CSCI 135 Software Design and Analysis, C++
Lab 8

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Lab A: Skolem
An infinite Skolem sequence $a[0], a[1], a[2], \ldots$ satisfies the following two conditions:

- for every $n \in N$, there exist exactly two integers i and j such that $a[i] = a[j] = n$. Furthermore, $i - j = n$.
- for every $n < m$, if i and j are the smallest such that $a[i] = n$ and $a[j] = m$, then $i < j$.

Here are the first few terms:

$$1\ 1\ 2\ 3\ 2\ 4\ 3\ 5\ 6\ 4\ 7\ 8\ 5\ 9\ 6\ \ldots$$

Given an array of size k, fill the array with the first k terms of the infinite Skolem sequence. *Hint*: Initialize the array to zeros. Then for every n in increasing order, find the first spot that is available, say i, and assign $a[i]$ and $a[i + n]$ the value n. But make sure not to exceed the boundary of the array.

```
void SkolemFill(int * a, int k) {...}
```

continue $--->$

Lab B: Imaginary numbers

Consider the following class for imaginary numbers:

```
class Im {
  double r;
  double i;

 public:
  Im() {...}
  Im(double rl) {...}
  Im(double rl, double imgnr) {...}

  void set(double rl, double imgnr) {...}

  double real() {//returns the real part}
  double im() {//returns the imaginary part}
  bool isIm() {//returns true iff imaginary part is not zero}

  void print() {cout<<r<<"+i"<<i;}

  Im add(Im n) {...}
  Im sub(Im n) {...}
  Im mul(Im n) {...}
  Im div(Im n) {...}
};
```

Complete the implementation of the class.

Note:

$$(a + ib) + (c + id) = (a + c) + i(b + d)$$

$$(a + ib) - (c + id) = (a - c) + i(b - d)$$

$$(a + ib)(c + id) = (ac - bd) + i(ad + bc)$$

$$(a + ib)/(c + id) = (a/l + ib/l)(c - id)$$

where $l = c^2 + d^2$.