

Lab 03 – Part B: Arrays on the Stack**Assigned:** 2019-02-05 08:00:00**Due:** 2019-02-07 23:59:00, concurrent with Part A of this lab.**Instructions:**

- Written portions of this assignment are submitted via Canvas. Unless specified otherwise, the written portion of the assignment is to be completed using LaTeX. All derivations, images, graphs, and tables are to be included in this document. Handwritten solutions will receive zero credit.
- Code portions of this assignment are submitted via `code.vt.edu`. Source code must be in the private repository, to which the CMDA 3634 instructors must have access.

Deliverables: For this assignment, you are to submit the following:

1. (Canvas) `<pid>_Lab_03.pdf`: A PDF file, rendered by `pdflatex` (the file generated by Overleaf is sufficient) containing the answers to the questions requiring written answers. Use the template provided in the project repository. Your submission should include both Part A and Part B of this lab.
2. (`code.vt.edu`) The source files required to compile and run your solutions to the lab and the tex and image files for your report, in the appropriate directories.

Collaboration: This assignment is to be completed by yourself, however, you may seek assistance from your classmates. In your submission you must indicate from whom you received assistance.**Honor Code:** By submitting this assignment, you acknowledge that you have adhered to the Virginia Tech Honor Code and attest to the following:

I have neither given nor received unauthorized assistance on this assignment. The work I am presenting is ultimately my own.

Resources

- More on Git:
 - <https://www.taniarascia.com/getting-started-with-git/>
 - <http://rogerdudler.github.io/git-guide/>
- More on LaTeX:
 - <https://www.overleaf.com/learn>
- More on C programming:
 - <https://www.geeksforgeeks.org/c-programming-language/>
 - Recommended texts

Tasks

Warning: I have indicated where you should be running commands in a terminal with the > character. This character is **not** part of the command!

1. **Setup** your coding environment.
 - (a) Pull the lab materials from the upstream repository.
 - (b) Examine the history to see what new files have been added by the instructors.
 - (c) Push your local master branch to the origin repository to add the new changes.
2. **Implement** the following requirements in C. Read the readme file in the labs/lab03/code/ directory. Be sure to use git to commit your code regularly.
 - (a) Write a program that uses automatically allocated arrays to store and manipulate data.
 - i. In the labs/lab03/code/stack_arrays/ directory, you will find a program named `stack_array.c`, which contains an empty main body and includes a library for performing basic operations on an array. In the library, `array_utils.h` and `array_utils.c`, there is a routine to populate an array with pseudorandom integers. Use the provided makefile, with the correct rule, to build your program.
 - ii. In the main routine, allocate an automatically allocated integer array of size 128, and use the provided routine to populate it with random numbers.
 - iii. In the array utilities library, write a function `void print_array(int* arr, int N)`, which prints contents of the array to the screen as a comma separated list. Take care to not print an extra comma at the end.
 - iv. In the main program, create a pointer to the 10th entry of the array and use your print routine to print the next 7 entries. Be careful with how you count to 10.
 - v. In the array utilities library, write a function `sum_array`, which computes the sum of the values in an array.
 - vi. In the array utilities library, write a function `mean_array`, which computes the average of the values in an array. Think carefully about the return type and how to ensure you return a value of that type.
 - vii. In the main program, print the sum and mean of the entire array.
 - viii. In the main program, create pointers to the first, 33rd, 65th, and 97th entries of the array. For each of these entries, print the sum and mean of the next 32 entries of the array.
 - ix. Redirect the output of the `stack_array` program to a text file named `output_pt.b.txt`.

```
> ./stack_array > output_pt.b.txt
```

Be sure to include this output file in your final git submission.

3. **Answer** the questions listed below. The following workflow uses Overleaf, but you are welcome to use a local tex installation if you prefer.
 - (a) In Overleaf, open your Lab 03 project.
 - (b) Copy the files `lab03_report_b.tex` from the `labs/lab03/report/` directory to Overleaf.
 - (c) Be sure to uncomment the lines defining the section for Part B and including the Part B solutions.
 - (d) Answer the questions, and upload data files where necessary.
 - (e) In your VM, copy your report tex source and images into the `labs/lab03/report/` directory. Overleaf allows you to download projects in `.zip` format. Download the zip file, move it to the report directory, and unzip it.

```
> unzip <project_name>.zip .
```
 - (f) Add them to git, and commit them.
4. **Submit** your results.
 - (a) When you have completed Part B of this lab, upload a PDF of your report to Canvas.
 - (b) Push your source code and latex files to `code.vt.edu`. From anywhere in your local projects repository

```
> git push origin master
```
 - (c) Examine your assignment repository on `code.vt.edu` to be sure that all of your materials have been correctly submitted.

Questions

Answer the following questions using the latex template provided in the `lab03/report` directory of the assignment repository.

1. Use the `listings` package to include your output (`output_pt.b.txt`) in your pdf. You will need to copy `output_pt.b.txt` to the reports directory.
2. Call your `sum` function with a value for `N` that is larger than the number of entries in the array. What happens when you compile? When you run? What is happening here?
3. Other than the instructor or TAs, who did you receive assistance from on this assignment?