COMP 302 System Programming Spring 2023
Instructor: Zafer Aydın
Midterm Exam

The exam is open book and notes. You are allowed to use the terminal and the man pages of the commands in a Linux operating system. You are not allowed to use resources in the internet. Submit your solutions to the questions below in a file you prepare using vim editor. You can name your file in name_surname format. Other file formats such as those with .doc, .docx, .odt, and .pdf extensions are not acceptable. Your file should be opened directly from the commandline using vim editor. The commands in your solution should work when they are copied and pasted into commandline. Therefore you should be careful with quote symbols and space characters. Define a directory under your home folder of the workstation in the following format:

```
/home/username/comp_302/exams/midterm/
```

and save your solution file under this folder. DO NOT upload your solution file to Canvas.

1. (a) Write an alias named `dateinfo` that will print the current date, the path to the current directory, and the contents of that directory listed in detailed format including the file dates and permissions. For example:

```
$ dateinfo
Tue Oct 30 15:43:59 PDT 2017
/home/user/docs
total 12
-rw-rw-r-- 1 user user 68 Oct 30 12:31 hello.c
-rw-rw-r-- 1 user user 17 Oct 28 15:43 README
-rw-rw-r-- 1 user user 35 Oct 12 13:15 story.txt
```

(b) Which file you should insert that alias command to (i.e. the alias you defined in part (a)) so that it is effective each time you login to your account and start a new terminal session?

(c) Provide a single line of command (piping is allowed but combining multiple commands with semi-colon is not) for adding the `bin` directory in your home directory to your PATH variable. Use the `export` command so that the PATH variable can be passed to child processes if needed.

2. Assume you are given the directory structure shown in figure below (ellipses are directories and rectangles are files)

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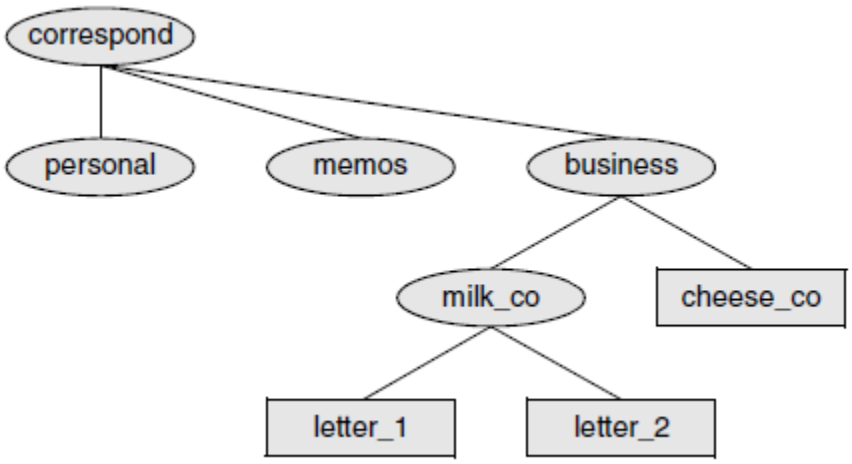

and the following permissions:

```
d--x--x--x 3 zach pubs 512 Mar 10 15:16 correspond

d--x--x--- 3 zach pubs 512 Mar 10 15:16 business

drwxr-xr-x 2 zach pubs 512 Mar 10 15:16 milk_co

-r--r--r-- 2 zach pubs 512 Mar 10 15:16 letter_1
```

For each category of permissions—owner, group, and other—what happens when you run each of the following commands? State whether you can execute the command successfully or not as the owner, as the group or as others and state the reason why you can or cannot execute it. Assume the working directory is the parent of `correspond` and that the file `cheese_co` is readable by everyone.

(a) `ls -l correspond/business`

(b) `cat correspond/business/cheese_co`

(c) `rm -rf correspond/business/milk_co/letter_1`

3. (a) Provide a single-line command using `find` that finds all the files in the current directory, which are modified more than 50 days ago and less than 100 days ago.

(b) Provide a single-line command using `find` that finds all the files in the current directory but not its subdirectories whose permission setting is 777 and changes those permissions to 755.

4. Run the following commands:

```
ls /bin > dirlist-bin.txt

ls /usr/bin > dirlist-usr-bin.txt
```

```
ls /sbin > dirlist-sbin.txt

ls /usr/sbin > dirlist-usr-sbin.txt
```

Give a single-line command (piping is allowed but not semi-colons) that searches for the word `util` in files that start with `dirlist` and compresses those files found (that start with `dirlist`) using `tar` to produce a file named `utils.tgz` file (i.e. a `tar` archive plus compression using `gzip`). What is the compression ratio? Do not compute the compression ratio using `gzip -l utils.tgz` command as it computes the ratio for going from .tar file to .tgz file. You can use the following formula for this purpose:

Compression ratio = (uncompressed file size – compressed file size) / uncompressed file size

Show the steps of your computations and the commands you used to obtain file sizes explicitly. Give the output of the ls command that shows the sizes of the compressed and uncompressed files.

5. (a) Provide a single-line command using `grep` (but not `find`) that prints the number of empty lines in a file named file1.txt.

(b) Explain what the following command prints as the output (i.e. what does the regular expression `^[^hello]` do?)

```
grep -h "^[^hello]" hello.txt
```

Assume that `hello.txt` is a file that contains text information. An example such file is given below, which you can use to test the command

```
Hello World
hello world
world hello
WORLD HELLO
hello hello world
hello world world
```

(c) Provide a single-line command using `grep` (but not `find`) that prints lines that contain integer numbers in the range of 0 to 999. Do not use alternation (i.e. |) in your regular expression.

(d) Provide a single-line command that lists the information about files with permissions 755 or 777 in detailed format. Use `ls` and `grep` commands.