```
###############################################################

  Block Cipher Modes of Operation

      CCM Mode for Authentication and Confidentiality

###############################################################

CCM-AES128
---------------------------------------------------------------

Example #1

Tlen = 32
Nlen = 56
Alen = 64
Plen = 32
---------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
N is
    10111213 141516
A is
    00010203 04050607
P is
    20212223


----------------------------

B
    4F101112 13141516 00000000 00000004
    00080001 02030405 06070000 00000000
    20212223 00000000 00000000 00000000

----------------------------

Compute the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000004
    InputBlock    4F101112 13141516 00000000 00000004
```

```
    OutputBlock   2AD239BB 229B8FB4 6E308F5B C7409B88
  Block #2
    Plaintext
    00080001 02030405 06070000 00000000
    InputBlock    2ADA39BA 20988BB1 68378F5B C7409B88
    OutputBlock   2E3B9553 0AD7C902 68CAF2C5 97C49292
  Block #3
    Plaintext
    20212223 00000000 00000000 00000000
    InputBlock    0E1AB770 0AD7C902 68CAF2C5 97C49292
    OutputBlock   6084341B 32042BF0 00B4B799 5553A3C5

T
    6084341B

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   2D281146 10676C26 32BAD748 559A679A
    Text-In       6084341B 00000000 00000000 00000000
    Text-Out      4DAC255D 10676C26 32BAD748 559A679A
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   51432378 E474B339 71318484 103CDDFB
    Text-In       20212223 6F006E00 73005C00 50007200
    Text-Out      7162015B 8B74DD39 0231D884 403CAFFB
----------------------------


C is
    7162015B 4DAC255D

-------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn
```

```
  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   2D281146 10676C26 32BAD748 559A679A
    Text-In       4DAC255D 78013300 656E7473 20616E64
    Text-Out      6084341B 68665F26 57D4A33B 75FB09FE
  Block #2
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   51432378 E474B339 71318484 103CDDFB
    Text-In       7162015B 74696E67 735C416C 6C205573
    Text-Out      20212223 901DDD5E 026DC5E8 7C1C8888

P
    20212223


T
    6084341B


----------------------------

B
    4F101112 13141516 00000000 00000004
    00080001 02030405 06070000 00000000
    20212223 00000000 00000000 00000000

----------------------------

Verify the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000004
    InputBlock    4F101112 13141516 00000000 00000004
    OutputBlock   2AD239BB 229B8FB4 6E308F5B C7409B88
  Block #2
    Plaintext
    00080001 02030405 06070000 00000000
    InputBlock    2ADA39BA 20988BB1 68378F5B C7409B88
    OutputBlock   2E3B9553 0AD7C902 68CAF2C5 97C49292
  Block #3
    Plaintext
    20212223 00000000 00000000 00000000
    InputBlock    0E1AB770 0AD7C902 68CAF2C5 97C49292
    OutputBlock   6084341B 32042BF0 00B4B799 5553A3C5
```

```
---------------------------
Mac
    6084341B

Mac'
    6084341B


---------------------------

The Mac verifies

P is
    20212223

================================================================

Example #2

Tlen = 48
Nlen = 64
Alen = 128
Plen = 128
----------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
N is
    10111213 14151617
A is
    00010203 04050607 08090A0B 0C0D0E0F
P is
    20212223 24252627 28292A2B 2C2D2E2F


---------------------------

B
    56101112 13141516 17000000 00000010
    00100001 02030405 06070809 0A0B0C0D
    0E0F0000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
```

```
----------------------------

Compute the Mac

  Block #1
    Plaintext
    56101112 13141516 17000000 00000010
    InputBlock    56101112 13141516 17000000 00000010
    OutputBlock   14DF069C ABD1BCDA B1FC1B76 2CA942CA
  Block #2
    Plaintext
    00100001 02030405 06070809 0A0B0C0D
    InputBlock    14CF069D A9D2B8DF B7FB137F 26A24EC7
    OutputBlock   46CFDF4B 2B2B0FF9 41F67E31 0699D812
  Block #3
    Plaintext
    0E0F0000 00000000 00000000 00000000
    InputBlock    48C0DF4B 2B2B0FF9 41F67E31 0699D812
    OutputBlock   8E3A0218 5B01A7A1 CCB79832 A65E188A
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    AE1B203B 7F248186 E49EB219 8A7336A5
    OutputBlock   7F479FFC A464322B FE2D4F45 A8D8BA24

T
    7F479FFC A464

----------------------------

Compute S0

  Block #1
    InputBlock    06101112 13141516 17000000 00000000
    OutputBlock   6081D043 08A97DCC 20CDCC60 BF947B78
    Text-In       7F479FFC A4640000 00000000 00000000
    Text-Out      1FC64FBF ACCD7DCC 20CDCC60 BF947B78
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    06101112 13141516 17000000 00000001
    OutputBlock   F280D2C3 75CF7945 20335DB9 2B107712
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      D2A1F0E0 51EA5F62 081A7792 073D593D
```

```
----------------------------


C is
    D2A1F0E0 51EA5F62 081A7792 073D593D
    1FC64FBF ACCD

---------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    06101112 13141516 17000000 00000000
    OutputBlock   6081D043 08A97DCC 20CDCC60 BF947B78
    Text-In       1FC64FBF ACCD5F26 57D4A33B 75FB09FE
    Text-Out      7F479FFC A46422EA 77196F5B CA6F7286
  Block #2
    InputBlock    06101112 13141516 17000000 00000001
    OutputBlock   F280D2C3 75CF7945 20335DB9 2B107712
    Text-In       D2A1F0E0 51EA5F62 081A7792 073D593D
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F

P
    20212223 24252627 28292A2B 2C2D2E2F


T
    7F479FFC A464


----------------------------

B
    56101112 13141516 17000000 00000010
    00100001 02030405 06070809 0A0B0C0D
    0E0F0000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F

----------------------------

