

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

School of Computer and Communication Sciences

Handout 15
Homework 9

Introduction to Communication Systems
November 13, 2008

PROBLEM 1. 1. Calculate $4^8 \bmod 15$.

2. Calculate $26^{180} \bmod 29$.

3. What are the last two digits of 7^{20} ?

PROBLEM 2. Compute the following inverses using Bezout's algorithm.

1. $7^{-1} \bmod 26$.

2. $13^{-1} \bmod 37$.

PROBLEM 3. Let m be a prime number.

1. Prove that $\phi(m^3) = m^2(m - 1)$.

2. Show that for any $n \in \mathbb{N}$, $\phi(m^n) = m^{n-1}(m - 1)$.

PROBLEM 4. 1. Find the Euler Totient function, $\phi(30)$.

2. Using the Euler Totient function find $13^{-1} \bmod 30$.

PROBLEM 5. 1. Find x such that $2^x \equiv 9 \pmod{17}$.

2. Find x such that $2^x \equiv 3 \pmod{12}$.