ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE
School of Computer and Communication Sciences

Handout 15 | Introduction to Communication Systems
Homework 8 | November 12, 2009

PROBLEM 1.

1. Calculate $5^{21} \bmod 8$.
2. Calculate $31^{201} \bmod 33$.
3. What are the last two digits of 9^{30}? (Hint: Compute $9^{10} \bmod 100$)

PROBLEM 2. In each part, decide if the inverse exists. In the case that inverse exists, compute it using Bezout's algorithm.

1. $5^{-1} \bmod 26$.
2. $11^{-1} \bmod 36$.
3. $14^{-1} \bmod 35$

PROBLEM 3. Let m, p, q be distinct prime numbers.

1. Prove that $\phi(m^4) = m^3(m-1)$.
2. Show that $\phi(pq) = (p-1)(q-1)$.

PROBLEM 4.

1. Find the Euler Totient function, $\phi(42)$.
2. Using the Euler Totient function find $11^{-1} \bmod 42$.

PROBLEM 5.

1. Find x such that $3^x \equiv 5 \bmod 17$.
2. Find another solution for x.
3. Find x such that $3^x \equiv 5 \bmod 15$ if such an x exists.