CSc 3320: Systems Programming

Spring 2021

Midterm 1: Total points = 100

Assigned: 26th Feb 2021: 12.01 PM

Submission Deadline: 2nd Mar 2021: 12.01 PM

(No extensions. If your submission is not received by this time then it will NOT be accepted.)

Submission instructions:

1. Create a Google doc for your submission.
2. Start your responses from page 2 of the document and copy these instructions on page 1.
3. Fill in your name, campus ID and panther # in the fields provided. If this information is missing TWO POINTS WILL BE DEDUCTED.
4. Keep this page 1 intact. If this *submissions instructions* page is missing in your submission TWO POINTS WILL BE DEDUCTED.
5. Start your responses to each QUESTION on a new page.
6. If you are being asked to write code copy the code into a separate txt file and submit that as well. The code should be executable. E.g. if asked for a C script then provide myfile.c so that we can execute that script. In your answer to the specific question, provide the steps on how to execute your file (like a ReadMe).
7. If you are being asked to test code or run specific commands or scripts, provide the evidence of your outputs through a screenshot and/or screen video-recordings and copy the same into the document.
8. Upon completion, download a .PDF version of the google doc document and submit the same along with all the supplementary files (videos, pictures, scripts etc).

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Questions 1-5 are 20pts each

1. Pick any of your 10 favourite unix commands. For each command run the *man* command and copy the text that is printed into a **mandatabase.txt**. Write a shell script ***helpme.sh*** that will ask the user to type in a command and then print the manual's text associated with that corresponding command. If the command the user types is not in the database then the script must print
   sorry, I cannot help you

chmod +x helpme.sh

./help.sh

The 10 commands in the mandatabase.txt are:

ls
pwd
cat
cp
mv
mkdir
rmdir
rm
touch
find

```
[rshaon1@gsuad.gsu.edu@snowball ~]$ chmod +x helpme.sh
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./helpme.sh
Enter the command for which help is needed: awk
Sorry, I cannot help you
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./helpme.sh
Enter the command for which help is needed:
Sorry, I cannot help you
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./helpme.sh
Enter the command for which help is needed: rmdir
RMDIR(1)                                                    User Commands                                                    RMDIR(1)

NAME
       rmdir - remove empty directories

SYNOPSIS
       rmdir [OPTION]... DIRECTORY...

DESCRIPTION
       Remove the DIRECTORY(ies), if they are empty.

       --ignore-fail-on-non-empty

              ignore each failure that is solely because a directory

              is non-empty

       -p, --parents
              remove DIRECTORY and its ancestors; e.g., 'rmdir -p a/b/c' is simi
lar to 'rmdir a/b/c a/b a'

       -v, --verbose
              output a diagnostic for every directory processed

       --help display this help and exit

       --version
              output version information and exit

AUTHOR
       Written by David MacKenzie.

REPORTING BUGS
       GNU coreutils online help: <https://www.gnu.org/software/coreutils/>
       Report any translation bugs to <https://translationproject.org/team/>

COPYRIGHT
       Copyright © 2020 Free Software Foundation, Inc.  License GPLv3+: GNU GPL version 3 or later <https://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.

SEE ALSO
       rmdir(2)

       Full documentation <https://www.gnu.org/software/coreutils/rmdir>
       or available locally via: info '(coreutils) rmdir invocation'

GNU coreutils 8.32                                          July 2020                                                    RMDIR(1)
[rshaon1@gsuad.gsu.edu@snowball ~]$
```

Note: Copy the mandatabase.txt file in the same directory as the script is located or specify the full path of it inside the script by changing the value of the mandatabase variable.

2. On your computer open your favourite Wikipedia page. Copy the text from that page into a text file **myexamfile.txt** and then copy that file to a directory named **midterm** (use mkdir to create the directory if it doesn't exist) in your snowball server home directory (use any FTP tool such as Putty or Filezilla to copy the file from your computer to the remote snowball server machine: see Lab 6).

Create a directory in your home directory: mkdir midterm

Copy the file myexamfile.txt to this directory: cp myexamfile.txt

Go into the midterm directory: cd midterm

Write a shell script that will find the number of occurrences of a particular keyword typed by the user. Present evidence of your testing with at least 5 trials (different keywords each time)

chmod +x wordsearch.sh

./wordsearch.sh

```
[rshaon1@gsuad.gsu.edu@snowball midterm]$ chmod +x wordsearch.sh
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search: Linux
1409
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search: Fedora
13
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search: GNU
133
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search: Linus
44
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search: kernel
125
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search:
0
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search: xyzabc
0
[rshaon1@gsuad.gsu.edu@snowball midterm]$ ./wordsearch.sh
Enter a keyword to search: Bodhi
2
[rshaon1@gsuad.gsu.edu@snowball midterm]$ grep 'Bodhi' myexamfile.txt
     * [2327]Bodhi Linux
2327. https://en.wikipedia.org/wiki/Bodhi_Linux
[rshaon1@gsuad.gsu.edu@snowball midterm]$
```

