

Project 13: To mimic the CMP command of Linux in C

Name	:	Dhruval PB
SRN	:	PES1UG19CS313
Class	:	2 'D'
Roll number	:	42

The cmp command in Linux/UNIX is used to compare two files byte by byte and helps us to find out whether two files are identical or not. When cmp is used for comparing two files, it reports the location (byte value) of the first mismatch to the standard output. If no difference is found i.e. the files being compared are identical, cmp displays no message.

Now, the actual cmp in LINUX has a number of options and they are as follows:

- b, --print-bytes
 print differing bytes
- i, --ignore-initial=SKIP
 skip first SKIP bytes of both inputs
- i, --ignore-initial=SKIP1:SKIP2
 skip first SKIP1 bytes of FILE1 and first SKIP2 bytes of FILE2
- l, --verbose
 output byte numbers and differing byte values
- n, --bytes=LIMIT
 compare at most LIMIT bytes
- s, --quiet, --silent
 suppress all normal output
- help display this help and exit
- v, --version
 output version information and exit

I have tried my best to implement all of these as close to the original cmp function as possible and all outputs (including the help page and the version have been copied directly from the output screen while using the actual cmp command).

Observations made:

- 1) When a single file name is entered after cmp command in the shell, it never terminates if -n is not given. Hence I have handled this case by prompting the user to enter the byte limit.
- 2) When -n is entered multiple times it takes the least number of bytes.
- 3) When -i is entered multiple times it takes the largest individual skip values.
- 4) When a number is entered without being preceded by an option like -n or -i it is taken as skip initial byte value for the first file.
- 5) Caret notations are used (^I for \t and ^J for \n) when the -b option is used.

Bugs:

- 1) I couldn't understand what '--' alone signifies for cmp as sometimes I found that it just ignores it. So this hasn't been implemented properly.
- 2) Maximum bytes value gets capped at largest 64 bit number with no way of identifying any number larger than that to throw appropriate warning.
- 3) When a single filename is entered and when text input is taken from the user for comparison, if the user enters a large amount of byte limit, segmentation fault could occur.

Couldn't do (Due to time constraints):

- 1) Take in numbers in any format other than base 10. (cmp supports octal, binary and hexadecimal byte value input as well).
- 2) Check for directories. (When a directory is entered in place of a filename, cmp can spot that and tells the user that it's a directory).
- 3) Alignment of output in some cases.
- 4) KiB, GiB, etc. notations couldn't be added. (However the notations stated in the man page have been implemented).

Note: I have renamed the executable as CMP (all capitals) using the make file itself.

Also, the return values are same as the original cmp command: 0 when files are same, 1 when files are different and 2 for trouble (any errors).

Output images: (With comparison to the original cmp command)

```
spyder@spyder:~/CMPS$ make -f m.mk
gcc -c cmp_server.c cmp_server.h -lm
gcc cmp_client.o cmp_server.o cmp_server.h -lm -o CMP
spyder@spyder:~/CMPS ls
a.out  CMP  cmp_client.c  cmp_client.o  cmp_server.c  cmp_server.h  cmp_server.h.gch  cmp_server.o  file1.txt  file2.txt  m.mk
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt
file1.txt file2.txt differ: byte 11, line 2
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt
file1.txt file2.txt differ: byte 11, line 2
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt -l
11 71 11
12 12 71
cmp: EOF on file1.txt after byte 12
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt -l
11 71 11
12 12 71
cmp: EOF on file1.txt after byte 12
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt -l -b
11 71 9    11 ^I
12 12 ^J   71 9
cmp: EOF on file1.txt after byte 12
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt -l -b
11 71 9    11 ^I
12 12 ^J   71 9
cmp: EOF on file1.txt after byte 12
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt -b
file1.txt file2.txt differ: byte 11, line 2 is 71 9  11 ^I
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt -b
file1.txt file2.txt differ: byte 11, line 2 is 12 ^J 11 ^I
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes
file1.txt file2.txt differ: byte 11, line 2 is 71 9  11 ^I
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt --print-bytes
file1.txt file2.txt differ: byte 11, line 2 is 12 ^J 11 ^I
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes --verbose
11 71 9    11 ^I
12 12 ^J   71 9
cmp: EOF on file1.txt after byte 12
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt --print-bytes --verbose
11 71 9    11 ^I
12 12 ^J   71 9
cmp: EOF on file1.txt after byte 12
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes --verbose -s
cmp: options -l and -s are incompatible
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt --print-bytes --verbose -s
cmp: options -l and -s are incompatible
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes --verbose --quiet
cmp: options -l and -s are incompatible
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt --print-bytes --verbose --quiet
cmp: options -l and -s are incompatible
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes --verbose --quiet
cmp: options -l and -s are incompatible
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes --verbose --silent
cmp: options -l and -s are incompatible
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp file1.txt file2.txt --print-bytes --verbose --silent
cmp: options -l and -s are incompatible
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes --quiet
cmp: options -l and -s are incompatible
spyder@spyder:~/CMPS$ ./CMP file1.txt file2.txt --print-bytes --quiet --help
Usage: cmp [OPTION]... FILE1 [FILE2 [SKIP1 [SKIP2]]]
Compare two files byte by byte.
```

