CS 240: Data Structure
Problem Set 2

Due: 03/01/2018

Instructions:
Please follow the instruction given at each problem for submission. The deadline of each assignment is 11:59 pm on the due date, unless otherwise specified. It is important that your code/solution is straight forward, not cumbersome. At the beginning of each cpp file, you must include the following:
1. Description: description of the program (later we will elaborate this more, but for now, just describe what the program does)
2. Author: the person who writes this program
3. Date: the very last date/time the program is modified

First Name:

Last Name:

Score: **/100 + 10**

Problem 1 Bored Post man: array and bool: 20 pts

Peter the postman became bored one night and, to break the boredom, he carried out the following experiments with a row of mailboxes in the post office. These mailboxes were numbered 1 through 150 and beginning with mailbox 2, he opened the doors of all the even-numbered mailboxes, leaving others closed. Next, beginning at mailbox 3, he went to every third mail box, openning its door if it is closed and closing it if open. Then he repeated this procedure with every fourth maiblox, then 5th and so on. When he finished, he was surprised at the distribution of closed mailboxes. Write a program to simulate this experiment and report which mailboxes are closed at the end of experiment.

(Bonus 10pts) Please write out the expression for those mailboxes that are closed at the end of experiment. For instance, if the closed boxes are located at 1, 11, 21, ..., 141, then the expression is (1+10i) where i =0, 1, ..., 14.

Problem 2 Programming: Find me the primes: 40 pts

A prime number is an integer greater than 1 whose only positive divisors are 1 and the integer itself. The greek mathematician Eratosthenes develope an algorithm , know as the Sieve of Eratoshenes, for finding all prime numbers less than or equal to a given number n, that is all primes in the range 2 and n. Two is the smallest prime but the multiples of 2 (4,6,8, ...) are not prime numbers, so they are crossed out. Then you proceed to 3 (add to the prime list), and then the multiples of 3 (6, 9, ..) are crossed out. Then you proceed to 5 (we skipped 4 because 4 was already crossed out when we were dealing with 2). This procedure continues till you reach a number that has not been crossed out and its square is greater than n. Write a program to simluate this algorithm. Let say we will test with $n = 550$ and $n = 5500$, please spit out the sum of the primes.

Problem 3 Programming: Matrix Multiplication: 40 pts

Write a program that will ask the following parameter m, n and k (positive integers, your program needs to verify it also). Then your program will (1) generate an m by n matrix A and an n by k matrix B (2) then it will produce an m by k matrix C where C is the product of matrix A and matrix B, i.e. $C = A \times B$.

Problem 4 Practice

1. Trace on functions that passe parameters via (a) reference (b) pointer (c) variable
2. Convert millitary time to standard time
3. Create a simple linkedlist by inserting the inputs one after one to the head of the list (no sorting required); What elements inside struct??
4. Given an array of numbers, how would you sort them? It does not have to be efficient. Just your ideas.
4. The post man problem but now you ask for input from the user to determine the size of the array (i.e. using dynamic array now)