CMPUT275—Assignment 1 (Winter 2025)

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Due Date: Friday January 31st, 8:00PM

Per course policy you are allowed to engage in *reasonable* collaboration with your classmates. You must include in the comments of your assignment solutions a list of any students you collaborated with on that particular question.

For assignment questions we will give you a sample executable — this is *our* solution to the problem which you will be tested against. You should use this assignment question to check what the expected output is. If you ever have a question "What should our program do when XYZ" the answer is what does the sample executable do? With the notable exception of *invalid input*. Breaking the rules of what the program expects is considered invalid input and wouldn't be a valid test case unless we explicitly told you what your program should do to handle such a problem. **Note:** These sample executables are compiled on the student environment — that means they are only guaranteed to work on that environment. They likely will not work on your local machine, you should use them on the student environment if this is the case, which is where you should be testing your own code anyways.
Most of the questions of this assignment are steps to building a larger script which will help you throughout this course with testing your own assignment code. We suggest you start early so that getting stuck on an early question does not mean you won't be able to finish later questions.

1. **This question is about downloading the course repository, you do not have to write any code for this question. However, the files required for all future questions are included in this repository, without completing this question you cannot work on the subsequent questions.** The course repository is a Git repository hosted on GitHub were all files related to the course will be distributed. This is where all future assignments will be released, as well as all in-class code examples and slides.

   For this question you only have to clone the course repository, so that you are able to access these files. Git is already installed on the student server, so if you are working on the student server you do not need to install anything. If you are working locally and do not already have Git installed you must install git. Assuming you have already installed the other suggested course software then the steps are as follows.

   For Mac: Run the following command. This assumes you already installed homebrew per the instructions on the Discussion forum.

   ```
   brew install git
   ```

   For WSL on Windows: Run the following command in your WSL shell:

   ```
   sudo apt install git -y
   ```

Once you have installed Git you need to run the command to clone the repository, that command is:

```
git clone https://github.com/rh-cmput275/w25-cmput275.git
```

Which will create a directory for you named `w25-cmput275` in your current working directory, with all the currently uploaded files in it. In the future whenever you attend class or work on this course you should start by entering that directory and running the command **git pull** in order to pull all the newly added files and updates to the repository.

Do not edit files in this directory! Use this directory as read only, and if you want to use files from it copy them to your own directory.

Once you have cloned the repository, you must find the file within the a1 directory named `hello.txt`. You must submit this file with your assignment submission.

2. **This question is about writing a bash script — you should not write any C code for this question.**

   In this question you are writing a bash script named `testDescribe` which expects one command line argument which is a filepath. The filepath `testDescribe` receives should be to a text file whose contents are a series of strings separated by whitespace. We'll call this file a "test set file". Here is an example of the contents of a test set file named `set1.txt`:

   ```
   test1  /home/rob/foo/test2
       ./test3
   test4
   ```

   The strings inside the test set file we'll call file *stems*. These strings are meant to represent every part of a filepath *except* for the file extension. You'll notice that the contents can be absolute or relative paths — this should not affect how you write your script.

   Your script must iterate through the contents of the test set file and for each file stem it should perform the process described below. Note that in each place the process says `stem` it means each of the strings contained within the test set file.

   (a) If no command line argument is given for the test set file print a usage message to `stderr`

   (b) If the file `stem.desc` does not exist print out the message `stem:  No test description`

   (c) If the file `stem.desc` does exist print out the contents of the file `stem.desc`

   (d) Make sure steps (b) and (c) are repeated for every `stem` in the test set file

   For example consider your current working directory contains the file `test1.desc` with the following contents:

   ```
   This test uses negative inputs
   ```

   And your current working directory contains the file `test3.desc` with the following contents:

   ```
   This test using zero as an input
   ```

   And your file system contains the file `/home/rob/foo/test2.desc` with the following contents:

```
This test uses positive inputs
```

Then the output of executing your script as follow `$ ./testDescribe set1.txt` would be

```
This test uses negative inputs
This test uses positive inputs
This test using zero as an input
test4: No test description
```

Hint: You may need some conditions we didn't talk about in class for your `if` statements in bash. Here's a useful website with lots of bash tips https://devhints.io/bash.

