

Homework 3

Due Date: November 16, 2000

200 Points

1. (30 points) Chapter 9, exercise 2
2. (30 points) Chapter 9, exercise 16
3. (10 points) Chapter 9, exercise 18
4. (10 points) Chapter 9, exercise 19
5. (60 points) Consider double encryption, where $c = E_{k'}(E_k(m))$ and the keys k and k' are each n bits long. Assume each encipherment takes 1 time unit. A cryptanalyst will use a known plaintext attack to determine the key from two messages m_0, m_1 and their corresponding ciphertexts c_0 and c_1 .
 - a. The cryptographer computes $E_x(m_0)$ for each possible key x and stores each in a table. How many bits of memory does the table require? How many time units does computing the entry take?
 - b. She then computes $y = D_{x'}(c_0)$, where D is the decipherment function corresponding to E , for each possible key x' . She then checks the table to see if y is in it. If so, (x, x') is a candidate for the key pair. How should the table be organized to allow the cryptographer to find a match for y in time $O(1)$? How many time units would pass before a match must occur?
 - c. How can the cryptographer confirm that (x, x') is in fact the key pair she seeks?
 - d. What is the maximum time and memory needed for the attack? What is the expected time and memory?
6. (20 points) A network consists of n hosts. Assuming cryptographic keys are distributed on a per-host-pair basis, please compute how many different keys are required.
7. (40 points) Consider an RSA digital signature scheme. Alice tricks Bob into signing messages m_1 and m_2 such that $m = m_1 m_2 \bmod n_{Bob}$. Prove that Alice can forge Bob's signature on m .