The optional SKIP1 and SKIP2 specify the number of bytes to skip at the beginning of each file (zero by default).

Mandatory arguments to long options are mandatory for short options too.

-b, --print-bytes	print differing bytes
-i, --ignore-initial=SKIP	skip first SKIP bytes of both inputs
-i, --ignore-initial=SKIP1:SKIP2	skip first SKIP1 bytes of FILE1 and first SKIP2 bytes of FILE2
-l, --verbose	output byte numbers and differing byte values
-n, --bytes=LIMIT	compare at most LIMIT bytes
-s, --quiet, --silent	suppress all normal output
--help	display this help and exit
-v, --version	output version information and exit

SKIP values may be followed by the following multiplicative suffixes:
kB 1000, K 1024, MB 1,000,000, M 1,048,576,
GB 1,000,000,000, G 1,073,741,824, and so on for T, P, E, Z, Y.

If a FILE is '-' or missing, read standard input.
Exit status is 0 if inputs are the same, 1 if different, 2 if trouble.

Report bugs to: bug-diffutils@gnu.org
GNU diffutils home page: <<http://www.gnu.org/software/diffutils/>>
General help using GNU software: <<http://www.gnu.org/gethelp/>>

The above outputs show the usage of -l (--verbose), -b (--print-bytes), -s (--silent or --quiet) and --help. It also shows the priority of --help over these options.