Verify the Mac
```

```
  Block #1
    Plaintext
    56101112 13141516 17000000 00000010
    InputBlock    56101112 13141516 17000000 00000010
    OutputBlock   14DF069C ABD1BCDA B1FC1B76 2CA942CA
  Block #2
    Plaintext
    00100001 02030405 06070809 0A0B0C0D
    InputBlock    14CF069D A9D2B8DF B7FB137F 26A24EC7
    OutputBlock   46CFDF4B 2B2B0FF9 41F67E31 0699D812
  Block #3
    Plaintext
    0E0F0000 00000000 00000000 00000000
    InputBlock    48C0DF4B 2B2B0FF9 41F67E31 0699D812
    OutputBlock   8E3A0218 5B01A7A1 CCB79832 A65E188A
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    AE1B203B 7F248186 E49EB219 8A7336A5
    OutputBlock   7F479FFC A464322B FE2D4F45 A8D8BA24

----------------------------
Mac
    7F479FFC A464

Mac'
    7F479FFC A464


----------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F

============================================================

Example #3

Tlen = 64
Nlen = 96
Alen = 160
Plen = 192
------------------------------------------------------------
```

```
Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
N is
    10111213 14151617 18191A1B
A is
    00010203 04050607 08090A0B 0C0D0E0F
    10111213
P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637


----------------------------

B
    5A101112 13141516 1718191A 1B000018
    00140001 02030405 06070809 0A0B0C0D
    0E0F1011 12130000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 00000000 00000000

----------------------------

Compute the Mac

  Block #1
    Plaintext
    5A101112 13141516 1718191A 1B000018
    InputBlock    5A101112 13141516 1718191A 1B000018
    OutputBlock   A72F566C FDF02E0C C9FD2E5A 7EC8DC2D
  Block #2
    Plaintext
    00140001 02030405 06070809 0A0B0C0D
    InputBlock    A73B566D FFF32A09 CFFA2653 74C3D020
    OutputBlock   C1429ED7 C76185E3 D1B720B1 4CE8BF82
  Block #3
    Plaintext
    0E0F1011 12130000 00000000 00000000
    InputBlock    CF4D8EC6 D57285E3 D1B720B1 4CE8BF82
    OutputBlock   A9509E3B 58CCA9C4 D855BE30 8A60F2D1
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    8971BC18 7CE98FE3 F07C941B A64DDCFE
```

```
    OutputBlock   8F634EB8 2AC15581 490194CD F74B711E
  Block #5
    Plaintext
    30313233 34353637 00000000 00000000
    InputBlock    BF527C8B 1EF463B6 490194CD F74B711E
    OutputBlock   67C99240 C7D51048 B4C9BCEC 10AE0215

T
    67C99240 C7D51048

----------------------------

Compute S0

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000000
    OutputBlock   2F8A00BB 06658919 C3A040A6 EAED1A7F
    Text-In       67C99240 C7D51048 00000000 00000000
    Text-Out      484392FB C1B09951 C3A040A6 EAED1A7F
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000001
    OutputBlock   C393238A D1923C5D B335C0C7 E1BAC924
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      E3B201A9 F5B71A7A 9B1CEAEC CD97E70B
  Block #2
    InputBlock    02101112 13141516 1718191A 1B000002
    OutputBlock   514798EA 9077BC92 6C22EBEF 2AC732DC
    Text-In       30313233 34353637 65007300 5C007200
    Text-Out      6176AAD9 A4428AA5 092298EF 76C740DC
----------------------------


C is
    E3B201A9 F5B71A7A 9B1CEAEC CD97E70B
    6176AAD9 A4428AA5 484392FB C1B09951

----------------------------------------------------------------

Decrypt-Verify

----------------------------
```

```
Compute S0..Sn

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000000
    OutputBlock   2F8A00BB 06658919 C3A040A6 EAED1A7F
    Text-In       484392FB C1B09951 00000000 00000004
    Text-Out      67C99240 C7D51048 C3A040A6 EAED1A7B
  Block #2
    InputBlock    02101112 13141516 1718191A 1B000001
    OutputBlock   C393238A D1923C5D B335C0C7 E1BAC924
    Text-In       E3B201A9 F5B71A7A 9B1CEAEC CD97E70B
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F
  Block #3
    InputBlock    02101112 13141516 1718191A 1B000002
    OutputBlock   514798EA 9077BC92 6C22EBEF 2AC732DC
    Text-In       6176AAD9 A4428AA5 00000000 00000000
    Text-Out      30313233 34353637 6C22EBEF 2AC732DC

P
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637


T
    67C99240 C7D51048


----------------------------

B
    5A101112 13141516 1718191A 1B000018
    00140001 02030405 06070809 0A0B0C0D
    0E0F1011 12130000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 00000000 00000000

----------------------------

Verify the Mac

  Block #1
    Plaintext
    5A101112 13141516 1718191A 1B000018
    InputBlock    5A101112 13141516 1718191A 1B000018
    OutputBlock   A72F566C FDF02E0C C9FD2E5A 7EC8DC2D
  Block #2
```

```
    Plaintext
    00140001 02030405 06070809 0A0B0C0D
    InputBlock    A73B566D FFF32A09 CFFA2653 74C3D020
    OutputBlock   C1429ED7 C76185E3 D1B720B1 4CE8BF82
  Block #3
    Plaintext
    0E0F1011 12130000 00000000 00000000
    InputBlock    CF4D8EC6 D57285E3 D1B720B1 4CE8BF82
    OutputBlock   A9509E3B 58CCA9C4 D855BE30 8A60F2D1
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    8971BC18 7CE98FE3 F07C941B A64DDCFE
    OutputBlock   8F634EB8 2AC15581 490194CD F74B711E
  Block #5
    Plaintext
    30313233 34353637 00000000 00000000
    InputBlock    BF527C8B 1EF463B6 490194CD F74B711E
    OutputBlock   67C99240 C7D51048 B4C9BCEC 10AE0215

----------------------------
Mac
    67C99240 C7D51048

Mac'
    67C99240 C7D51048


----------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637

============================================================

Example #4

Tlen = 32
Nlen = 56
Alen = 0
Plen = 512
------------------------------------------------------------
```

```
Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
N is
    10111213 141516
A is
    <empty>
P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F


