2.1 Description

One of the earliest computers was a Analytical Engine made by Charles Babbage. The Analytical Engine had an instruction set similar to what we have today (there were if-statements, conditionals, and variables). The analytical engine worked similar to early computers, by using cards to read in instructions and then an instruction to be computed. In this assignment, we will update the analytical engine to perform some other computations.

In this assignment, you will take input from the user, and output the answer of several useful mathematical computations.
2.2 Evaluation/Rubric

- Files are properly named as specified below.
- You include a file called README describing your assignment.
  - Within your README, you must document your custom function (input 8) in your README.
- Part of your assignment will be graded based on code style.
- The remaining part of your assignment will be graded based on the correctness, and that it works to the specification.
  - Each function for example, will be worth some points.
  - Your program should run indefinitely, until the user terminates it.

2.2.1 Style

For this assignment, it is required that you write functions. When you write functions, you will want to document them using this template. An example is shown below:

```cpp
// Desc: This returns a 1 if the integer value is even. Otherwise 0 is returned.
// Input: N/A (User will input value)
// Output: Returns a 1 or 0 integer
// Error Conditions: User inputs a non-integer value.
int isEven() {
  std::cout << "Enter an integer and return 1 if even or 0 if odd\n"
  "\n";
  Your code here
  return ...
}
```

Listing 2.1: Submit Assignment

2.3 Files

You will be creating the files from scratch for this Assignment. You will have files named exactly (including the exact capitalization):

- assignment2.cpp
- README
2.4 Refresher

```cpp
// It will be useful in this assignment to be familiar with:
// - std::cin
// - if-statements
// - loops
// - breaking your code into functions
#include <iostream>

// Remember to have the correct return type
// if you need the value computed by the function.

void posOrNeg(int value)
{
    if (value > 0)
    {
        std::cout << "value is positive\n";
    }
    else if (value < 0)
    {
        std::cout << "value is negative\n";
    }
    else
    {
        std::cout << "value is 0\n";
    }
}

int main()
{
    int x;
    std::cin >> x;
    posOrNeg(x);
    return 0;
}
```

Listing 2.2: Submit Assignment

2.4.1 Mathematical Functions

As a refresher, here are the mathematical functions you will be defining.

1. Average - E.g. Sum of ten numbers divided by 10
2. Factorial - 4! = 1*2*3*4
3. multiply by 2 - Multiply an integer by 2. Note, there is a nice C++ operator to do this.
4. divide by 2 - Divide an integer by 2. Note, there is a nice C++ operator to do this.
5. Greatest Common Denominator (GCD) - The largest positive integer that divides each of the integers. For this assignment, the input will be two integers.
6. Prime Number - Compute the first x prime numbers, which are less than the input N is your input (e.g. N = 12 outputs 2,3,5,7,11)
7. isEven - Returns 1 if a number is even or a 0 if it is false. Investigate the
modulo operator.

8. Your custom function - Write an interesting mathematical function. Doc-
ument it in the readme.

2.5 Submission

```
provide comp11_ps2_assignment2.cpp README
```

Listing 2.3: Submit Assignment

2.6 Going Further

Did you enjoy this lab? Want to try out some additional commands to go
further?

- Try adding more mathematical functions.
- Try exploring the cmath library when building these functions.

2.7 Expected Output

You can run a completed version of the program on by logging into the server
and executing this file.

```
/g/11/2017uc/solution/ps2
```

```
Welcome to the (Modern) Analytical Engine
Enter a number (1−9) to perform a computation
Enter '0' (zero) to quit
1 – (float) Average of 10 numbers:
2 - Factorial:
3 – Multiply by 2:
4 - Divide by 2:
5 - Greatest Common Denominator:
6 - Print First x Prime Numbers less than N:
7 - Is Even number:
8 - Your custom function
```

Please make an input: 1
Input 10 floats(1 at a time)
1
2
3
4
5
6
7
8
9

2-3
Welcome to the (Modern) Analytical Engine
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4 – Divide by 2:
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7 – Is Even number:
8 – Your custom function

Please make an input: 2
Input an integer
7
The result is: 5040

Welcome to the (Modern) Analytical Engine
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3 – Multiply by 2:
4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 3
Enter an integer and return the value times 2
8
The result is: 16

Welcome to the (Modern) Analytical Engine
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3 – Multiply by 2:
4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 4
Enter an integer and return the value divided by 2
8
The result is: 32
Welcome to the (Modern) Analytical Engine

Enter a number (1−9) to perform a computation
Enter '0' (zero) to quit

1 – (float) Average of 10 numbers:
2 – Factorial:
3 – Multiply by 2:
4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 5
Enter 1st integer:
54
Enter 2nd integer:
24
Computing GCD
The result is: 6

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2 – Factorial:
3 – Multiply by 2:
4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 6
Enter an integer: N=
50
2 3 5 7 11 13 17 19 23 29 31 37 41 43 47

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2 – Factorial:
3 – Multiply by 2:
4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 7
Enter an integer and return 1 if even or 0 if odd
50
The result is: 1
Welcome to the (Modern) Analytical Engine

Enter a number (1−9) to perform a computation
Enter ‘0’ (zero) to quit
1 – (float) Average of 10 numbers:
2 – Factorial:
3 – Multiply by 2:
4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 7
Enter an integer and return 1 if even or 0 if odd
The result is: 0

Welcome to the (Modern) Analytical Engine
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Enter ‘0’ (zero) to quit
1 – (float) Average of 10 numbers:
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4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 8
You write this and document this function in your code
Input a number(1−20)) and you will get a special output
1 1 2 3 5 8 13 21 34 55 89 144 233 377 610
Sum of the first 15 fibonacci numbers are:
The result is: 1596

Welcome to the (Modern) Analytical Engine
Enter a number (1−9) to perform a computation
Enter ‘0’ (zero) to quit
1 – (float) Average of 10 numbers:
2 – Factorial:
3 – Multiply by 2:
4 – Divide by 2:
5 – Greatest Common Denominator:
6 – Print First x Prime Numbers less than N:
7 – Is Even number:
8 – Your custom function

Please make an input: 0
Good bye!

Listing 2.4: Submit Assignment