Information Security

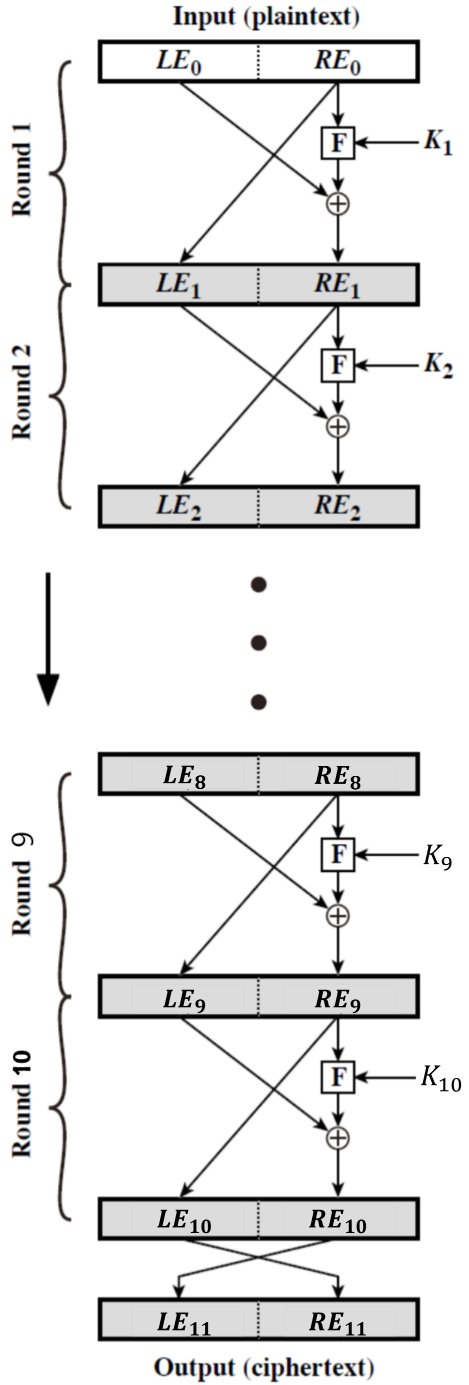
Project 1
Symmetric Cipher

Prof. Junbeom Hur
Department of Computer Science and Engineering
Korea University

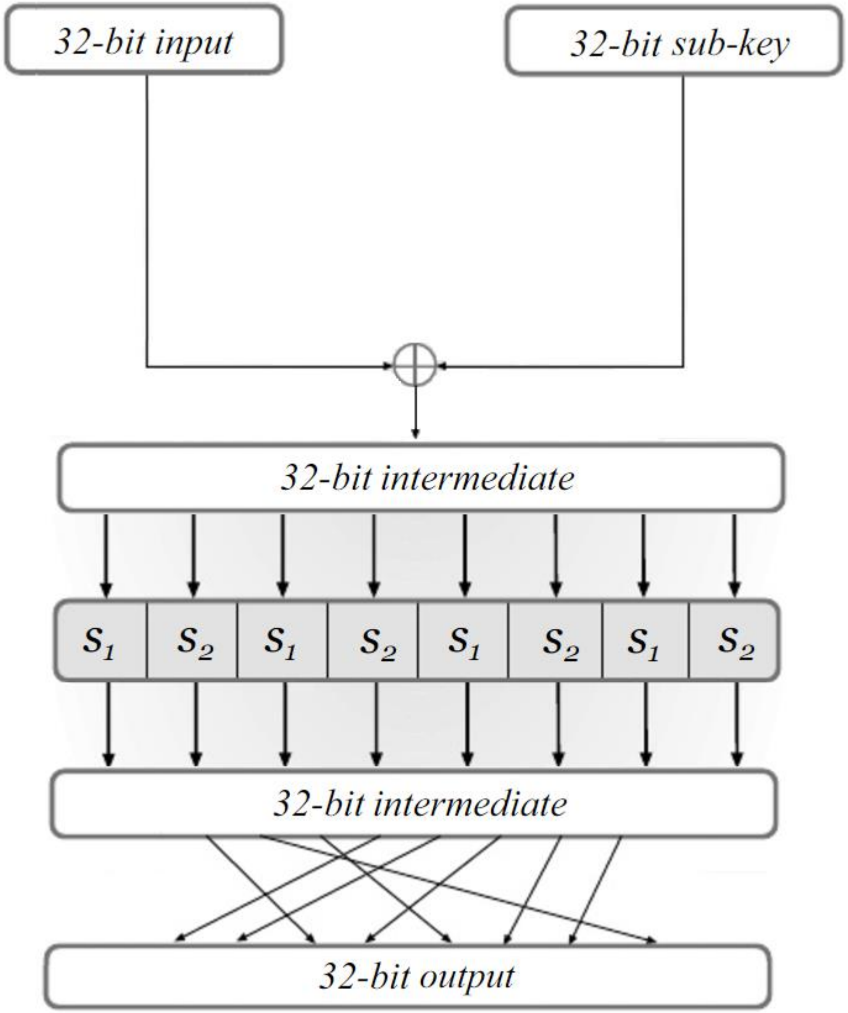
Project 1

- Consider the following encryption algorithm
  - Key size: 32 bits
  - Block size: 64 bits
  - Structure: Feistel-Network with 10 rounds
  - S-box and Permutation structure are given

Feistel Cipher Structure



F function Structure



Project 1

- Key Schedule
  - Create 10 subkeys using one 32bit input

- Algorithm
  - Divide the input into 16 bits L and R
  - The i-th L_i and R_i are shift-left operations by i-bit, respectively
  - The i-th Subkey is concatenated with L_i and R_i