The next set of outputs show that the priority of --help and --version are the same and when they are used together, the one that is typed first is executed.

```
spyder@spyder:~/CMPS cmp file1.txt file2.txt --print-bytes --quiet --help
Usage: cmp [OPTION]... FILE1 [FILE2 [SKIP1 [SKIP2]]]
Compare two files byte by byte.

The optional SKIP1 and SKIP2 specify the number of bytes to skip
at the beginning of each file (zero by default).

Mandatory arguments to long options are mandatory for short options too.
-b, --print-bytes      print differing bytes
-i, --ignore-initial=SKIP    skip first SKIP bytes of both inputs
-i, --ignore-initial=SKIP1:SKIP2  skip first SKIP1 bytes of FILE1 and
                                first SKIP2 bytes of FILE2
-l, --verbose          output byte numbers and differing byte values
-n, --bytes=LIMIT      compare at most LIMIT bytes
-s, --quiet, --silent   suppress all normal output
--help                display this help and exit
-v, --version          output version information and exit

SKIP values may be followed by the following multiplicative suffixes:
kB 1000, K 1024, MB 1,000,000, M 1,048,576,
GB 1,000,000,000, G 1,073,741,824, and so on for T, P, E, Z, Y.

If a FILE is '-' or missing, read standard input.
Exit status is 0 if inputs are the same, 1 if different, 2 if trouble.

Report bugs to: bug-diffutils@gnu.org
GNU diffutils home page: <http://www.gnu.org/software/diffutils/>
General help using GNU software: <http://www.gnu.org/gethelp/>
spyder@spyder:~/CMPS ./CMP file1.txt file2.txt --print-bytes --quiet --version
cmp (GNU diffutils) 3.6
Copyright (C) 2017 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Written by Torbjörn Granlund and David MacKenzie.
spyder@spyder:~/CMPS cmp file1.txt file2.txt --print-bytes --quiet --version
cmp (GNU diffutils) 3.6
Copyright (C) 2017 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Written by Torbjörn Granlund and David MacKenzie.
spyder@spyder:~/CMPS ./CMP file1.txt file2.txt --print-bytes --quiet --version --help
cmp (GNU diffutils) 3.6
Copyright (C) 2017 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Written by Torbjörn Granlund and David MacKenzie.
spyder@spyder:~/CMPS cmp file1.txt file2.txt --print-bytes --quiet --version --help
cmp (GNU diffutils) 3.6
Copyright (C) 2017 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Written by Torbjörn Granlund and David MacKenzie.
spyder@spyder:~/CMPS ./CMP file1.txt file2.txt --print-bytes --quiet --help --version
Usage: cmp [OPTION]... FILE1 [FILE2 [SKIP1 [SKIP2]]]
Compare two files byte by byte.

The optional SKIP1 and SKIP2 specify the number of bytes to skip
at the beginning of each file (zero by default).

Mandatory arguments to long options are mandatory for short options too.
-b, --print-bytes      print differing bytes
-i, --ignore-initial=SKIP    skip first SKIP bytes of both inputs
-i, --ignore-initial=SKIP1:SKIP2  skip first SKIP1 bytes of FILE1 and
                                first SKIP2 bytes of FILE2
-l, --verbose          output byte numbers and differing byte values
-n, --bytes=LIMIT      compare at most LIMIT bytes
-s, --quiet, --silent   suppress all normal output
--help                display this help and exit
-v, --version          output version information and exit

SKIP values may be followed by the following multiplicative suffixes:
kB 1000, K 1024, MB 1,000,000, M 1,048,576,
GB 1,000,000,000, G 1,073,741,824, and so on for T, P, E, Z, Y.

If a FILE is '-' or missing, read standard input.
Exit status is 0 if inputs are the same, 1 if different, 2 if trouble.

Report bugs to: bug-diffutils@gnu.org
GNU diffutils home page: <http://www.gnu.org/software/diffutils/>
General help using GNU software: <http://www.gnu.org/gethelp/>
spyder@spyder:~/CMPS ./CMP file1.txt file2.txt --print-bytes --quiet --help --version
Usage: cmp [OPTION]... FILE1 [FILE2 [SKIP1 [SKIP2]]]
Compare two files byte by byte.

The optional SKIP1 and SKIP2 specify the number of bytes to skip
at the beginning of each file (zero by default).

Mandatory arguments to long options are mandatory for short options too.
-b, --print-bytes      print differing bytes
-i, --ignore-initial=SKIP    skip first SKIP bytes of both inputs
-i, --ignore-initial=SKIP1:SKIP2  skip first SKIP1 bytes of FILE1 and
                                first SKIP2 bytes of FILE2
-l, --verbose          output byte numbers and differing byte values
-n, --bytes=LIMIT      compare at most LIMIT bytes
-s, --quiet, --silent   suppress all normal output
--help                display this help and exit
-v, --version          output version information and exit

SKIP values may be followed by the following multiplicative suffixes:
kB 1000, K 1024, MB 1,000,000, M 1,048,576,
GB 1,000,000,000, G 1,073,741,824, and so on for T, P, E, Z, Y.

If a FILE is '-' or missing, read standard input.
Exit status is 0 if inputs are the same, 1 if different, 2 if trouble.

Report bugs to: bug-diffutils@gnu.org
GNU diffutils home page: <http://www.gnu.org/software/diffutils/>
General help using GNU software: <http://www.gnu.org/gethelp/>
```