----------------------------

B
    0F101112 13141516 00000000 00000040
    00000000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

----------------------------

Compute the Mac

  Block #1
    Plaintext
    0F101112 13141516 00000000 00000040
    InputBlock    0F101112 13141516 00000000 00000040
    OutputBlock   9099080E C6CB2EC8 73619985 E6730968
  Block #2
    Plaintext
    00000000 00000000 00000000 00000000
    InputBlock    9099080E C6CB2EC8 73619985 E6730968
    OutputBlock   5341DFC2 74723423 D1C9E26B A6619DC2
  Block #3
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    7360FDE1 50571204 F9E0C840 8A4CB3ED
    OutputBlock   91172D79 7A9E08D1 2E2C4FB2 A6CD753D
  Block #4
    Plaintext
```

```
    30313233 34353637 38393A3B 3C3D3E3F
    InputBlock    A1261F4A 4EAB3EE6 16157589 9AF04B02
    OutputBlock   94B23C70 D438AEFB BE03B4EE 5B117E13
  Block #5
    Plaintext
    40414243 44454647 48494A4B 4C4D4E4F
    InputBlock    D4F37E33 907DE8BC F64AFEA5 175C305C
    OutputBlock   ADB37F9A A66B218C 2D6B3924 7FF7FD42
  Block #6
    Plaintext
    50515253 54555657 58595A5B 5C5D5E5F
    InputBlock    FDE22DC9 F23E77DB 7532637F 23AAA31D
    OutputBlock   5B3DB9A8 F8D66649 5CC78634 61654863

T
    5B3DB9A8

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   2D281146 10676C26 32BAD748 559A679A
    Text-In       5B3DB9A8 00000000 00000000 00000000
    Text-Out      7615A8EE 10676C26 32BAD748 559A679A
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   51432378 E474B339 71318484 103CDDFB
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      7162015B C051951E 5918AEAF 3C11F3D4
  Block #2
    InputBlock    07101112 13141516 00000000 00000002
    OutputBlock   9C070DBE 6F5FC5E4 5159013F CE719016
    Text-In       30313233 34353637 38393A3B 3C3D3E3F
    Text-Out      AC363F8D 5B6AF3D3 69603B04 F24CAE29
  Block #3
    InputBlock    07101112 13141516 00000000 00000003
    OutputBlock   D60F6D68 BD965704 BF6C6D85 61F94CA5
    Text-In       40414243 44454647 48494A4B 4C4D4E4F
    Text-Out      964E2F2B F9D31143 F72527CE 2DB402EA
  Block #4
```

```
    InputBlock    07101112 13141516 00000000 00000004
    OutputBlock   E7375C19 44E5D8D5 7E3C4D96 AA5F39A6
    Text-In       50515253 54555657 58595A5B 5C5D5E5F
    Text-Out      B7660E4A 10B08E82 266517CD F60267F9
----------------------------


C is
    7162015B C051951E 5918AEAF 3C11F3D4
    AC363F8D 5B6AF3D3 69603B04 F24CAE29
    964E2F2B F9D31143 F72527CE 2DB402EA
    B7660E4A 10B08E82 266517CD F60267F9
    7615A8EE

----------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   2D281146 10676C26 32BAD748 559A679A
    Text-In       7615A8EE 13141516 1718191A 1B000018
    Text-Out      5B3DB9A8 03737930 25A2CE52 4E9A6782
  Block #2
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   51432378 E474B339 71318484 103CDDFB
    Text-In       7162015B C051951E 5918AEAF 3C11F3D4
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F
  Block #3
    InputBlock    07101112 13141516 00000000 00000002
    OutputBlock   9C070DBE 6F5FC5E4 5159013F CE719016
    Text-In       AC363F8D 5B6AF3D3 69603B04 F24CAE29
    Text-Out      30313233 34353637 38393A3B 3C3D3E3F
  Block #4
    InputBlock    07101112 13141516 00000000 00000003
    OutputBlock   D60F6D68 BD965704 BF6C6D85 61F94CA5
    Text-In       964E2F2B F9D31143 F72527CE 2DB402EA
    Text-Out      40414243 44454647 48494A4B 4C4D4E4F
  Block #5
    InputBlock    07101112 13141516 00000000 00000004
    OutputBlock   E7375C19 44E5D8D5 7E3C4D96 AA5F39A6
    Text-In       B7660E4A 10B08E82 266517CD F60267F9
```

```
    Text-Out      50515253 54555657 58595A5B 5C5D5E5F

P
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F


T
    5B3DB9A8


----------------------------

B
    0F101112 13141516 00000000 00000040
    00000000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

----------------------------

Verify the Mac

  Block #1
    Plaintext
    0F101112 13141516 00000000 00000040
    InputBlock    0F101112 13141516 00000000 00000040
    OutputBlock   9099080E C6CB2EC8 73619985 E6730968
  Block #2
    Plaintext
    00000000 00000000 00000000 00000000
    InputBlock    9099080E C6CB2EC8 73619985 E6730968
    OutputBlock   5341DFC2 74723423 D1C9E26B A6619DC2
  Block #3
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    7360FDE1 50571204 F9E0C840 8A4CB3ED
    OutputBlock   91172D79 7A9E08D1 2E2C4FB2 A6CD753D
  Block #4
    Plaintext
    30313233 34353637 38393A3B 3C3D3E3F
    InputBlock    A1261F4A 4EAB3EE6 16157589 9AF04B02
```

```
    OutputBlock   94B23C70 D438AEFB BE03B4EE 5B117E13
  Block #5
    Plaintext
    40414243 44454647 48494A4B 4C4D4E4F
    InputBlock    D4F37E33 907DE8BC F64AFEA5 175C305C
    OutputBlock   ADB37F9A A66B218C 2D6B3924 7FF7FD42
  Block #6
    Plaintext
    50515253 54555657 58595A5B 5C5D5E5F
    InputBlock    FDE22DC9 F23E77DB 7532637F 23AAA31D
    OutputBlock   5B3DB9A8 F8D66649 5CC78634 61654863

----------------------------
Mac
    5B3DB9A8

Mac'
    5B3DB9A8


----------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

================================================================

Example #5

Tlen = 32
Nlen = 56
Alen = 512
Plen = 0
----------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
N is
    10111213 141516
```

```
A is
    00010203 04050607 08090A0B 0C0D0E0F
    10111213 14151617 18191A1B 1C1D1E1F
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
P is
    <empty>


----------------------------

B
    4F101112 13141516 00000000 00000000
    00400001 02030405 06070809 0A0B0C0D
    0E0F1011 12131415 16171819 1A1B1C1D
    1E1F2021 22232425 26272829 2A2B2C2D
    2E2F3031 32333435 36373839 3A3B3C3D