Deliverables: For this question include in your final submission zip your bash script file named `testDescribe`

3. **This question is about writing a bash script — you should not write any C code for this question.**

In this question you will be writing a bash script `runInTests` which expects two command line arguments, the first command line argument is a command to run, and the second command line argument is a test set file (as described in question 1). Below is an example run of your script:

```
./runInTests wc wc_set.txt
```

Consider the file `wc_set.txt` contains the following:

```
wcTest1
wcTest2
```

Your script `runInTests` will iterate through the file stems in the test set file and perform the following set of steps for each file stem, note in each step you should consider `stem` is a variable that represents any given file stem:

(a) Run the command given to your script while redirecting input from the file `stem.in`

(b) Compare the output from that execution of the command to the contents of the file `stem.out`

(c) If the output does not differ, then output `Test stem passed`

(d) If the output does differ, then output `Test stem failed`, followed on the next line by `Expected output:`, followed on the next line by the contents of `stem.out`, followed on the next line by `Actual output:`, followed on the next line by the output produced by running the given command with the given input file.

Try out sample executable with the sample command above with the provided files to see a sample output.

Note: If your program creates any files they *must* be temporary files. They must also be deleted once you are finished with them.

Hint 1: Consider using the `diff` command to help you solve this problem. Remember you can read the exit status of the previous command you executed with `$?` — read the `man` pages of the `diff` command to see if the exit status could help you.
Hint 2: If you want to run a command, but don't want the output produced by that command to print, you can redirect that commands output to `/dev/null`.

Deliverables For this question include in your final submission zip your bash script file named `runInTests`

4. **This question is about writing a bash script — you should not write any C code for this question.**

   In this question you will be updating your script `runInTests` from question 2, your new updated script should be named `runTests`. The changes you will need to make to your previous question will be quite small if you wrote your solution well. Our sample solution only needed a change to one line.

   Update your previous solution so that when it runs each test case not only does it redirect input from `stem.in` but it also passes command line arguments to the command which are the contents of the file `stem.args`.

   For example, if one of your command was `wc` and one of the stems was `wcTest1` and the contents of the file `wcTest1.args` were as follows:

   ```
   -l -w
   ```

   Then ultimately, for that test case, you'd run the command

   ```
   wc -l -w < wcTest1.in
   ```

   Of course, this needs to be done for each test case. You are not literally writing `-l -w` in the command, as the arguments to pass are the contents of the `.args` file.

   Hint: You'll need to place the contents of each args file directly in a command — what have you seen in class that could help solve this problem?

   Deliverables For this question include in your final submission zip your bash script file named `runTests`

5. **For this question you will be writing a C program.**

   In this question you will be writing a simple C program `divisors.c`

   Your program should:

   - Read one integer from standard input.
   - Print every divisor of the read in integer, from smallest to largest, with a space inbetween every divisor. **You must not print any additional spaces, including before the first divisor or after the last divisor**.
   - Your program should print a newline after the last divisor.

   For example, if your program was executed with the input 256 it would print:

   ```
   1 2 4 8 16 32 64 128
   ```

   You should test your program with your `runTests` script from the previous question.

   Deliverables For this question include in your final submission zip your c file named `divisors.c`

6. **Extra exercise:** This question is not for any marks — it is additional steps you can take to make your `runTests` program more helpful and user friendly.

   - Some programs only read input, some only use command line args, some will use both. Our `runTests` looks for an `.in` and `.args` file for every single stem — we may not want that. Update your script so it only provides input or args to the command when the corresponding files exist.
   - We may have forgotten to create a given output file for our test set, right now `runTests` assumes that every `.out` file exists. Update your script so that it prints a meaningful error message when a `.out` doesn't exist.
   - Consider your first program `testDescribe`, those descriptions could be handy to view for each test case. Consider updating your `runTests` script so that when printing out if a test failed or passed it also prints out description of that test.
   - In the real world you'll have to create your expected outputs yourself — since you won't have an already compiled executable of the code you're trying to write. In this class you will be given sample executables for the programs you need to write so take advantage of this! Create a new version of your `runTests` script that takes a third argument, the sample executable, and instead of using `.out` files this version compares the output of the two executables provided for each test case.

How to submit: Create a zip file `a1.zip`, make sure that zip file contains your cloned text file `hello.txt`, three bash scripts `testDescribe`, `runInTests`, `runTest`, and your C file `divisors.c`. Assuming all five of these files are in your current working directory you can create your zip file with the command

```
$ zip a1.zip hello.txt testDescribe runInTests runTests divisors.c
```

Upload your file `a1.zip` to the a1 submission link on eClass.