

Assignment-4

1. Decompress the download file src.3e.tar.gz using

command: **tar -xvf src.3e.tar.gz**

```
gurusaran@guru: ~/Desktop/OS
File Actions Edit View Help
gurusaran@guru:~/Desktop$ cd OS/
gurusaran@guru:~/Desktop/OS$ ls
P0 P0.tbz src.3e.tar.gz testfile tools.pdf tools.txt
gurusaran@guru:~/Desktop/OS$ tar xvf src.3e.tar.gz
apue.3e/
apue.3e/advio/
apue.3e/daemons/
apue.3e/datafiles/
apue.3e/db/
apue.3e/DISCLAIMER
```

2. Get into the directory using command: **cd apue.3e/** and execute the files using **make** command.

```
apue.3e/advio/mcopy2.c
apue.3e/advio/nonblockw.c
apue.3e/advio/readn.c
apue.3e/advio/rot13a.c
apue.3e/advio/rot13c2.c.in
apue.3e/advio/writen.c
gurusaran@guru:~/Desktop/OS$ ls
apue.3e P0 P0.tbz src.3e.tar.gz testfile tools.pdf tools.txt
gurusaran@guru:~/Desktop/OS$ cd apue.3e/
gurusaran@guru:~/Desktop/OS/apue.3e$ ls
advio environ include Make.defines.freebsd Make.libapue.inc relation systype.sh
daemons exercises intro Make.defines.linux printer signals termsios
datafiles figlinks ipc1 Make.defines.macos proc sockets threadctl
db filedir ipc2 Make.defines.solaris pty standards threads
DISCLAIMER fileio lib Makefile README stdio
gurusaran@guru:~/Desktop/OS/apue.3e$ make
for i in lib intro sockets advio daemons datafiles db environ fileio filedir ipc1 ipc2 proc pty relation signals st
andards stdio termsios threadctl threads printer exercises; do \
    (cd $i && echo "making $i" && make ) || exit 1; \
done
making lib
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/lib'
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o bufargs.o bufargs.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o cliconn.o cliconn.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o clrfl.o clrfl.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o daemonize.o daemonize.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o error.o error.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o errorlog.o errorlog.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o lockreg.o lockreg.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o locktest.o locktest.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o openmax.o openmax.c
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -c -o pathalloc.o pathalloc.c
```

