EXAM UNIX (90 POINTS + 3 EC)

- This is an examination. It is to be your work and your work alone.
- No exchange of information with another human entity in any form is acceptable.
- The use of ChatGPT is not allowed.
- It is ok to use your notes, your programs, your lab notes, and any other notes you have written for class.
- Using a textbook is ok.

```
Follow these instructions in each file you submit
●  Include the class header

●  Format of Q&A pairs
Example:

#mprocop2:09/27/2023:filename

#Q1
cat file

#Q2
ls -lt file
```

After you download Exam1-Fall2023.zip from Canvas, unzip the file if necessary, and a directory called Exam1-Fall2023 will be created.
Change into Exam1-Fall2023 and start your work in that directory.
If you open two terminals, make sure you change into Exam1-Fall2023 in both.

Policy for cheating: sharing code on the exam is unacceptable and will earn you a 0 and take you straight to the ethics board. Do not share any study documents either!

General Grading:
* Following instructions (class header and Q&A pair)
* Full points for correct answer
* Partial points are available

For Ubuntu users: in each script that you submit, include:
Class header
Ubuntu

1 (42) Make a file called **ex1-f23.bash** and answer in it the following questions, which refer to the directory structure depicted below. The directory structure was already made within the Exam1-Fall2023 directory.

Answer the questions by using the appropriate Unix commands.
You must start from the Exam1-Fall2023 directory. Remember to include the class header and **answer each question with only one line of code**.

```
                    file1
               /dir2/file2
Exam1-Fall2023/.hidden1.bash
               /dir1/aaa1
                    bbb2
                    ccc3
                    ddd4
                    dd3
                    dd4
                    f2
                    f1
```

Q0. As a comment include this sentence as Q0 for this script.
I promise not to communicate with another human being in any way about this exam.

Make sure you start from the Exam1-Fall2023 directory.

Q1 (2) Your current working directory is Exam1-Fall2023. List the hidden files that are within your current directory. You will see there is only one hidden file.

Q2 (4) Your current working directory is Exam1-Fall2023. Run the hidden file that is within the Exam1-Fall2023 directory.
You will see that the output includes both standard output and standard error.
You must write the entire name of the hidden file (so do not use metacharacters in the filename).

Q3 (10) Your current working directory is Exam1-Fall2023. Run again the hidden file that is within the Exam1-Fall2023 directory, redirect the standard error to the null device, and store the standard output in a variable called var. You must use command substitution to store the standard output into a variable.
Do all these with one line of code.

Q4 (6) **Append** the **contents** of variable var to the file file1 which is in directory dir2. Use a relative path.

If you did not make variable var in previous exercise just assign to variable var the string *Hello* and do this exercise.

Q5 (2) Go to directory dir1 by using a relative pathname.

Q6 (10) Your current working directory is dir1. You should perform text manipulation on file file2 located in directory dir2. To do this, do not change your current working directory, and use a relative pathname.
You task is to replace the occurrences of character 'y' with character 'o' in file2 and print out only the first 3 lines of the translated contents of file2. You should use a pipeline of commands, and the first command must be the **tr** command. Do not use sed. The correct output should look like this.

```
pop
jazz
disco
```

Q7 (7) You are still in directory dir1. Use a pipeline of commands, and metacharacters to display the number of lines, in decreasing order, and corresponding names of each file/directory whose name has 4 characters - use one line of code. Display those files/directories that are within your current working directory.

```
 19 aaa1
  6 ccc3
  3 bbb2
  1 ddd4
```

2 (18) Start this exercise from directory Exam1-Fall2023, and in it make a script called **ex2-f23.bash** that does **the following task.**
Directory dir1 contains files and directories.
In your script use **one for loop and one if-else statement inside the for loop** to count the number of files that are within dir1, and to count the number of directories that are within dir1. Both counts should be performed within the for loop.

When you make this script, you should assume that you do not know how many files and directories there are in dir1 and that you do not know which name corresponds to a file or directory.
Do not loop over specific files and/or directories, **but loop over all the contents of dir1,** and use a relative pathname. Do not change directory in the script.

Your script should print to screen **only the total number of files and the total number of directories.** The output of your script should be like this:

```
The number of files is 6
The number of directories is 2
```

3. (30) The provided file **happiness.dat** contains information about the happiness index in various European countries. There are two types of comment lines, those starting with a **#** and those starting with a **%**. After the comments, the fields are organized as follows:

1st : country name
2nd : gender of participants
3rd : mean happiness index
4th : number of participants
5th : population of the country
6th : GDP of the country

Start from the Exam1-Fall2023 directory, and in it make a script called **ex3-f23.bash** that does the following:

Q1 (6) Generate a file **mydata.dat** that does not contain any comment lines. Keep in mind that comment lines start with either # or %. Assume you do not know how many comments lines there are and where they are. Use grep.

If you do not know how to do this, you can use provided file mydata2.dat to answer the following questions.

Q2 (13) Calculate GDP per capita and display it in sorted order from largest to smallest. Show only the unique entries. Use awk to print the country name, and the GDP per capita. To calculate GDP per capita, divide values in 6th field (GDP) with the population of the country (5th field) and multiply it by 1000000000 (1 billion). Use a combination of commands in pipeline and use mydata.dat. The first 3 listed countries should be:

```
Norway      8.3e+04
Ireland     7.5e+04
Denmark     6.1e+04
….
```

The actual output is much longer. If you do not get Norway as your first country, keep in mind that you should **not initially format the numbers as exponents** as when sorted it can give you the wrong answer. You should format the numbers last, with another pipe.
Make sure fields are aligned as shown above, however, the exact number of spaces does not matter.

Q3 (10) Use mydata.dat and a combination of commands in pipeline to find out what is the country where women are the happiest (happiness index is in 3rd field). Show only the country name, which should be converted in uppercase letters. If you cannot do everything, answer this question partially, for partial credit.

EC (3 points) - all or nothing - work on this only if you have finished everything else.
In a script called **ECf23.bash** do the following:
Use a combination of Unix commands to find out the total happiness index of males and of females. Total happiness index is calculated as sum of values in 3rd field (mean happiness) for males and for females separately. After you discover that, use an if statement to print to screen who is happier. Do not hardcode anything, including the knowledge who is happier. Include a case where the total happiness could be equal. Use mydata.dat.

Deadline and late penalty
The deadline is **8:30pm with 3 min grace period** for you to check all the scripts and submit them to the Gradescope assignment called Exam1.

Late penalty:
After 8:33pm, the penalty is 2 points for each late minute.

Gradescope Exam1 will close at 8:40m.

IF YOU HAVE TECHNICAL ISSUES DURING THE EXAM LET THE PROFESSOR KNOW

Submit the following files to Gradescope:
ex1-f23.bash
ex2-f23.bash
ex3-f23.bash
ECf23.bash – if you made it.
DO NOT SUBMIT ANY ADDITIONAL DATA FILES OR DIRECTORIES.