The following outputs show the usage of --help and --version without any other arguments being passed.

```
spyder@spyder:~/CMPS ./CMP --help
Usage: cmp [OPTION]... FILE1 [FILE2 [SKIP1 [SKIP2]]]
Compare two files byte by byte.

The optional SKIP1 and SKIP2 specify the number of bytes to skip
at the beginning of each file (zero by default).

Mandatory arguments to long options are mandatory for short options too.
 -b, --print-bytes      print differing bytes
 -i, --ignore-initial=SKIP  skip first SKIP bytes of both inputs
 -i, --ignore-initial=SKIP1:SKIP2  skip first SKIP1 bytes of FILE1 and
                                 first SKIP2 bytes of FILE2
 -l, --verbose          output byte numbers and differing byte values
 -n, --bytes=LIMIT      compare at most LIMIT bytes
 -s, --quiet, --silent  suppress all normal output
 --help                display this help and exit
 -v, --version          output version information and exit

SKIP values may be followed by the following multiplicative suffixes:
KB 1000, K 1024, MB 1,000,000, M 1,048,576,
GB 1,000,000,000, G 1,073,741,824, and so on for T, P, E, Z, Y.

If a FILE is '--' or missing, read standard input.
Exit status is 0 if inputs are the same, 1 if different, 2 if trouble.

Report bugs to: bug-diffutils@gnu.org
GNU diffutils home page: <http://www.gnu.org/software/diffutils/>
General help using GNU software: <http://www.gnu.org/gethelp/>
spyder@spyder:~/CMPS ./CMP --version
cmp (GNU diffutils) 3.6
Copyright (C) 2017 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Written by Torbjörn Granlund and David MacKenzie.
spyder@spyder:~/CMPS cmp --help
Usage: cmp [OPTION]... FILE1 [FILE2 [SKIP1 [SKIP2]]]
Compare two files byte by byte.

The optional SKIP1 and SKIP2 specify the number of bytes to skip
at the beginning of each file (zero by default).

Mandatory arguments to long options are mandatory for short options too.
 -b, --print-bytes      print differing bytes
 -i, --ignore-initial=SKIP  skip first SKIP bytes of both inputs
 -i, --ignore-initial=SKIP1:SKIP2  skip first SKIP1 bytes of FILE1 and
                                 first SKIP2 bytes of FILE2
 -l, --verbose          output byte numbers and differing byte values
 -n, --bytes=LIMIT      compare at most LIMIT bytes
 -s, --quiet, --silent  suppress all normal output
 --help                display this help and exit
 -v, --version          output version information and exit

SKIP values may be followed by the following multiplicative suffixes:
KB 1000, K 1024, MB 1,000,000, M 1,048,576,
GB 1,000,000,000, G 1,073,741,824, and so on for T, P, E, Z, Y.

If a FILE is '--' or missing, read standard input.
Exit status is 0 if inputs are the same, 1 if different, 2 if trouble.

Report bugs to: bug-diffutils@gnu.org
GNU diffutils home page: <http://www.gnu.org/software/diffutils/>
General help using GNU software: <http://www.gnu.org/gethelp/>
spyder@spyder:~/CMPS cmp --version
cmp (GNU diffutils) 3.6
Copyright (C) 2017 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Written by Torbjörn Granlund and David MacKenzie.
```

The following outputs show the cases when no arguments are passed to the options -n (--bytes) and -i (--ignore-initial).

```
spyder@spyder:~/CMPS ./CMP -n
cmp: option requires an argument -- 'n'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n
cmp: option requires an argument -- 'n'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -i
cmp: option requires an argument -- 'i'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -i
cmp: option requires an argument -- 'i'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP --bytes
cmp: option '--bytes' requires an argument
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp --bytes
cmp: option '--bytes' requires an argument
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP --ignore-initial
cmp: option '--ignore-initial' requires an argument
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP --ignore-initial
cmp: option '--ignore-initial' requires an argument
cmp: Try 'cmp --help' for more information.
```

The following outputs show the cases when invalid options or byte values are passed.

```
spyder@spyder:~/CMPS$ ./CMP -j
cmp: invalid option -- 'j'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp -j
cmp: invalid option -- 'j'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp --j
cmp: unrecognized option '--j'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --j
cmp: unrecognized option '--j'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP -i9/5
cmp: invalid --ignore-initial value '9/5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp -i9/5
cmp: invalid --ignore-initial value '9/5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP -n6-5
cmp: invalid --bytes value '6-5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP -n6-5
cmp: invalid --bytes value '6-5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP -n6-5
cmp: invalid --bytes value '6-5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes=9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp --bytes=9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes 9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes 9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes98
cmp: unrecognized option '--bytes98'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp --bytes98
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP -i9/5
cmp: invalid --ignore-initial value '9/5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp -i9/5
cmp: invalid --ignore-initial value '9/5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP -n6-5
cmp: invalid --bytes value '6-5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP -n6-5
cmp: invalid --bytes value '6-5'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes=9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes=9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes 9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes 9*8
cmp: invalid --bytes value '9*8'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --bytes98
cmp: unrecognized option '--bytes98'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp --bytes98
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --ignore-initial98
cmp: unrecognized option '--ignore-initial98'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp --ignore-initial98
cmp: unrecognized option '--ignore-initial98'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ ./CMP --ignore-initial98
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$
```