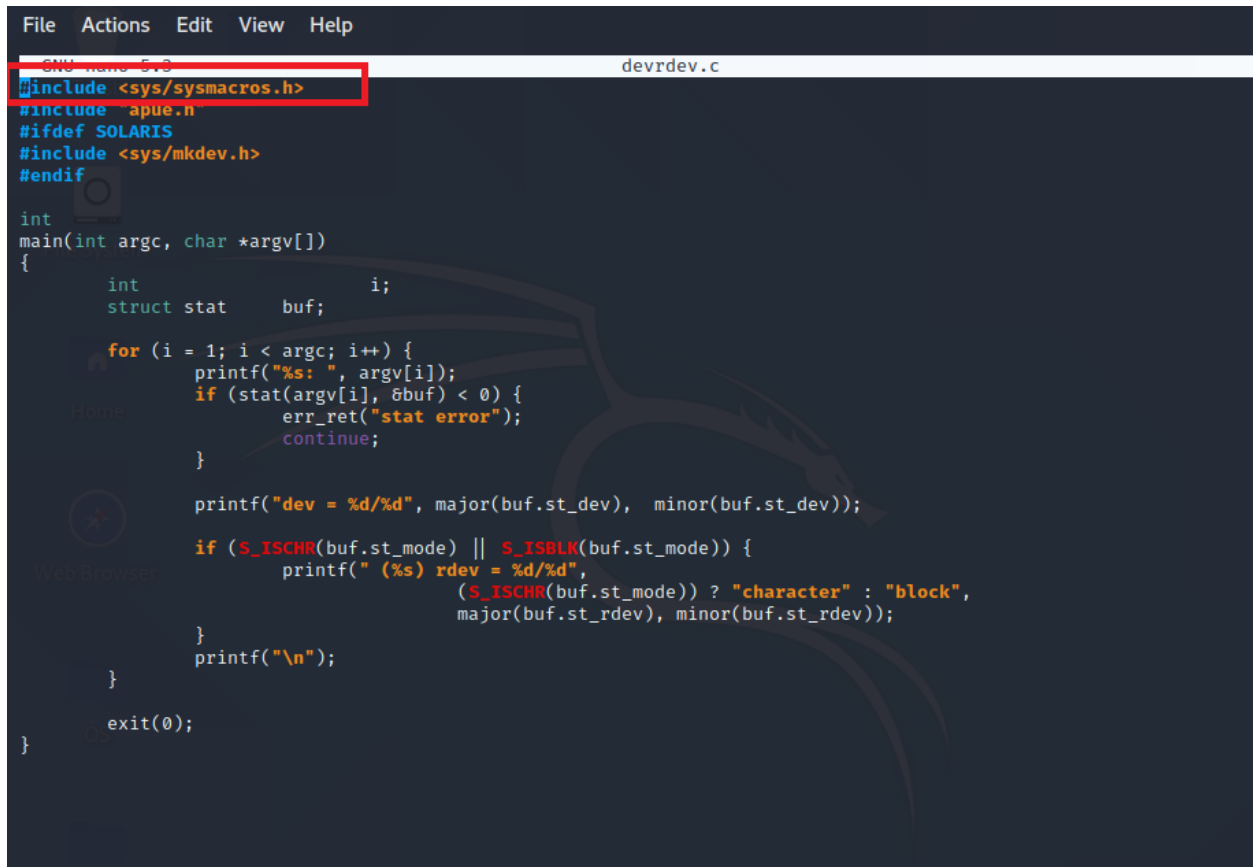
3. After running **make** command some errors are displayed.

```
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE devrdev.c -o devrdev -L../lib -lapue
devrdev.c: In function 'main':
devrdev.c:19:25: warning: implicit declaration of function 'major' [-Wimplicit-function-declaration]
   19 |     printf("dev = %d/%d", major(buf.st_dev), minor(buf.st_dev));
      |                        ^~~~~
devrdev.c:19:45: warning: implicit declaration of function 'minor' [-Wimplicit-function-declaration]
   19 |     printf("dev = %d/%d", major(buf.st_dev), minor(buf.st_dev));
      |                                           ^~~~~
/usr/bin/ld: /tmp/cc2WU75D.o: in function 'main':
devrdev.c:(.text+0xa9): undefined reference to `minor'
/usr/bin/ld: devrdev.c:(.text+0xbf): undefined reference to `major'
/usr/bin/ld: devrdev.c:(.text+0x10c): undefined reference to `minor'
/usr/bin/ld: devrdev.c:(.text+0x122): undefined reference to `major'
collect2: error: ld returned 1 exit status
make[1]: *** [Makefile:18: devrdev] Error 1
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/filedir'
make: *** [Makefile:6: all] Error 1
gurusaran@guru:~/Desktop/OS/apue.3e$
```

4. To fix this error first enter to **filedir** directory and edit the devrdev.c file

```
/usr/bin/ld: /tmp/ccjNGRoC.o: in function 'main':
devrdev.c:(.text+0xa9): undefined reference to `minor'
/usr/bin/ld: devrdev.c:(.text+0xbf): undefined reference to `major'
/usr/bin/ld: devrdev.c:(.text+0x10c): undefined reference to `minor'
/usr/bin/ld: devrdev.c:(.text+0x122): undefined reference to `major'
collect2: error: ld returned 1 exit status
make[1]: *** [Makefile:18: devrdev] Error 1
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/filedir'
make: *** [Makefile:6: all] Error 1
gurusaran@guru:~/Desktop/OS/apue.3e$ man major
gurusaran@guru:~/Desktop/OS/apue.3e$ cd filedir/
gurusaran@guru:~/Desktop/OS/apue.3e/filedir$ ls
access  cdpwd  changemod  devrdev.c  ftw8.c  mycd.c  unlink.c
access.c  cdpwd.c  changemod.c  filetype.c  Makefile  umask.c  zap.c
gurusaran@guru:~/Desktop/OS/apue.3e/filedir$ nano devrdev.c
```