Key schedule example

Input - 0101010101010101 1011011101111011

L - 0101010101010101

R- 1011011101111011

L_1- 1010101010101010

R_1- 0110111011110111

L_2- 0101010101010101

R_2- 1101110111101110

L_3- 1010101010101010

R_3- 1011101111011101

L_4- 0101010101010101

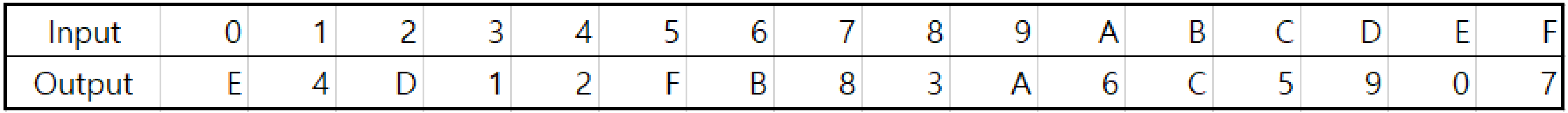
R_4- 0111011110111011

⋮ ⋮

Project 1

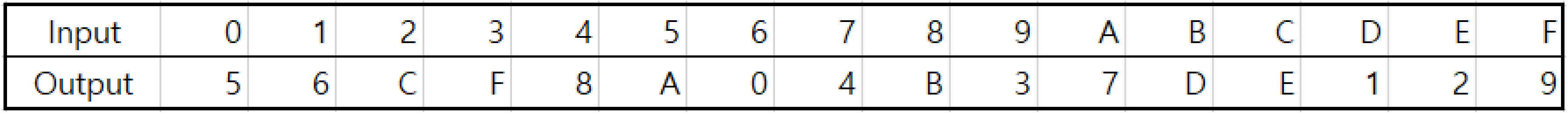
- S-box
  - Two S-boxes with 4-bit input and 4-bit output are used repeatedly

- Algorithm
  - S_1



Input	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Output	E	4	D	1	2	F	B	8	3	A	6	C	5	9	0	7

  - S_2

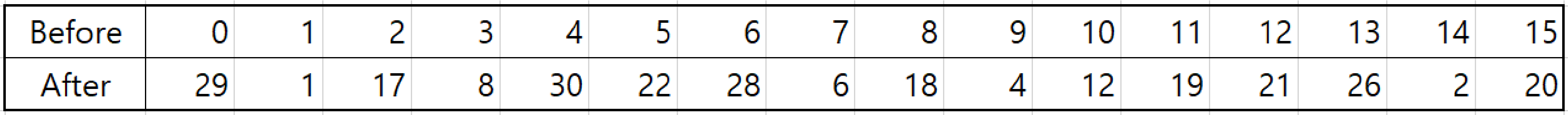


Input	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Output	5	6	C	F	8	A	0	4	B	3	7	D	E	1	2	9

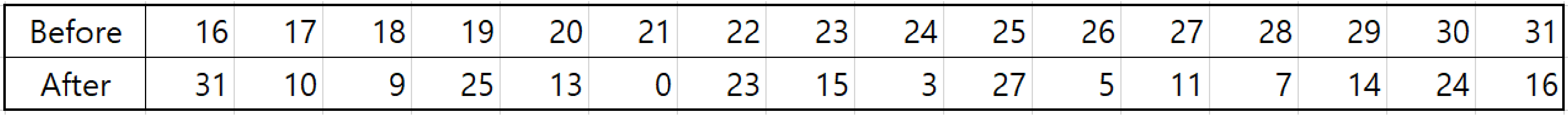
Project 1

- Permutation
  - A fixed Permutation table is given
  - Ex) The 0th bit goes to the 29th bit

- Algorithm



Before	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
After	29	1	17	8	30	22	28	6	18	4	12	19	21	26	2	20



Before	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
After	31	10	9	25	13	0	23	15	3	27	5	11	7	14	24	16

Permutation example

- Input
  - 0xE4 0xE8 0xEF 0x2E
  - 1110 0100 1110 1000 1110 1111 0010 1110

- Output
  - 0xCD 0x6F 0x67 0x85
  - 1100 1101 0110 1111 0110 0111 1000 0101

Project 1

1. Implement the encryption algorithm
   - You can use any language (e.g., C, Java, Python, …)

   - E.g., Sample info to check the correctness
     - key: 0x04 0x34 0xEF 0x71
     - plaintext: 0x10 0x24 0xAA 0x9F 0x47 0x3C 0x58 0xC1
     - ciphertext: 0x4F 0xC8 0x37 0x60 0xC7 0x8F 0x6E 0xF0

Project 1

2. Find the key K
   - Known plaintext attack
   - Sample:
     - plaintext: 0x40 0xFF 0x24 0x33 0x09 0x47 0xF6 0x10
     - ciphertext: 0xEC 0x2D 0xE1 0x30 0x5B 0x5F 0x5B 0x02

     - plaintext: 0x21 0x74 0xC5 0x01 0xAC 0x12 0xF9 0xD1
     - ciphertext: 0xDF 0x9F 0xCC 0x3F 0xFE 0x09 0x80 0x9D

Capture the result screen!!

Project 1

- Due date
  - 2017. Oct. 31, 23:59
  - Upload your source programs and results screen into the Blackboard
    - **Plagiarism will be “F”**

- If you have any question, send an email to T.A
  - Hyunsoo Kwon (khs910504@gmail.com)
  - Youngki Hong (gee308@naver.com)