Files used:

The screenshot shows the Spyder Python IDE interface with four windows open:

- Top Window:** Title bar says "file1.txt". It contains the following code:

```
1 123456789
2 9|
```
- Second Window:** Title bar says "file2.txt". It contains the following code:

```
1 123456789
2 9|
```
- Third Window:** Title bar says "f1.txt". It contains the following code:

```
1 abc def gh
2 i      jkl|
```
- Fourth Window:** Title bar says "f2.txt". It contains the following code:

```
1 a      bcd
2 efghijkl|
```

The following outputs show that when multiple -i and -n options are given, the --bytes (byte limit for comparison) will be set to the least value while skip values (--skip-initial) will be set to the maximum amongst the given arguments.

```
spyder@spyder:~/CMP$ ls *txt
f1.txt  f2.txt  file1.txt  file2.txt
spyder@spyder:~/CMP$ ./CMP f1.txt -n10 -i0:5 f2.txt -l -b
1 141 a    12 ^J
2 142 b    145 e
3 143 c    146 f
4 40      147 g
5 144 d    150 h
6 145 e    151 i
7 146 f    152 j
8 40      153 k
9 147 g    154 l
10 150 h   12 ^J
spyder@spyder:~/CMP$ cmp f1.txt -n10 -i0:5 f2.txt -l -b
1 141 a    12 ^J
2 142 b    145 e
3 143 c    146 f
4 40      147 g
5 144 d    150 h
6 145 e    151 i
7 146 f    152 j
8 40      153 k
9 147 g    154 l
10 150 h   12 ^J
spyder@spyder:~/CMP$ cmp f1.txt -n10 -i0:5 f2.txt -l -b -i 2:2 -n5
1 143 c    12 ^J
2 40      145 e
3 144 d    146 f
4 145 e    147 g
5 146 f    150 h
spyder@spyder:~/CMP$ ./CMP f1.txt -n10 -i0:5 f2.txt -l -b -i 2:2 -n5
1 143 c    12 ^J
2 40      145 e
3 144 d    146 f
4 145 e    147 g
5 146 f    150 h
spyder@spyder:~/CMP$ 
```

The following outputs show the case when a single filename and cmp takes user text input from the standard input in order to compare with the given file. It also shows that when -n isn't given, the original cmp command does not terminate. Hence, I have handled this case by prompting the user to enter byte limit.

```
spyder@spyder:~/CMP$ ./CMP file1.txt
Please enter byte limit
spyder@spyder:~/CMP$ ./CMP file1.txt -n5 -i2:2
1546879
file1.txt - differ: byte 1, line 1
spyder@spyder:~/CMP$ ./CMP file1.txt -n5 -i2:2 -l -b
1546879
1 63 3    64 4
2 64 4    66 6
3 65 5    70 8
4 66 6    67 7
5 67 7    71 9
spyder@spyder:~/CMP$ ./CMP file1.txt -n5 -i2:3 -l -b
abcdefg
1 63 3    144 d
2 64 4    145 e
3 65 5    146 f
4 66 6    147 g
5 67 7    12 ^J
spyder@spyder:~/CMP$ cmp file1.txt -n5 -i2:3 -l -b
abcdefg
1 63 3    144 d
2 64 4    145 e
3 65 5    146 f
4 66 6    147 g
5 67 7    12 ^J
spyder@spyder:~/CMP$ cmp file1.txt
abcdefg

a
a
a
a
^C
spyder@spyder:~/CMP$ ./CMP  f1.txt -n25
abc def gh
i      jkl

cmp: EOF on f1.txt after byte 17
spyder@spyder:~/CMP$ cmp  f1.txt -n25
abc def gh
i      jkl

cmp: EOF on f1.txt after byte 17, line 2
spyder@spyder:~/CMP$ 
```

