

## Problem Set 12

Problem Set 12 is due by the end of class on Wednesday, February 28, or using a free makeup, by the end of class on Friday, March 2.

1. Simplify  $51^{163} \pmod{83}$  to a number in the range  $\{0, 1, \dots, 82\}$ . You may not do this by direct computation (e.g. using mathematical software). Show your work!
2. Simplify  $\frac{36!}{17} \pmod{37}$  to a number in the range  $\{0, 1, \dots, 36\}$ . You may not do this by direct computation (e.g. using mathematical software). Show your work!
3. Simplify  $85! \pmod{89}$  to a number in the range  $\{0, 1, \dots, 88\}$ . You may not do this by direct computation (e.g. using mathematical software). Show your work!

Note: 89 is prime.