5. To remove the error om devrdev.c, add library **#include <sys/sysmacros.h>** to execute the file without errors



```
File Actions Edit View Help
GNU nano 5.1.3 devrdev.c
#include <sys/sysmacros.h>
#include <apue.h>
#ifdef SOLARIS
#include <sys/mkdev.h>
#endif

int
main(int argc, char *argv[])
{
    int i;
    struct stat buf;

    for (i = 1; i < argc; i++) {
        printf("%s: ", argv[i]);
        if (stat(argv[i], &buf) < 0) {
            err_ret("stat error");
            continue;
        }

        printf("dev = %d/%d", major(buf.st_dev), minor(buf.st_dev));

        if (S_ISCHR(buf.st_mode) || S_ISBLK(buf.st_mode)) {
            printf(" (%s) rdev = %d/%d",
                (S_ISCHR(buf.st_mode)) ? "character" : "block",
                major(buf.st_rdev), minor(buf.st_rdev));
        }
        printf("\n");
    }

    exit(0);
}
```

6. Now run **Make** command. Here we get some errors in **stdio** directory containing **buf.c** file.

```
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE -D_OPTIONS -L../lib -lapue
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/standards'
making stdio
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/stdio'
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE buf.c -o buf -L../lib -lapue
buf.c: In function 'is_unbuffered':
buf.c:90:15: error: 'FILE' {aka 'struct _IO_FILE'} has no member named '__pad'; did you mean '__pad5'?
  90 | #define _flag __pad[4]
      |               ^~~~~
buf.c:98:13: note: in expansion of macro '_flag'
  98 | return(fp->_flag & _IONBF);
      |               ^~~~~
buf.c: In function 'is_linebuffered':
buf.c:90:15: error: 'FILE' {aka 'struct _IO_FILE'} has no member named '__pad'; did you mean '__pad5'?
  90 | #define _flag __pad[4]
      |               ^~~~~
buf.c:104:13: note: in expansion of macro '_flag'
 104 | return(fp->_flag & _IOLBF);
      |               ^~~~~
buf.c: In function 'buffer_size':
buf.c:92:15: error: 'FILE' {aka 'struct _IO_FILE'} has no member named '__pad'; did you mean '__pad5'?
  92 | #define _base __pad[2]
      |               ^~~~~
buf.c:111:13: note: in expansion of macro '_base'
 111 | return(fp->_base - fp->_ptr);
      |               ^~~~~
buf.c:91:14: error: 'FILE' {aka 'struct _IO_FILE'} has no member named '__pad'; did you mean '__pad5'?
  91 | #define _ptr __pad[1]
      |               ^~~~~
buf.c:111:25: note: in expansion of macro '_ptr'
 111 | return(fp->_base - fp->_ptr);
      |               ^~~~~
buf.c: In function 'is_unbuffered':
buf.c:99:1: warning: control reaches end of non-void function [-Wreturn-type]
  99 | }
      | ^
buf.c: In function 'is_linebuffered':
buf.c:105:1: warning: control reaches end of non-void function [-Wreturn-type]
 105 | }
      | ^
buf.c: In function 'buffer_size':
buf.c:115:1: warning: control reaches end of non-void function [-Wreturn-type]
 115 | }
      | ^
make[1]: *** [Makefile:16: buf] Error 1
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/stdio'
make: *** [Makefile:6: all] Error 1
gurusaran@guru: ~/Desktop/OS/apue.3e$
```

7. In order to compile buf.c without error modify the code in buf.c as show below.

Before:

```
#elif defined(_IONBF)

#ifdef _LP64
#define _flag __pad[4]
#define _ptr __pad[1]
#define _base __pad[2]
#endif

int
is_unbuffered(FILE *fp)
{
    return(fp->_flag & _IONBF);
}

int
is_linebuffered(FILE *fp)
{
    return(fp->_flag & _IOLBF);
}

int
buffer_size(FILE *fp)
{
#ifdef _LP64
    return(fp->_base - fp->_ptr);
#else
    return(BUFSIZ); /* just a guess */
#endif
}

#else

#error unknown stdio implementation!
#endif
```