The following outputs show the acceptance of multipliers like KB, K, GB, G, etc as supported by cmp. They also show the cases when one of the files is smaller than the -i limit which is handled by showing that the file has reached its end and is empty after skipping the given number of bytes.

```
spyder@spyder:~/CMPS cmp -n E
cmp: missing operand after 'E'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n E
cmp: missing operand after 'E'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n G
cmp: missing operand after 'G'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n GB
cmp: missing operand after 'GB'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n EB
cmp: missing operand after 'EB'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n EB
cmp: missing operand after 'EB'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n GB
cmp: missing operand after 'GB'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n G
cmp: missing operand after 'G'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n k
cmp: missing operand after 'k'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n k
cmp: missing operand after 'k'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n K
cmp: missing operand after 'K'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n K
cmp: missing operand after 'K'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n KB
cmp: missing operand after 'KB'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n KB
cmp: missing operand after 'KB'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP -n Kb
cmp: invalid --bytes value 'Kb'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp -n Kb
cmp: invalid --bytes value 'Kb'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS []
spyder@spyder:~/CMPS ./CMP cmp_server.c f1.txt -n 10 -i5kB:3 -l -b
1 166 v    40
2 133 [    144 d
3 151 i    145 e
4 135 ]    146 f
5 51 )    40
6 40      147 g
7 75 =    150 h
8 75 =    12 ^j
9 40      151 i
10 62 2   11 ^I
spyder@spyder:~/CMPS cmp cmp_server.c f1.txt -n 10 -i5kB:3 -l -b
1 166 v    40
2 133 [    144 d
3 151 i    145 e
4 135 ]    146 f
5 51 )    40
6 40      147 g
7 75 =    150 h
8 75 =    12 ^j
9 40      151 i
10 62 2   11 ^I
spyder@spyder:~/CMPS ./CMP f1.txt cmp_server.c -n 10 -i5:30KB -l -b
cmp: EOF on cmp_server.c which is empty
spyder@spyder:~/CMPS cmp f1.txt cmp_server.c -n 10 -i5:30KB -l -b
cmp: EOF on cmp_server.c which is empty
spyder@spyder:~/CMPS cmp f1.txt cmp_server.c -n 10 -i50:3 -l -b
cmp: EOF on f1.txt which is empty
spyder@spyder:~/CMPS ./CMP f1.txt cmp_server.c -n 10 -i50:3 -l -b
cmp: EOF on f1.txt which is empty
spyder@spyder:~/CMPS []
```

The following outputs show what happens when only a single argument (the executable's name) or two arguments are entered.

```
spyder@spyder:~/CMPS ./CMP
cmp: missing operand after './CMP'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp
cmp: missing operand after 'cmp'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS ./CMP --
cmp: missing operand after '--'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS cmp --
cmp: missing operand after '--'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS []
```

The following outputs show the use of ‘-’ for filename in which case text input is taken from stdin and the compared with the other file. The position of ‘-’ plays an important role in the layout of the output as cmp follows “comparing first file to the second one”.

```
spyder@spyder:~/CMPS$ ./CMP f1.txt - -i4:3 -n7 -l -b
qwert
yuto
1 144 d 162 r
2 145 e 164 t
3 146 f 12 ^J
4 40 171 y
5 147 g 165 u
6 150 h 151 i
7 12 ^J 157 o
spyder@spyder:~/CMPS$ cmp f1.txt - -i4:3 -n7 -l -b
qwert
yuto
1 144 d 162 r
2 145 e 164 t
3 146 f 12 ^J
4 40 171 y
5 147 g 165 u
6 150 h 151 i
7 12 ^J 157 o
spyder@spyder:~/CMPS$ ./CMP - f1.txt - -i4:3 -n7 -l -b
asdf
gh
j
k
1 12 ^J 40
2 147 g 144 d
3 150 h 145 e
4 12 ^J 146 f
5 152 j 40
6 12 ^J 147 g
7 153 k 150 h
spyder@spyder:~/CMPS$ cmp - f1.txt - -i4:3 -n7 -l -b
asdf
gh
j
k
1 12 ^J 40
2 147 g 144 d
3 150 h 145 e
4 12 ^J 146 f
5 152 j 40
6 12 ^J 147 g
7 153 k 150 h
spyder@spyder:~/CMPS$ cmp - f1.txt - -i4:3 -n7 -b
asdfgjiwv
v
- f1.txt differ: byte 1, line 1 is 147 g 40
spyder@spyder:~/CMPS$ spyder@spyder:~/CMPS$ ./CMP - f1.txt - -i4:3 -n7 -b
asdfgjiwv
v
- f1.txt differ: byte 1, line 1 is 147 g 40
spyder@spyder:~/CMPS$ ./CMP f1.txt - -i4:3 -n7 -b
qwerty
uit
f1.txt - differ: byte 1, line 1 is 144 d 162 r
spyder@spyder:~/CMPS$ cmp f1.txt - -i4:3 -n7 -b
qwerty
uit
f1.txt - differ: byte 1, line 1 is 144 d 162 r
spyder@spyder:~/CMPS$
```