    3E3F0000 00000000 00000000 00000000

----------------------------

Compute the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000000
    InputBlock    4F101112 13141516 00000000 00000000
    OutputBlock   D5B7B9A9 D8A531A5 3DDC9151 7E069F61
  Block #2
    Plaintext
    00400001 02030405 06070809 0A0B0C0D
    InputBlock    D5F7B9A8 DAA635A0 3BDB9958 740D936C
    OutputBlock   F1772540 CF3CF000 6EEEB02D A4573703
  Block #3
    Plaintext
    0E0F1011 12131415 16171819 1A1B1C1D
    InputBlock    FF783551 DD2FE415 78F9A834 BE4C2B1E
    OutputBlock   7695F384 BADF4806 74190DA1 5E44DB68
  Block #4
    Plaintext
    1E1F2021 22232425 26272829 2A2B2C2D
    InputBlock    688AD3A5 98FC6C23 523E2588 746FF745
    OutputBlock   F1609045 D4CACF1F 6F6158D9 54461EA5
  Block #5
    Plaintext
    2E2F3031 32333435 36373839 3A3B3C3D
```

```
    InputBlock    DF4FA074 E6F9FB2A 595660E0 6E7D2298
    OutputBlock   2DE1F91A 1EC05368 B24669E4 899AB13E
  Block #6
    Plaintext
    3E3F0000 00000000 00000000 00000000
    InputBlock    13DEF91A 1EC05368 B24669E4 899AB13E
    OutputBlock   C56832BE B146FF3B 35BA1761 C9C00D58

T
    C56832BE

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   2D281146 10676C26 32BAD748 559A679A
    Text-In       C56832BE 00000000 00000000 00000000
    Text-Out      E84023F8 10676C26 32BAD748 559A679A
----------------------------

Compute S1..Sn

  <empty payload>

----------------------------


C is
    E84023F8

------------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   2D281146 10676C26 32BAD748 559A679A
    Text-In       E84023F8 51EA5F62 081A7792 073D593D
    Text-Out      C56832BE 418D3344 3AA0A0DA 52A73EA7
```

```
P
    <empty>


T
    C56832BE


----------------------------

B
    4F101112 13141516 00000000 00000000
    00400001 02030405 06070809 0A0B0C0D
    0E0F1011 12131415 16171819 1A1B1C1D
    1E1F2021 22232425 26272829 2A2B2C2D
    2E2F3031 32333435 36373839 3A3B3C3D
    3E3F0000 00000000 00000000 00000000

----------------------------

Verify the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000000
    InputBlock    4F101112 13141516 00000000 00000000
    OutputBlock   D5B7B9A9 D8A531A5 3DDC9151 7E069F61
  Block #2
    Plaintext
    00400001 02030405 06070809 0A0B0C0D
    InputBlock    D5F7B9A8 DAA635A0 3BDB9958 740D936C
    OutputBlock   F1772540 CF3CF000 6EEEB02D A4573703
  Block #3
    Plaintext
    0E0F1011 12131415 16171819 1A1B1C1D
    InputBlock    FF783551 DD2FE415 78F9A834 BE4C2B1E
    OutputBlock   7695F384 BADF4806 74190DA1 5E44DB68
  Block #4
    Plaintext
    1E1F2021 22232425 26272829 2A2B2C2D
    InputBlock    688AD3A5 98FC6C23 523E2588 746FF745
    OutputBlock   F1609045 D4CACF1F 6F6158D9 54461EA5
  Block #5
    Plaintext
    2E2F3031 32333435 36373839 3A3B3C3D
    InputBlock    DF4FA074 E6F9FB2A 595660E0 6E7D2298
```

```
    OutputBlock   2DE1F91A 1EC05368 B24669E4 899AB13E
  Block #6
    Plaintext
    3E3F0000 00000000 00000000 00000000
    InputBlock    13DEF91A 1EC05368 B24669E4 899AB13E
    OutputBlock   C56832BE B146FF3B 35BA1761 C9C00D58

----------------------------
Mac
    C56832BE

Mac'
    C56832BE


----------------------------

The Mac verifies

P is
    <empty>

============================================================

************************************************************

CCM-AES192
------------------------------------------------------------

Example #1

Tlen = 32
Nlen = 56
Alen = 64
Plen = 32
------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657
N is
    10111213 141516
A is
    00010203 04050607
```

```
P is
    20212223


----------------------------

B
    4F101112 13141516 00000000 00000004
    00080001 02030405 06070000 00000000
    20212223 00000000 00000000 00000000

----------------------------

Compute the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000004
    InputBlock    4F101112 13141516 00000000 00000004
    OutputBlock   41010554 D3301B18 DA9BB4FD 48D9F733
  Block #2
    Plaintext
    00080001 02030405 06070000 00000000
    InputBlock    41090555 D1331F1D DC9CB4FD 48D9F733
    OutputBlock   521A1567 B9C519DC B1FE866B C94D576A
  Block #3
    Plaintext
    20212223 00000000 00000000 00000000
    InputBlock    723B3744 B9C519DC B1FE866B C94D576A
    OutputBlock   08C8A3CE 4D53E873 AC4338BC 70E01090

T
    08C8A3CE

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   C00B851B BC5508C7 DE9B8605 06CA6B84
    Text-In       08C8A3CE 00000000 00000000 00000000
    Text-Out      C8C326D5 BC5508C7 DE9B8605 06CA6B84
----------------------------

Compute S1..Sn
```

```
  Block #1
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   38CF3513 D06C288F 6F81C3EE 1EEBB1B3
    Text-In       20212223 6F006E00 20212223 24252627
    Text-Out      18EE1730 BF6C468F 4FA0E1CD 3ACE9794
----------------------------


C is
    18EE1730 C8C326D5

------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   C00B851B BC5508C7 DE9B8605 06CA6B84
    Text-In       C8C326D5 F5B71A7A 9B1CEAEC CD97E70B
    Text-Out      08C8A3CE 49E212BD 45876CE9 CB5D8C8F
  Block #2
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   38CF3513 D06C288F 6F81C3EE 1EEBB1B3
    Text-In       18EE1730 A4428AA5 092298EF 76C740DC
    Text-Out      20212223 742EA22A 66A35B01 682CF16F

P
    20212223


T
    08C8A3CE


----------------------------

B
    4F101112 13141516 00000000 00000004
    00080001 02030405 06070000 00000000
    20212223 00000000 00000000 00000000
```

```
----------------------------

Verify the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000004
    InputBlock    4F101112 13141516 00000000 00000004
    OutputBlock   41010554 D3301B18 DA9BB4FD 48D9F733