After:

```
int
buffer_size(FILE *fp)
{
    return(fp->_bf._size);
}

#elif defined(_IONBF)

#ifdef _LP64
#define _flag __pad[4]
#define _ptr __pad[1]
#define _base __pad[2]
#endif

int
is_unbuffered(FILE *fp)
{
    return(fp->_flags & _IONBF);
}

int
is_linebuffered(FILE *fp)
{
    return(fp->_flags & _IOLBF);
}

int
buffer_size(FILE *fp)
{
#ifdef _LP64
    return(fp->_IO_buf_end - fp->_IO_buf_base);
#else
    return(BUFSIZ); /* just a guess */
#endif
}

#else

#error unknown stdio implementation!
#endif
```

Replace the code as shown below:

- **return(fp->_flag & _IOLBF);** changed into **return(fp->_flags & _IOLBF);**
- **return(fp->_base - fp->_ptr);** changed into **return(fp->_IO_buf_end - fp->_IO_buf_base);**

8. Execute the **buf.c** then we got an error. It says cannot find **-lbsd**

```
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/threadctl'
making threads
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/threads'
gcc -ansi -I../include -Wall -DLINUX -D_GNU_SOURCE badexit2.c -o badexit2 -L../lib -lapue -pthread -lrt -lbsd
/usr/bin/ld: cannot find -lbsd
collect2: error: ld returned 1 exit status
make[1]: *** [Makefile:31: badexit2] Error 1
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/threads'
make: *** [Makefile:6: all] Error 1
gurusaran@guru:~/Desktop/OS/apue.3e$
```

9. Install bsd library inorder to remove the error.

```
243 packages can be upgraded. Run 'apt list --upgradable' to see them.
gurusaran@guru:~/Desktop/OS/apue.3e$ sudo apt install libbsd-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
 libcdio18 libcfitsio8 libcharls2 libgtksourceview2.0-0 libgtksourceview2.0-common libpgm-5.2-0 libpoppler82
 libpoppler95 libproxchains3 libsnmp35 libtsk13 libyara3 linux-image-5.5.0-kali2-amd64
 linux-image-5.7.0-kali1-amd64 openjdk-8-jre proxchains python-cairo python-chardet python-dbus python-enchanted
 python-gi python-gobject-2 python-gtk2 python-gtksourceview2 python-numpy python-pkg-resources
 python3-flask-restless python3-grequests python3-mimeparse python3-mimerender
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
 libbsd-dev
0 upgraded, 1 newly installed, 0 to remove and 243 not upgraded.
Need to get 227 kB of archives.
After this operation, 722 kB of additional disk space will be used.
Get:1 http://ftp.harukasan.org/kali kali-rolling/main amd64 libbsd-dev amd64 0.10.0-1 [227 kB]
```

10. Copy **libapue.a** static link library to **/usr/lib**:

- cp include/apue.h /usr/include/
- cp lib/libapue.a /usr/lib

```
gurusaran@guru:~/Desktop/OS/apue.3e$ sudo cp include/apue.h /usr/include/
[sudo] password for gurusaran:
gurusaran@guru:~/Desktop/OS/apue.3e$ sudo cp lib/libapue.a /usr/lib
gurusaran@guru:~/Desktop/OS/apue.3e$
```

11. After installing the bsd run the **Make** command

```
gurusaran@guru:~/Desktop/OS/apue.3e$ make
for i in lib intro sockets advio daemons datafiles db environ fileio filedir ipc1 ipc2 proc pty relation signals st
andards stdio termios threadctl threads printer exercises; do \
    (cd $i && echo "making $i" && make ) || exit 1; \
done
making lib
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/lib'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/lib'
making intro
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/intro'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/intro'
making sockets
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/sockets'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/sockets'
making advio
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/advio'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/advio'
making daemons
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/daemons'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/daemons'
making datafiles
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/datafiles'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/datafiles'
making db
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/db'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/db'
making environ
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/environ'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/environ'
making fileio
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/fileio'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/fileio'
making filedir
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/filedir'
make[1]: Nothing to be done for 'all'.
make[1]: Leaving directory '/home/gurusaran/Desktop/OS/apue.3e/filedir'
making ipc1
make[1]: Entering directory '/home/gurusaran/Desktop/OS/apue.3e/ipc1'
make[1]: Nothing to be done for 'all'.
```