VE 280 Lab 1

Out: 00:01 am, May 18, 2022; **Due**: 11:59 pm, May 24, 2020.

Ex1. Scripting Web Server

Related Topics: *Linux*.

Jin decides to develop his personal website and implement a convenient shell script to automate command line tasks. These tasks include:

- Create: create the working directory of the database and webserver, and initialize the database;
- Dump: dump the data in the database into the webserver;
- List: list all the files stored in the webserver;
- Display: display the data in the webserver;
- Destroy: remove the working directory of database and webserver.

He has already implemented the skeleton of `ex1.sh`, but he forgets to add some basic commands. There are 5 of such lines in the script that are marked as `TODO` comments:

```
# TODO: Replace this line with a linux command line.
```

Please help him finish this script by replacing the `TODO`s with a Linux command line you learned from lecture.

1. Create a directory named `sql/`.
2. Copy the file `sql/database.txt` to the directory `webserver/`
3. List all files in directory `webserver/`.
4. Display `webserver/database.txt` in `stdout`.
5. Remove the `webserver/` and `sql/` directories.

Testing

To test the script, please first make it executable by running:

```
chmod +x ./ex1.sh
```

Then, you can test the script by running the following commands and observe the results.

```
./ex1.sh create
./ex1.sh dump
./ex1.sh list
./ex1.sh display
./ex1.sh destroy
```

Ex2. Validating Password

Related Topics: *loops*, *arrays*, *boolean*, *ASCII*.

Jin builds his website and wants to develop the back-end of the sign-up page for jAccount. In one of his programs, he has to write a function that checks if the password user submitted to the webserver is valid:

- Contains at least 1 alphabetic characters;
- Contains at least 1 numerical characters;
- Contains at least 1 non-alphanumeric characters.

The function takes a password (an array of chars) as input, returns true if the password is valid and returns false if not.

```
bool isValidPassword(char password[]){
    // TODO: Implement this function.
}
```

You are told that no password contains more than 50 characters. Please help him implement the function.

Example

Example input:

```
I-love-VE280
```

Example output:

```
1
```

Ex3. Programming Algebra

Related Topics: *loops*, *array*s, *math*.

Jin is taking a Machine Learning course, and is asked to develop a model to recommend courses for a student based on the dataset of students' ratings of JI courses.

One of his tasks is to write a function that takes a $n \times n$ weight matrix W (a 2D square array of int) and the size of the weight matrix n as input, and returns the trace of the Laplacian of the weight matrix.

```
int traceLaplacian(int weight[][50], int size){
    // TODO: Implement this function.
}
```

The formulas are given as follows.

- The degree matrix D is a diagonal matrix, whose i^{th} diagonal element is the sum of the i^{th} row of the weight matrix W:

$$D_{i,i} = \sum_{j=1}^{n} W_{i,j},\ D_{i,j} = 0 \text{ if } i \neq j$$

- The Laplacian $\mathcal{L}$ of the weight matrix W:

$$\mathcal{L} = D - W. \text{ That is, } \mathcal{L}_{i,j} = D_{i,j} - W_{i,j}$$

- The trace of the Laplacian $\mathcal{L}$ is the sum of the diagonal of $\mathcal{L}$:

$tr(\mathcal{L}) = \sum_{i=1}^{n} \mathcal{L}_{i,i}$

If an empty weight matrix is passed in ($n = 0$), the Laplacian should be empty and its trace should be 0. You don't need to worry about the case where $n > 50$ and ignore integer overflow. Please help Jin implement this function.

Example

Example input:

The first line contains a single int, which is the size n of the matrix.

The following lines encodes the matrix, each row separated by a `\n` and each column separated by space.

```
3
1 2 3
3 2 4
2 1 0
```

- The weight matrix W ($n = 3$) is then:

$$W = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 4 \\ 2 & 1 & 0 \end{bmatrix}.$$

- The Degree matrix D is then:

$$D = \begin{bmatrix} 1+2+3 & 0 & 0 \\ 0 & 3+2+4 & 0 \\ 0 & 0 & 2+1+0 \end{bmatrix} = \begin{bmatrix} 6 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 3 \end{bmatrix}.$$

- The Laplacian $\mathcal{L}$ is then:

$$L = \begin{bmatrix} 6 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 3 \end{bmatrix} - \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 4 \\ 2 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 5 & -2 & -3 \\ -3 & 7 & -4 \\ -2 & -1 & 3 \end{bmatrix}.$$

- The trace is then:

$$tr(\mathcal{L}) = 5 + 7 + 3 = 15$$

Example output:

```
15
```

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