The following show the output when both the files are same or the text entered is the same as the file given. It also shows one case wherein my program doesn't produce an output same as that of the original cmp. This happens when the initial skip values are larger than that of the file's size.

```
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt -i4:4
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt -i4:4
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt -i4:4 -n3M
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt -i4:4 -n3M
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt -i4M:4M -n3M
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt -i4M:4M -n3M
cmp: EOF on f1.txt which is empty
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt -i4M:4G -n3M
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt -i4M:4G -n3M
cmp: EOF on f1.txt which is empty
spyder@spyder:~/CMPS$ ./CMP f1.txt -n17
abc def gh
i jkl
spyder@spyder:~/CMPS$ ./CMP f1.txt -n17 -l
abc def gh
i jkl
spyder@spyder:~/CMPS$ cmp f1.txt -n17 -l
abc def gh
i jkl
spyder@spyder:~/CMPS$ cmp f1.txt -n17
abc def gh
i jkl
spyder@spyder:~/CMPS$ ./CMP f1.txt -n18
abc def gh
i jkl
cmp: EOF on f1.txt after byte 17, line 2
spyder@spyder:~/CMPS$ cmp f1.txt -n18
abc def gh
i jkl
cmp: EOF on f1.txt after byte 17, line 2
spyder@spyder:~/CMPS$
```

The following outputs show that when a number is entered without any -n or -i preceding them, after entering two filenames, it is taken as the skip value for the first file.

```
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt -i4:2 -l -b
1 144 d 143 c
2 145 e 40
3 146 f 144 d
4 40 145 e
5 147 g 146 f
6 150 h 40
7 12 ^J 147 g
8 151 i 150 h
9 11 ^I 12 ^J
10 152 j 151 i
11 153 k 11 ^I
12 154 l 152 j
13 12 ^J 153 k
cmp: EOF on f1.txt after byte 13
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt -i4:2 -l -b
1 144 d 143 c
2 145 e 40
3 146 f 144 d
4 40 145 e
5 147 g 146 f
6 150 h 40
7 12 ^J 147 g
8 151 i 150 h
9 11 ^I 12 ^J
10 152 j 151 i
11 153 k 11 ^I
12 154 l 152 j
13 12 ^J 153 k
cmp: EOF on f1.txt after byte 13
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt -i4:2 -l -b 9
1 150 h 143 c
2 12 ^J 40
3 151 i 144 d
4 11 ^I 145 e
5 152 j 146 f
6 153 k 40
7 154 l 147 g
8 12 ^J 150 h
cmp: EOF on f1.txt after byte 8
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt -i4:2 -l -b 9
1 150 h 143 c
2 12 ^J 40
3 151 i 144 d
4 11 ^I 145 e
5 152 j 146 f
6 153 k 40
7 154 l 147 g
8 12 ^J 150 h
cmp: EOF on f1.txt after byte 8
spyder@spyder:~/CMPS$ ./CMP f1.txt f1.txt -i4:2 -l -b kl
cmp: invalid --ignore-initial value 'kl'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$ cmp f1.txt f1.txt -i4:2 -l -b kl
cmp: invalid --ignore-initial value 'kl'
cmp: Try 'cmp --help' for more information.
spyder@spyder:~/CMPS$
```

Conclusion:

Coding this was a very good exercise and I got to brush up on a lot of topics related to C. This also helped me explore the LINUX commands and the knowledge I gained from this is unforgettable.