  Block #2
    Plaintext
    00080001 02030405 06070000 00000000
    InputBlock    41090555 D1331F1D DC9CB4FD 48D9F733
    OutputBlock   521A1567 B9C519DC B1FE866B C94D576A
  Block #3
    Plaintext
    20212223 00000000 00000000 00000000
    InputBlock    723B3744 B9C519DC B1FE866B C94D576A
    OutputBlock   08C8A3CE 4D53E873 AC4338BC 70E01090

----------------------------
Mac
    08C8A3CE

Mac'
    08C8A3CE


----------------------------

The Mac verifies

P is
    20212223

============================================================

Example #2

Tlen = 48
Nlen = 64
Alen = 128
Plen = 128
------------------------------------------------------------

Encrypt-Generate
```

```
K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657
N is
    10111213 14151617
A is
    00010203 04050607 08090A0B 0C0D0E0F
P is
    20212223 24252627 28292A2B 2C2D2E2F


----------------------------

B
    56101112 13141516 17000000 00000010
    00100001 02030405 06070809 0A0B0C0D
    0E0F0000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F

----------------------------

Compute the Mac

  Block #1
    Plaintext
    56101112 13141516 17000000 00000010
    InputBlock    56101112 13141516 17000000 00000010
    OutputBlock   9AF42EF5 A6120A84 A09BFCB6 87514EE0
  Block #2
    Plaintext
    00100001 02030405 06070809 0A0B0C0D
    InputBlock    9AE42EF4 A4110E81 A69CF4BF 8D5A42ED
    OutputBlock   4B8CFC80 8B7F8CCC E11E180B 741BDF2A
  Block #3
    Plaintext
    0E0F0000 00000000 00000000 00000000
    InputBlock    4583FC80 8B7F8CCC E11E180B 741BDF2A
    OutputBlock   1C5FA006 CF5154F4 FD6C1988 A26D89EC
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    3C7E8225 EB7472D3 D54533A3 8E40A7C3
    OutputBlock   CB70F475 C8E87078 58D54254 E1464C98

T
```

```
    CB70F475 C8E8

----------------------------

Compute S0

  Block #1
    InputBlock    06101112 13141516 17000000 00000000
    OutputBlock   9D99385D 628F5E77 0C92E77B 6C0206C4
    Text-In       CB70F475 C8E80000 00000000 00000000
    Text-Out      56E9CC28 AA675E77 0C92E77B 6C0206C4
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    06101112 13141516 17000000 00000001
    OutputBlock   021394C3 B6646E89 5A109696 362250E4
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      2232B6E0 924148AE 7239BCBD 1A0F7ECB
----------------------------


C is
    2232B6E0 924148AE 7239BCBD 1A0F7ECB
    56E9CC28 AA67

------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    06101112 13141516 17000000 00000000
    OutputBlock   9D99385D 628F5E77 0C92E77B 6C0206C4
    Text-In       56E9CC28 AA6712BD 45876CE9 CB5D8C8F
    Text-Out      CB70F475 C8E84CCA 49158B92 A75F8A4B
  Block #2
    InputBlock    06101112 13141516 17000000 00000001
    OutputBlock   021394C3 B6646E89 5A109696 362250E4
    Text-In       2232B6E0 924148AE 7239BCBD 1A0F7ECB
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F
```

```
P
    20212223 24252627 28292A2B 2C2D2E2F


T
    CB70F475 C8E8


----------------------------

B
    56101112 13141516 17000000 00000010
    00100001 02030405 06070809 0A0B0C0D
    0E0F0000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F

----------------------------

Verify the Mac

  Block #1
    Plaintext
    56101112 13141516 17000000 00000010
    InputBlock    56101112 13141516 17000000 00000010
    OutputBlock   9AF42EF5 A6120A84 A09BFCB6 87514EE0
  Block #2
    Plaintext
    00100001 02030405 06070809 0A0B0C0D
    InputBlock    9AE42EF4 A4110E81 A69CF4BF 8D5A42ED
    OutputBlock   4B8CFC80 8B7F8CCC E11E180B 741BDF2A
  Block #3
    Plaintext
    0E0F0000 00000000 00000000 00000000
    InputBlock    4583FC80 8B7F8CCC E11E180B 741BDF2A
    OutputBlock   1C5FA006 CF5154F4 FD6C1988 A26D89EC
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    3C7E8225 EB7472D3 D54533A3 8E40A7C3
    OutputBlock   CB70F475 C8E87078 58D54254 E1464C98

----------------------------
Mac
    CB70F475 C8E8

Mac'
```

```
    CB70F475 C8E8


---------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F

================================================================

Example #3

Tlen = 64
Nlen = 96
Alen = 160
Plen = 192
----------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657
N is
    10111213 14151617 18191A1B
A is
    00010203 04050607 08090A0B 0C0D0E0F
    10111213
P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637


---------------------------

B
    5A101112 13141516 1718191A 1B000018
    00140001 02030405 06070809 0A0B0C0D
    0E0F1011 12130000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 00000000 00000000

---------------------------
```

```
Compute the Mac

  Block #1
    Plaintext
    5A101112 13141516 1718191A 1B000018
    InputBlock    5A101112 13141516 1718191A 1B000018
    OutputBlock   C4941769 35E08020 E5E2A33A A3AC831E
  Block #2
    Plaintext
    00140001 02030405 06070809 0A0B0C0D
    InputBlock    C4801768 37E38425 E3E5AB33 A9A78F13
    OutputBlock   3A0F3212 A3C1341E 8803BBF9 7EE3AF26
  Block #3
    Plaintext
    0E0F1011 12130000 00000000 00000000
    InputBlock    34002203 B1D2341E 8803BBF9 7EE3AF26
    OutputBlock   7D481F1E E022C8CB C3BF2330 6E8BD185
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    5D693D3D C407EEEC EB96091B 42A6FFAA
    OutputBlock   15414200 1B7575C7 2B6C7C12 50FEFDA8
  Block #5
    Plaintext
    30313233 34353637 00000000 00000000
    InputBlock    25707033 2F4043F0 2B6C7C12 50FEFDA8
    OutputBlock   0BCD9057 7CDC251A E7C9EF4F C18B0BFB

T
    0BCD9057 7CDC251A

----------------------------

Compute S0

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000000
    OutputBlock   49FBF905 2C83BC40 5C8AFAB3 20C91973
    Text-In       0BCD9057 7CDC251A 00000000 00000000
