ISyE 6679 – Assignment 2

1. Write a C program to carry out random matrix multiplications by command-line arguments to the program executable. Specifically

   - the program should be executed from the command line as
     `program r1 c1 m1 ...  [rN cN mN]`
     and work correctly for an arbitrary number of $r - c - m$ triplets
   - for each set of command line specifications r_n and c_n, the program should generate a matrix pair (A, B) with $\dim(A) = r_n \times c_n$ and $\dim(B) = c_n \times r_n$ and random elements in the range $[0, m_n]$ with three decimal places
   - multiply the matrices A and B and write the result to the screen
   - make sure that your program compiles without warnings using
     `gcc -Wall -O3 -o program program.c`
   - make sure that your output contains one row in a line, with corresponding row elements separated by a space. For example
     `program 2 2 4`
     should yield an output such as:
     ```
     3.2345 4.345
     2.3546 1.2345
     ```
   - in the case of multiple $r - c - m$ triplets, the program should return the corresponding matrices separated by an empty line. For example
     `program 2 1 3 3 4 3`
     should yield an output such as:
     ```
     3.2345 4.345
     2.3546 1.2345

     3.21234 1.2345 1.782345
     1.246657 5.4762 1.353645
     1.2357457 9.2345634 7.234345
     ```
     Note the empty line between the two matrix outputs. Your output should NOT contain an empty line at the end.

2. Write a bash script that automates the running of the program written in the previous problem. The script should

- accept command line arguments in the form
  `timingscript low high num`
- generate all possible combinations of (r, c) in the range [low, high] and pass them to the C program with a value for m that is drawn randomly in the range $[1, \text{num}]$
- time the execution of the program, and report the total execution time and average time per call in seconds to the C program on the same line separated by a space. For example
  `timingscript low high num`
  should yield an output as:
  `3.425 0.823`
- make sure to name your script timingscript and round each time to 3 decimals.
- redirect the C program's output to /dev/null

Instructions for submitting your solutions

1. Compress the two files into a tar directory hw1.tar by running
   `tar -cvf hw1.tar program.c timingscript`
2. Do NOT put the above files in a folder and then tar the folder.
3. Submit your work online.