Project 1 :

Warmup to C and Unix programming

Summary

The program named "reverse" reads lines of text from a file and standard input and prints them in reverse order. It can be printed to a file or to the screen. It uses a double-linked list to store lines. For memory it uses dynamic memory allocation. The program can handle long lines and large files too. It also has error handling for invalid arguments, basic file operations, and memory allocation fails.

Basic operations

There are different ways to invoke the file. For example,

1. When invoked without any arguments, your reversing program should read from standard input (stdin), which is the input that a user types in, and write to standard output (i.e., the screen).
2. When invoked with just one command-line argument, the user supplies the input file, but the file should be printed to the screen. In Unix-based systems, printing to the screen is the same as writing to a special file known as standard output, or stdout for short.
3. Finally, when invoked with two command-line arguments, the program should read from the input file the user supplies and write the reversed version of said file to the output file the user supplies.

```
vagrant@precise32:/vagrant/Linux/project_1$ gcc reverse.c –o reverse
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse
Merry Christmas
and
Happy New Year
to
everybody
!
!
everybody
to
Happy New Year
and
Merry Christmas
vagrant@precise32:/vagrant/Linux/project_1$ cat input.txt
hello
this
is
a file
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse input.txt
a file
is
this
hello
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse input.txt output.txt
vagrant@precise32:/vagrant/Linux/project_1$ cat output.txt
a file
is
this
hello
```

Assumptions and errors

There are additional assumptions and errors addressed in the code. For example,

1. If the input file and output file are the same file, you should print out an error message "Input and output file must differ" and exit with return code 1.
2. If the user runs reverse with too many arguments, print usage: reverse <input> <output> and exit with return code 1.
3. You may not assume anything about how long a line should be. Thus, you may have to read in a very long input line. You may not assume anything about the length of the file, i.e., it may be VERY long.
    - For long lines, I used long quotes in a single line. The file contains 3 long lines, which the program prints to the screen in reverse order when run.
    - For a large file, I used Midsummer_nights_dream.txt provided in week 8. I renamed it as largefile.txt. When run, the program prints the lines in reverse order.
4. If the user specifies an input file or output file, and for some reason, when you try to open said file (e.g., input.txt) and fail, you should print out the following exact error message: error: cannot open file 'input.txt' and then exit with return code 1 (i.e., call exit(1);).
    - I tested this with an input file that doesn't exist and a file without permission to write.
5. If you call malloc() to allocate some memory, and malloc fails, you should print the error message malloc failed and exit with return code 1.
6. On any error, you should print the error to the screen using fprintf(), and send the error message to stderr (standard error) and not stdout (standard output). This is accomplished in your C code as follows: fprintf(stderr, "whatever the error message is\n");

```
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse input.txt input.txt
Input and output file must differ
vagrant@precise32:/vagrant/Linux/project_1$ cat longlines.txt
1. I think about life and death a lot. For the longest time I thought this was it, but the
n I thought maybe reincarnation does exist and we will all come back. My new thought is ei
ther of these could be true, but realistically what is going to happen is when you are dea
d you are not going to know you are dead, so it's not the end of the world.

2. As long as I focus on what I feel and don't worry about where I'm going, it works out.
Having no expectations but being open to everything is what makes wonderful things happen.
 If I don't worry, there's no obstruction and life flows easily. It sounds impractical, bu
t 'Expect nothing; be open to everything' is really all it is.

3. You don’t get better on the days when you feel like going. You get better on the days w
hen you don’t want to go, but you go anyway. If you can overcome the negative energy comin
g from your tired body or unmotivated mind, you will grow and become better. It won’t be t
he best workout you have, you won’t accomplish as much as what you usually do when you act
ually feel good, but that doesn’t matter. Growth is a long term game, and the crappy days
are more important.
```

```
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse longlines.txt
3. You don’t get better on the days when you feel like going. You get better on the days w
hen you don’t want to go, but you go anyway. If you can overcome the negative energy comin
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vagrant@precise32:/vagrant/Linux/project_1$ cat largefile.txt
Shakespeare homepage | Midsummer Night's Dream | Entire play

  ACT I

  SCENE I. Athens. The palace of THESEUS.

     Enter THESEUS, HIPPOLYTA, PHILOSTRATE, and Attendants

    THESEUS

      Now, fair Hippolyta, our nuptial hour
      Draws on apace; four happy days bring in
      Another moon: but, O, methinks, how slow
      This old moon wanes! she lingers my desires,
      Like to a step-dame or a dowager
      Long withering out a young man revenue.

    HIPPOLYTA

      Four days will quickly steep themselves in night;
      Four nights will quickly dream away the time;
      And then the moon, like to a silver bow
      New-bent in heaven, shall behold the night

    PUCK

      If we shadows have offended,
      Think but this, and all is mended,
      That you have but slumber'd here
      While these visions did appear.
      And this weak and idle theme,
      No more yielding but a dream,
      Gentles, do not reprehend:
      if you pardon, we will mend:
      And, as I am an honest Puck,
      If we have unearned luck
      Now to 'scape the serpent's tongue,
      We will make amends ere long;
      Else the Puck a liar call;
      So, good night unto you all.
      Give me your hands, if we be friends,
      And Robin shall restore amends.
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse largefile.txt
      And Robin shall restore amends.
      Give me your hands, if we be friends,
      So, good night unto you all.
      Else the Puck a liar call;
      We will make amends ere long;
      Now to 'scape the serpent's tongue,
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      And, as I am an honest Puck,
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      No more yielding but a dream,
      And this weak and idle theme,
      While these visions did appear.
      That you have but slumber'd here
      Think but this, and all is mended,
      If we shadows have offended,

    PUCK
```

```
    New-bent in heaven, shall behold the night
    And then the moon, like to a silver bow
    Four nights will quickly dream away the time;
    Four days will quickly steep themselves in night;

  HIPPOLYTA

    Long withering out a young man revenue.
    Like to a step-dame or a dowager
    This old moon wanes! she lingers my desires,
    Another moon: but, O, methinks, how slow
    Draws on apace; four happy days bring in
    Now, fair Hippolyta, our nuptial hour

  THESEUS

    Enter THESEUS, HIPPOLYTA, PHILOSTRATE, and Attendants

SCENE I. Athens. The palace of THESEUS.

ACT I

Shakespeare homepage | Midsummer Night's Dream | Entire play
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse nonexistent.txt
error: cannot open file 'nonexistent.txt'
vagrant@precise32:/vagrant/Linux/project_1$ touch readonly.txt
vagrant@precise32:/vagrant/Linux/project_1$ chmod -w readonly.txt
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse input.txt readonly.txt
error: cannot open file 'readonly.txt'
vagrant@precise32:/vagrant/Linux/project_1$ ./reverse input.txt output.txt extra.txt
usage: reverse <input> <output>
```

Sources

Mainly I used the code solution framework provided in the weekly task 4 in week 9. In addition I used the following sources :

- ➔ My code exercises from the course Basics of C-programming
- ➔ https://www.eskimo.com/~scs/cclass/int/sx1e.html
- ➔ https://www.geeksforgeeks.org/how-to-create-a-doubly-linked-list-in-c/
- ➔ https://www.geeksforgeeks.org/doubly-linked-list-in-c/
- ➔ https://www.programiz.com/dsa/doubly-linked-list
- ➔ https://www.geeksforgeeks.org/size_t-data-type-c-language/
- ➔ https://jameshfisher.com/2017/02/22/ssize_t/#:~:text=In%20short%2C%20ssize_t%20is%20the,a%20way%20to%20indicate%20error.