    Text-Out      42366952 505F995A 5C8AFAB3 20C91973
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000001
```

```
    OutputBlock   A0A0134C FCB302F1 04CE4954 9564BB99
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      8081316F D89624D6 2CE7637F B94995B6
  Block #2
    InputBlock    02101112 13141516 1718191A 1B000002
    OutputBlock   532D62E5 21B3E836 0D7BC2DE B6BD8500
    Text-In       30313233 34353637 38393A3B 3C3D3E3F
    Text-Out      631C50D6 1586DE01 3542F8E5 8A80BB3F
----------------------------


C is
    8081316F D89624D6 2CE7637F B94995B6
    631C50D6 1586DE01 42366952 505F995A

------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000000
    OutputBlock   49FBF905 2C83BC40 5C8AFAB3 20C91973
    Text-In       42366952 505F995A 00000000 00000004
    Text-Out      0BCD9057 7CDC251A 5C8AFAB3 20C91977
  Block #2
    InputBlock    02101112 13141516 1718191A 1B000001
    OutputBlock   A0A0134C FCB302F1 04CE4954 9564BB99
    Text-In       8081316F D89624D6 2CE7637F B94995B6
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F
  Block #3
    InputBlock    02101112 13141516 1718191A 1B000002
    OutputBlock   532D62E5 21B3E836 0D7BC2DE B6BD8500
    Text-In       631C50D6 1586DE01 00000000 00000000
    Text-Out      30313233 34353637 0D7BC2DE B6BD8500

P
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637


T
    0BCD9057 7CDC251A
```

```
----------------------------

B
    5A101112 13141516 1718191A 1B000018
    00140001 02030405 06070809 0A0B0C0D
    0E0F1011 12130000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 00000000 00000000

----------------------------

Verify the Mac

  Block #1
    Plaintext
    5A101112 13141516 1718191A 1B000018
    InputBlock    5A101112 13141516 1718191A 1B000018
    OutputBlock   C4941769 35E08020 E5E2A33A A3AC831E
  Block #2
    Plaintext
    00140001 02030405 06070809 0A0B0C0D
    InputBlock    C4801768 37E38425 E3E5AB33 A9A78F13
    OutputBlock   3A0F3212 A3C1341E 8803BBF9 7EE3AF26
  Block #3
    Plaintext
    0E0F1011 12130000 00000000 00000000
    InputBlock    34002203 B1D2341E 8803BBF9 7EE3AF26
    OutputBlock   7D481F1E E022C8CB C3BF2330 6E8BD185
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    5D693D3D C407EEEC EB96091B 42A6FFAA
    OutputBlock   15414200 1B7575C7 2B6C7C12 50FEFDA8
  Block #5
    Plaintext
    30313233 34353637 00000000 00000000
    InputBlock    25707033 2F4043F0 2B6C7C12 50FEFDA8
    OutputBlock   0BCD9057 7CDC251A E7C9EF4F C18B0BFB

----------------------------
Mac
    0BCD9057 7CDC251A

Mac'
```

```
    0BCD9057 7CDC251A


---------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637

================================================================

Example #4

Tlen = 32
Nlen = 56
Alen = 0
Plen = 512
----------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657
N is
    10111213 141516
A is
    <empty>
P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F


---------------------------

B
    0F101112 13141516 00000000 00000040
    00000000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F
```

```
----------------------------

Compute the Mac

  Block #1
    Plaintext
    0F101112 13141516 00000000 00000040
    InputBlock    0F101112 13141516 00000000 00000040
    OutputBlock   7B02760B A35C4239 18471C8B DE51F837
  Block #2
    Plaintext
    00000000 00000000 00000000 00000000
    InputBlock    7B02760B A35C4239 18471C8B DE51F837
    OutputBlock   ACE3016B 92292633 5E7CFFF8 DE5157C3
  Block #3
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    8CC22348 B60C0014 7655D5D3 F27C79EC
    OutputBlock   5290ED1F 5F9B1C14 8433BE5A 953D6931
  Block #4
    Plaintext
    30313233 34353637 38393A3B 3C3D3E3F
    InputBlock    62A1DF2C 6BAE2A23 BC0A8461 A900570E
    OutputBlock   BBDF68ED FF53D392 CCBD5B04 283F7B99
  Block #5
    Plaintext
    40414243 44454647 48494A4B 4C4D4E4F
    InputBlock    FB9E2AAE BB1695D5 84F4114F 647235D6
    OutputBlock   4AE822D3 CFDDA06B 24966A87 91CCE14D
  Block #6
    Plaintext
    50515253 54555657 58595A5B 5C5D5E5F
    InputBlock    1AB97080 9B88F63C 7CCF30DC CD91BF12
    OutputBlock   A5A6FA8C 236418A5 17A33DD0 DF8EAAC0

T
    A5A6FA8C

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   C00B851B BC5508C7 DE9B8605 06CA6B84
```

```
    Text-In       A5A6FA8C 00000000 00000000 00000000
    Text-Out      65AD7F97 BC5508C7 DE9B8605 06CA6B84
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   38CF3513 D06C288F 6F81C3EE 1EEBB1B3
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      18EE1730 F4490EA8 47A8E9C5 32C69F9C
  Block #2
    InputBlock    07101112 13141516 00000000 00000002
    OutputBlock   3A62A86B 682B4D5D 62C023CF BDADB696
    Text-In       30313233 34353637 38393A3B 3C3D3E3F
    Text-Out      0A539A58 5C1E7B6A 5AF919F4 819088A9
  Block #3
    InputBlock    07101112 13141516 00000000 00000003
    OutputBlock   2E977016 14DD9547 3634DC77 379D5DA4
    Text-In       40414243 44454647 48494A4B 4C4D4E4F
    Text-Out      6ED63255 5098D300 7E7D963C 7BD013EB
  Block #4
    InputBlock    07101112 13141516 00000000 00000004
    OutputBlock   60272383 AF96CC5A ACFB30C4 17C313F2
    Text-In       50515253 54555657 58595A5B 5C5D5E5F
    Text-Out      307671D0 FBC39A0D F4A26A9F 4B9E4DAD
----------------------------


C is
    18EE1730 F4490EA8 47A8E9C5 32C69F9C
    0A539A58 5C1E7B6A 5AF919F4 819088A9
    6ED63255 5098D300 7E7D963C 7BD013EB
    307671D0 FBC39A0D F4A26A9F 4B9E4DAD
    65AD7F97

------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
```

```
    OutputBlock   C00B851B BC5508C7 DE9B8605 06CA6B84
    Text-In       65AD7F97 13141516 1718191A 1B000018
