CS641

Modern Cryptology

Indian Institute of Technology, Kanpur

Group Name: 261

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Mid Semester Examination

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Question 1

Consider a variant of DES algorithm in which all the S-boxes are replaced. The new S-boxes are all identical and defined as follows.

> Let $b_1, b_2, \cdots, b_6$ represent the six input bits to an S-box. Its output is $b_1 \oplus (b_2 \cdot b_3 \cdot b_4), (b_3 \cdot b_4 \cdot b_5) \oplus b_6, b_1 \oplus (b_4 \cdot b_5 \cdot b_2), (b_5 \cdot b_2 \cdot b_3) \oplus b_6$.

Here '$\oplus$' is bitwise XOR operation, and '$\cdot$' is bitwise multiplication. Design an algorithm to break 16-round DES with new S-boxes as efficiently as possible.

Solution

Your solution goes here.

Question 2

Suppose Anubha and Braj decide to do key-exchange using Diffie-Hellman scheme except for the choice of group used. Instead of using F_p^* as in Diffie-Hellman, they use S_n, the group of permutations of numbers in the range $[1, n]$. It is well-known that $|S| = n!$ and therefore, even for $n = 100$, the group has very large size. The key-exchange happens as follows:

> An element $g \in S_n$ is chosen such that g has large order, say l. Anubha randomly chooses a random number $c \in [1, l-1]$, and sends g^c to Braj. Braj choses another random number $d \in [1, l-1]$ and sends g^d to Anubha. Anubha computes $k = (g^d)^c$ and Braj computes $k = (g^c)^d$.

Show that an attacker Ela can compute the key k efficiently.

Solution

Your solution goes here.

References