Lab8 Shor's algorithm - general idea on the simple example

Exercise 1
Solve assigment II from the file http://www.lassp.cornell.edu/mermin/qcomp/prob4.pdf

Exercise 2:
Implement (in arbitrary programming language on classical computer) function a^x mod N for x=1..100, N=55, a=9 (as in exercise 1) . Observe the period. Optional: produce a plot (in any tool) .

Exercise 3
Quantum gate for calculating a^x mod N function.

Use the draft of the code below to calculate values of function a^x mod N for x=1..100 by using provided expModulo gate in the simulator .

```
//initialize x, N, a
    //int N= ...
    //int a= ...
    //ulong x
   // calculate how many bits we need for N
  ulong ulongN = (ulong)N;
  int width = (int)Math.Ceiling(Math.Log(N, 2));

  // quantum computer initialization
  QuantumComputer comp = QuantumComputer.GetInstance();

  //input register
  Register regX = comp.NewRegister(0, 2 * width);

  // output register
  Register regY = comp.NewRegister(1, width + 1);

  // setting input register with x value
  regX.Reset(x);

  //setting output register with 1
      // needed  if we execute in a loop
  regY.Reset(1);

     // calculate a^x mod N
  comp.ExpModulo(regX, regY, a, N);

     //measure
  int valueMeasured = (int)regY.Measure();
```

```
        Console.WriteLine ("Dla {0} reszta to {1}",x,
valueMeasured);
```

Exercise 4.

Run the whole period funding function in the simulator using the file.