    Text-Out      A5A6FA8C AF411DD1 C9839F1F 1DCA6B9C
  Block #2
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   38CF3513 D06C288F 6F81C3EE 1EEBB1B3
    Text-In       18EE1730 F4490EA8 47A8E9C5 32C69F9C
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F
  Block #3
    InputBlock    07101112 13141516 00000000 00000002
    OutputBlock   3A62A86B 682B4D5D 62C023CF BDADB696
    Text-In       0A539A58 5C1E7B6A 5AF919F4 819088A9
    Text-Out      30313233 34353637 38393A3B 3C3D3E3F
  Block #4
    InputBlock    07101112 13141516 00000000 00000003
    OutputBlock   2E977016 14DD9547 3634DC77 379D5DA4
    Text-In       6ED63255 5098D300 7E7D963C 7BD013EB
    Text-Out      40414243 44454647 48494A4B 4C4D4E4F
  Block #5
    InputBlock    07101112 13141516 00000000 00000004
    OutputBlock   60272383 AF96CC5A ACFB30C4 17C313F2
    Text-In       307671D0 FBC39A0D F4A26A9F 4B9E4DAD
    Text-Out      50515253 54555657 58595A5B 5C5D5E5F

P
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F


T
    A5A6FA8C


----------------------------

B
    0F101112 13141516 00000000 00000040
    00000000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

----------------------------
```

```
Verify the Mac

  Block #1
    Plaintext
    0F101112 13141516 00000000 00000040
    InputBlock    0F101112 13141516 00000000 00000040
    OutputBlock   7B02760B A35C4239 18471C8B DE51F837
  Block #2
    Plaintext
    00000000 00000000 00000000 00000000
    InputBlock    7B02760B A35C4239 18471C8B DE51F837
    OutputBlock   ACE3016B 92292633 5E7CFFF8 DE5157C3
  Block #3
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    8CC22348 B60C0014 7655D5D3 F27C79EC
    OutputBlock   5290ED1F 5F9B1C14 8433BE5A 953D6931
  Block #4
    Plaintext
    30313233 34353637 38393A3B 3C3D3E3F
    InputBlock    62A1DF2C 6BAE2A23 BC0A8461 A900570E
    OutputBlock   BBDF68ED FF53D392 CCBD5B04 283F7B99
  Block #5
    Plaintext
    40414243 44454647 48494A4B 4C4D4E4F
    InputBlock    FB9E2AAE BB1695D5 84F4114F 647235D6
    OutputBlock   4AE822D3 CFDDA06B 24966A87 91CCE14D
  Block #6
    Plaintext
    50515253 54555657 58595A5B 5C5D5E5F
    InputBlock    1AB97080 9B88F63C 7CCF30DC CD91BF12
    OutputBlock   A5A6FA8C 236418A5 17A33DD0 DF8EAAC0

----------------------------
Mac
    A5A6FA8C

Mac'
    A5A6FA8C


----------------------------

The Mac verifies
```

```
P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

================================================================

Example #5

Tlen = 32
Nlen = 56
Alen = 512
Plen = 0
----------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657
N is
    10111213 141516
A is
    00010203 04050607 08090A0B 0C0D0E0F
    10111213 14151617 18191A1B 1C1D1E1F
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
P is
    <empty>


----------------------------

B
    4F101112 13141516 00000000 00000000
    00400001 02030405 06070809 0A0B0C0D
    0E0F1011 12131415 16171819 1A1B1C1D
    1E1F2021 22232425 26272829 2A2B2C2D
    2E2F3031 32333435 36373839 3A3B3C3D
    3E3F0000 00000000 00000000 00000000

----------------------------

Compute the Mac
```

```
  Block #1
    Plaintext
    4F101112 13141516 00000000 00000000
    InputBlock    4F101112 13141516 00000000 00000000
    OutputBlock   9A092A11 7F2BD319 D45C4EF9 9FD0E8A9
  Block #2
    Plaintext
    00400001 02030405 06070809 0A0B0C0D
    InputBlock    9A492A10 7D28D71C D25B46F0 95DBE4A4
    OutputBlock   FACA8BA0 73669FD4 5CF43B42 7E3013F6
  Block #3
    Plaintext
    0E0F1011 12131415 16171819 1A1B1C1D
    InputBlock    F4C59BB1 61758BC1 4AE3235B 642B0FEB
    OutputBlock   CEC60BC8 54B4DE20 C7D921EB 4A468269
  Block #4
    Plaintext
    1E1F2021 22232425 26272829 2A2B2C2D
    InputBlock    D0D92BE9 7697FA05 E1FE09C2 606DAE44
    OutputBlock   AB7B4C27 CA1ECA3F A3109637 2558D66F
  Block #5
    Plaintext
    2E2F3031 32333435 36373839 3A3B3C3D
    InputBlock    85547C16 F82DFE0A 9527AE0E 1F63EA52
    OutputBlock   0FFB328B 7D21D483 7E1F1636 2409C26F
  Block #6
    Plaintext
    3E3F0000 00000000 00000000 00000000
    InputBlock    31C4328B 7D21D483 7E1F1636 2409C26F
    OutputBlock   31F0AF4C E0F62807 70F709E9 8671AD14

T
    31F0AF4C

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   C00B851B BC5508C7 DE9B8605 06CA6B84
    Text-In       31F0AF4C 00000000 00000000 00000000
    Text-Out      F1FB2A57 BC5508C7 DE9B8605 06CA6B84
----------------------------

Compute S1..Sn
```

```
  <empty payload>

----------------------------


C is
    F1FB2A57

------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   C00B851B BC5508C7 DE9B8605 06CA6B84
    Text-In       F1FB2A57 924148AE 7239BCBD 1A0F7ECB
    Text-Out      31F0AF4C 2E144069 ACA23AB8 1CC5154F

P
    <empty>


T
    31F0AF4C


----------------------------

B
    4F101112 13141516 00000000 00000000
    00400001 02030405 06070809 0A0B0C0D
    0E0F1011 12131415 16171819 1A1B1C1D
    1E1F2021 22232425 26272829 2A2B2C2D
    2E2F3031 32333435 36373839 3A3B3C3D
    3E3F0000 00000000 00000000 00000000

----------------------------

Verify the Mac

  Block #1
```

```
    Plaintext
    4F101112 13141516 00000000 00000000
    InputBlock    4F101112 13141516 00000000 00000000
    OutputBlock   9A092A11 7F2BD319 D45C4EF9 9FD0E8A9
  Block #2
    Plaintext
    00400001 02030405 06070809 0A0B0C0D
    InputBlock    9A492A10 7D28D71C D25B46F0 95DBE4A4
    OutputBlock   FACA8BA0 73669FD4 5CF43B42 7E3013F6
  Block #3
    Plaintext
    0E0F1011 12131415 16171819 1A1B1C1D
    InputBlock    F4C59BB1 61758BC1 4AE3235B 642B0FEB
    OutputBlock   CEC60BC8 54B4DE20 C7D921EB 4A468269
  Block #4
    Plaintext
    1E1F2021 22232425 26272829 2A2B2C2D