3. Write a shell script to find files in a directory hierarchy (e.g. your home directory) that have not been accessed for N days and compress them. Here N is a parameter and the user will be asked for that input as the first step of the script execution.

chmod +x oldfiles.sh

./oldfiles.sh

```
[rshaon1@gsuad.gsu.edu@snowball ~]$ chmod +x oldfiles.sh
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./oldfiles.sh
Enter the number of days the files are not accessed: 5
  adding: home/rshaon1/checkError.sh (deflated 44%)
  adding: home/rshaon1/hello.sh (deflated 41%)
  adding: home/rshaon1/myName.c (deflated 3%)
  adding: home/rshaon1/foo.sh (deflated 27%)
  adding: home/rshaon1/hello (deflated 73%)
  adding: home/rshaon1/Result (stored 0%)
  adding: home/rshaon1/foo.java (deflated 18%)
  adding: home/rshaon1/foo.class (deflated 37%)
  adding: home/rshaon1/hello.c (deflated 1%)
Created a compressed (zip) file of the old accessed files with the name 5_old_access.zip
[rshaon1@gsuad.gsu.edu@snowball ~]$ ls -l 5_old_access.zip
-rw-rw-r--. 1 rshaon1@gsuad.gsu.edu rshaon1@gsuad.gsu.edu 5453 Feb 27 21:30 5_old_access.zip
[rshaon1@gsuad.gsu.edu@snowball ~]$ zipinfo -1 5_old_access.zip
home/rshaon1/checkError.sh
home/rshaon1/hello.sh
home/rshaon1/myName.c
home/rshaon1/foo.sh
home/rshaon1/hello
home/rshaon1/Result
home/rshaon1/foo.java
home/rshaon1/foo.class
home/rshaon1/hello.c
[rshaon1@gsuad.gsu.edu@snowball ~]$
```

4. Build a phone-book utility that allows you to access and modify an alphabetical list of names, addresses and telephone numbers. Use utilities such as awk and sed, to maintain and edit the file of phone-book information. The user (in this case, you) must be able to read, edit, and delete the phone book contents. The permissions for the phone book database must be such that it is inaccessible to anybody other than the user.

