Assignment 2: Systematically Calculate the Multiplicative Inverse

Due date: October 24th, 2024

You will be working in a group of 2 students to implement the following multiplicative inverse algorithm (it means create the code in any programming language you are familiar with):

Input: two positive integers b and a.
Output: the inverse of a modulo b, a^{-1} mod b, if it exists.
Initialize: $b_0 = b,\ a_0 = a,\ r_0 = 0,\ r = 1,\ \mathrm{q} = \left\lfloor \frac{b_0}{a_0} \right\rfloor,\ s = b_0 - qa_0.$
Step 1: **While** $s > 0$ **do**
Step 1.1: $\mathrm{temp} = r_0 - qr.$
Step 1.2: **If** $\mathrm{temp} \geq 0$ **then** $\mathrm{temp} = \mathrm{temp} \mod b$.
Step 1.2.1: **Else** $\mathrm{temp} = b - ((-\mathrm{temp}) \mod b)$.
Step 1.3: $r_0 = r$.
Step 1.4: $r = \mathrm{temp}$.
Step 1.5: $b_0 = a_0$.
Step 1.6: $a_0 = s$.
Step 1.7: $\mathrm{q} = \left\lfloor \frac{b_0}{a_0} \right\rfloor$.
Step 1.8: $s = b_0 - qa_0$.
Step 2: **End While**
Step 3: **If** $a_0 \neq 1$ **then output** a has no inverse modulo b
Step 3.1: **Else return** $a^{-1} = r \mod b$.

You are requested to submit the following:

1. The program code you implemented.
2. A file readme containing the following:
   a. An example input numbers and expected outputs.
   b. A detailed description of the way you used your program to find out the multiplicative inverse. This includes detailed instructions for compiling and executing the programs. The program will be tested according to your instructions to produce the expected outputs.