def print\_state(state):

for row in state:

print(' '.join(f'{hex(val)}' for val in row))

def xor\_state(state1, state2):

return [[state1[i][j] ^ state2[i][j] for j in range(4)] for i in range(4)]

S\_BOX = [

[0x63, 0x7C, 0x77, 0x7B, 0xF2, 0x6B, 0x6F, 0xC5],

[0x30, 0x01, 0x67, 0x2B, 0xFE, 0xD7, 0xAB, 0x76],

[0xCA, 0x82, 0xC9, 0x7D, 0xFA, 0x59, 0x47, 0xF0],

[0xAD, 0xD4, 0xA2, 0xAF, 0x9C, 0xA8, 0x51, 0xA3],

[0x40, 0x8F, 0x92, 0x9D, 0x38, 0xF5, 0xBC, 0xB6],

[0xDA, 0x21, 0x10, 0xFF, 0xF3, 0xD2, 0xCD, 0x0C],

[0x13, 0xEC, 0x5F, 0x97, 0x44, 0x17, 0xC4, 0xA7],

[0x7E, 0x3D, 0x64, 0x5D, 0x19, 0x73, 0x60, 0x81],

]

def sub\_bytes(state):

return [[S\_BOX[i][j] for j in range(4)] for i in range(4)]

def shift\_rows(state):

return [state[i][i:] + state[i][:i] for i in range(4)]

def add\_round\_key(state, round\_key):

return xor\_state(state, round\_key)

def key\_expansion(key):

round\_key = [[key[i \* 4 + j] for j in range(4)] for i in range(4)]

return [round\_key]

def encrypt(plaintext, key):

state = [[plaintext[i \* 4 + j] for j in range(4)] for i in range(4)]

round\_keys = key\_expansion(key)

state = add\_round\_key(state, round\_keys[0])

state = sub\_bytes(state)

state = shift\_rows(state)

state = add\_round\_key(state, round\_keys[0])

return state

# Converts words like "one two three" to a hex array

def word\_digits\_to\_hex(word\_input):

word\_to\_digit = {

'zero': '00', 'one': '01', 'two': '02', 'three': '03', 'four': '04',

'five': '05', 'six': '06', 'seven': '07', 'eight': '08', 'nine': '09',

'ten': '0a', 'eleven': '0b', 'twelve': '0c', 'thirteen': '0d', 'fourteen': '0e', 'fifteen': '0f'

}

words = word\_input.lower().split()

hex\_vals = [int(word\_to\_digit[word], 16) for word in words]

if len(hex\_vals) != 16:

raise ValueError("Please enter exactly 16 digits in words (0 to 15).")

return hex\_vals

# Main function

def main():

print("Simplified AES (S-AES) Encryption with digit-letters input")

print("Valid words: zero one two ... fifteen (16 total values needed)\n")

key\_input = input("Enter 16 key digits (in words, space-separated): ")

key = word\_digits\_to\_hex(key\_input)

plaintext\_input = input("Enter 16 plaintext digits (in words, space-separated): ")

plaintext = word\_digits\_to\_hex(plaintext\_input)

ciphertext = encrypt(plaintext, key)

print("\nEncrypted Ciphertext:")

print\_state(ciphertext)

if \_\_name\_\_ == "\_\_main\_\_":

main()

Enter 16 key digits (in words, space-separated): one two three four five six seven eight nine ten eleven twelve thirteen fourteen fifteen zero

Enter 16 plaintext digits (in words, space-separated): zero one two three four five six seven eight nine ten eleven twelve thirteen fourteen fifteen