chmod +x phonemgr.sh
./phonemgr.sh

After each entry of a new name and etc. the phonebook.txt will constantly get updated as many times as you make updates through the phonemgr.sh. The phonebook.txt will be created when you put in your first entry.

```
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./phonemgr.sh
[

 ================================
      Phone Directory Manager
 ================================
 1.   Display phone directory
 2.   Find people
 3.   Add a new entry
 4.   Modify an entry
 5.   Delete an entry
 6.   Exit

 Enter option [1-6]: 1
[
 No phone directory 'phonebook.txt' found

 ================================
      Phone Directory Manager
 ================================
 1.   Display phone directory
 2.   Find people
 3.   Add a new entry
 4.   Modify an entry
 5.   Delete an entry
 6.   Exit

 Enter option [1-6]: 2
[
 Enter First Name (Type exit to end): Raul
[Enter Last Name (Type exit to end) : Mijangos
[
 Info: No match found

 ================================
      Phone Directory Manager
 ================================
 1.   Display phone directory
 2.   Find people
 3.   Add a new entry
 4.   Modify an entry
 5.   Delete an entry
 6.   Exit

 Enter option [1-6]: 3
[
 Enter First Name (Type exit to end): Raul
[Enter Last Name (Type exit to end) : Mijangos
[Enter phone# (Type exit to end)    : (678)751-1932
[Enter address (Type exit to end)     : 2737 Fairlane Dr., Atlanta GA, 30341
[
 Info: New phone added
```

```
================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 1

Phone Directory sorted on Last Name (second column)

Raul  Mijangos  (678)751-1932  2737 Fairlane Dr., Atlanta GA, 30341

================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 3

Enter First Name (Type exit to end): Edgar
Enter Last Name (Type exit to end) : Santiago
Enter phone# (Type exit to end)    : (770)549-9828
Enter address (Type exit to end)     : 4567 Ortega Way, Atlanta GA, 30341

Info: New phone added

================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 2

Enter First Name (Type exit to end): Edgar
Enter Last Name (Type exit to end) : Santiago

Edgar:Santiago:(770)549-9828:4567 Ortega Way, Atlanta GA, 30341
```

```
================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 3
[
Enter First Name (Type exit to end): Sandy
[Enter Last Name (Type exit to end) : Nguyen
[Enter phone# (Type exit to end)    : (404)345-1582
[Enter address (Type exit to end)     : 3784 Stratford Arms Dr., Chamblee GA, 30341
[
Info: New phone added

================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 1

[Phone Directory sorted on Last Name (second column)

Raul   Mijangos  (678)751-1932  2737 Fairlane Dr., Atlanta GA, 30341
Sandy  Nguyen    (404)345-1582  3784 Stratford Arms Dr., Chamblee GA, 30341
Edgar  Santiago  (770)549-9828  4567 Ortega Way, Atlanta GA, 30341

================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 4

[Enter old First Name (Type exit to end): Edgar
Enter old Last Name (Type exit to end) : Santiago
[
[Enter new First Name (Type exit to end): Edgar
Enter new Last Name (Type exit to end) : Alavez
[Enter new phone# (Type exit to end)    : (404)207-7421
[Enter new address (Type exit to end)   : 6509 New Peachtree Rd., Doraville GA, 30340
[
[Info: Modified phone
```

```
================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 1

Phone Directory sorted on Last Name (second column)

Edgar  Alavez    (404)207-7421  6509 New Peachtree Rd., Doraville GA,, 30340
Raul   Mijangos  (678)751-1932  2737 Fairlane Dr., Atlanta GA, 30341
Sandy  Nguyen    (404)345-1582  3784 Stratford Arms Dr., Chamblee GA, 30341

================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 5

Enter First Name (Type exit to end): Raul
Enter Last Name (Type exit to end) : Mijangos

Info: Deleted phone

================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 1

Phone Directory sorted on Last Name (second column)

Edgar  Alavez  (404)207-7421  6509 New Peachtree Rd., Doraville GA,, 30340
Sandy  Nguyen  (404)345-1582  3784 Stratford Arms Dr., Chamblee GA, 30341
```

```
================================
     Phone Directory Manager
================================
1.   Display phone directory
2.   Find people
3.   Add a new entry
4.   Modify an entry
5.   Delete an entry
6.   Exit

Enter option [1-6]: 6

[rshaon1@gsuad.gsu.edu@snowball ~]$ cat phonebook.txt
Edgar:Alavez:(404)207-7421:6509 New Peachtree Rd., Doraville GA,, 30340
Sandy:Nguyen:(404)345-1582:3784 Stratford Arms Dr., Chamblee GA, 30341
[rshaon1@gsuad.gsu.edu@snowball ~]$ ls -l phonebook.txt
-rw-------. 1 rshaon1@gsuad.gsu.edu rshaon1@gsuad.gsu.edu 143 Feb 27 21:50 phonebook.txt
```

5.

A. Write a C script that will compute the factorial of a given number (positive integer).

```
[rshaon1@gsuad.gsu.edu@snowball ~]$ gcc factorial.c -o factorial
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./factorial 10
3628800
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./factorial 4
[24
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./factorial 3
6
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./factorial 2
2
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./factorial 1
1
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./factorial 0
1
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./factorial -67
Error: Invalid number entered
[[rshaon1@gsuad.gsu.edu@snowball ~]$
```

B. Write a C script to find the new integer value of an original integer when it is bit-shifted left by 3 bits and added to its complement (one's complement of the original integer).

```
[rshaon1@gsuad.gsu.edu@snowball ~]$ gcc shift.c -o shift
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./shift 5
[34
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./shift 10
[69
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./shift -267
-1870
[[rshaon1@gsuad.gsu.edu@snowball ~]$
```

(Note: You can manually type in the binary representation of the original integer)

(10 bonus points for writing the C script to convert the integer to binary and vice-versa)

Decimal to Binary

```
[rshaon1@gsuad.gsu.edu@snowball ~]$ gcc dec2bin.c -o dec2bin
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./dec2bin 5
101
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./dec2bin 10
[1010
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./dec2bin 19
10011
[[rshaon1@gsuad.gsu.edu@snowball ~]$
```

Binary to Decimal

```
[rshaon1@gsuad.gsu.edu@snowball ~]$ gcc bin2dec.c -o bin2dec -lm
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./bin2dec 10011
[19
[rshaon1@gsuad.gsu.edu@snowball ~]$ ./bin2dec 1010
[10
[[rshaon1@gsuad.gsu.edu@snowball ~]$ ./bin2dec 100
4
[[rshaon1@gsuad.gsu.edu@snowball ~]$
```

(10 bonus points for writing a shell script that will execute both the C scripts from above for a given integer number)

```
[[rshaon1@gsuad.gsu.edu@snowball ~]$ chmod +x runc.sh
 [rshaon1@gsuad.gsu.edu@snowball ~]$ ./runc.sh
 Usage: ./runc.sh integer
 [rshaon1@gsuad.gsu.edu@snowball ~]$ ./runc.sh 10
[3628800
[69
 [rshaon1@gsuad.gsu.edu@snowball ~]$
```