanced
spls_advanced.c
```

파일 옵션

```
sp20157522025@ubuntu:~$ ./spls_advanced B.c C H d -al
-rw-rw-r-- 1    sp20157522025    sp20157522025    1215    Apr 06 09:40    B.c
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Apr 04 21:05    C
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Apr 04 21:06    H
-rw-rw-r-- 1    sp20157522025    sp20157522025    0       Apr 04 21:05    d
```

5. Conclusion

생각보다 구현하는데 꽤 오래 시간이 걸린 과제다. C나 C++에서와는 다른 디버깅 방식으로 익숙해지는데 시간이 조금 걸리게 되었고, 코드를 어느 정도 완성하고 나서도 생각보다 자세한 부분에서의 예외처리가 필요하기도 하여 신경 쓰고 고치는데 많은 시간이 걸렸다. 또한 link파일을 읽어 링크파일이 실제로 가리키고 있는 실제 경로를 표시해주는데 있어 링크되어있는 경로를 찾아주는 함수를 사용 함으로써 strcat함수를 사용하여 원래 파일 이름 뒤에 '->'표시와 함께 붙여주는 작업을 하였다. 이런 부분을 제외한다면 실습시간과 설계시간에 배운 내용으로 option에 관련된 동작들을 모두 수행할 수 있으며, 과제의 큰 틀을 설계 하는 부분에서는 큰 어려움이 없었다고 생각된다.