    InputBlock    D0D92BE9 7697FA05 E1FE09C2 606DAE44
    OutputBlock   AB7B4C27 CA1ECA3F A3109637 2558D66F
  Block #5
    Plaintext
    2E2F3031 32333435 36373839 3A3B3C3D
    InputBlock    85547C16 F82DFE0A 9527AE0E 1F63EA52
    OutputBlock   0FFB328B 7D21D483 7E1F1636 2409C26F
  Block #6
    Plaintext
    3E3F0000 00000000 00000000 00000000
    InputBlock    31C4328B 7D21D483 7E1F1636 2409C26F
    OutputBlock   31F0AF4C E0F62807 70F709E9 8671AD14

----------------------------
Mac
    31F0AF4C

Mac'
    31F0AF4C


----------------------------

The Mac verifies

P is
    <empty>

============================================================
```

```
*************************************************************

CCM-AES256
-------------------------------------------------------------

Example #1

Tlen = 32
Nlen = 56
Alen = 64
Plen = 32
-------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F
N is
    10111213 141516
A is
    00010203 04050607
P is
    20212223


----------------------------

B
    4F101112 13141516 00000000 00000004
    00080001 02030405 06070000 00000000
    20212223 00000000 00000000 00000000

----------------------------

Compute the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000004
    InputBlock    4F101112 13141516 00000000 00000004
    OutputBlock   E0E3B7CF 31198BC9 3B59D464 962B4FE1
  Block #2
    Plaintext
    00080001 02030405 06070000 00000000
```

```
    InputBlock    E0EBB7CE 331A8FCC 3D5ED464 962B4FE1
    OutputBlock   6303B133 0D864156 A023F693 468A4069
  Block #3
    Plaintext
    20212223 00000000 00000000 00000000
    InputBlock    43229310 0D864156 A023F693 468A4069
    OutputBlock   F2BAF340 77D1A66B 94DC0EFD FD9ED77D

T
    F2BAF340

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   6746FB60 9785DCD1 6A4A5203 5D2E067B
    Text-In       F2BAF340 00000000 00000000 00000000
    Text-Out      95FC0820 9785DCD1 6A4A5203 5D2E067B
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   AA908A57 D2A01903 6B8CBF2B DBA03908
    Text-In       20212223 6F006E00 20212223 24252627
    Text-Out      8AB1A874 BDA07703 4BAD9D08 FF851F2F
----------------------------


C is
    8AB1A874 95FC0820

----------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   6746FB60 9785DCD1 6A4A5203 5D2E067B
```

```
    Text-In       95FC0820 D89624D6 2CE7637F B94995B6
    Text-Out      F2BAF340 4F13F807 46AD317C E46793CD
  Block #2
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   AA908A57 D2A01903 6B8CBF2B DBA03908
    Text-In       8AB1A874 1586DE01 3542F8E5 8A80BB3F
    Text-Out      20212223 C726C702 5ECE47CE 51208237

P
    20212223


T
    F2BAF340


----------------------------

B
    4F101112 13141516 00000000 00000004
    00080001 02030405 06070000 00000000
    20212223 00000000 00000000 00000000

----------------------------

Verify the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000004
    InputBlock    4F101112 13141516 00000000 00000004
    OutputBlock   E0E3B7CF 31198BC9 3B59D464 962B4FE1
  Block #2
    Plaintext
    00080001 02030405 06070000 00000000
    InputBlock    E0EBB7CE 331A8FCC 3D5ED464 962B4FE1
    OutputBlock   6303B133 0D864156 A023F693 468A4069
  Block #3
    Plaintext
    20212223 00000000 00000000 00000000
    InputBlock    43229310 0D864156 A023F693 468A4069
    OutputBlock   F2BAF340 77D1A66B 94DC0EFD FD9ED77D

----------------------------
Mac
    F2BAF340
```

```
Mac'
    F2BAF340


----------------------------

The Mac verifies

P is
    20212223

================================================================

Example #2

Tlen = 48
Nlen = 64
Alen = 128
Plen = 128
----------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F
N is
    10111213 14151617
A is
    00010203 04050607 08090A0B 0C0D0E0F
P is
    20212223 24252627 28292A2B 2C2D2E2F


----------------------------

B
    56101112 13141516 17000000 00000010
    00100001 02030405 06070809 0A0B0C0D
    0E0F0000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F

----------------------------

Compute the Mac
```

```
  Block #1
    Plaintext
    56101112 13141516 17000000 00000010
    InputBlock    56101112 13141516 17000000 00000010
    OutputBlock   067CB8E5 D59D8225 A9C1ECE9 ACF1469C
  Block #2
    Plaintext
    00100001 02030405 06070809 0A0B0C0D
    InputBlock    066CB8E4 D79E8620 AFC6E4E0 A6FA4A91
    OutputBlock   B7B77DB8 7195ADBC D529D9D9 8E0EC0A8
  Block #3
    Plaintext
    0E0F0000 00000000 00000000 00000000
    InputBlock    B9B87DB8 7195ADBC D529D9D9 8E0EC0A8
    OutputBlock   38539AC0 F34ADDEF 19A699BB F7DCCF68
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    1872B8E3 D76FFBC8 318FB390 DBF1E147
    OutputBlock   3DD67149 DBD1CF3B F003B424 3B2C074C

T
    3DD67149 DBD1

----------------------------

Compute S0

  Block #1
    InputBlock    06101112 13141516 17000000 00000000
    OutputBlock   A96E5781 5F4F7C7B 8860376F DF23150A
    Text-In       3DD67149 DBD10000 00000000 00000000
    Text-Out      94B826C8 849E7C7B 8860376F DF23150A
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    06101112 13141516 17000000 00000001
    OutputBlock   8F36A7DF 2B7B81F7 E793A959 6A656AB8
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      AF1785FC 0F5EA7D0 CFBA8372 46484497
----------------------------
```

```
C is
    AF1785FC 0F5EA7D0 CFBA8372 46484497
    94B826C8 849E

---------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    06101112 13141516 17000000 00000000
    OutputBlock   A96E5781 5F4F7C7B 8860376F DF23150A
    Text-In       94B826C8 849EF807 46AD317C E46793CD
    Text-Out      3DD67149 DBD1847C CECD0613 3B4486C7
  Block #2
    InputBlock    06101112 13141516 17000000 00000001
    OutputBlock   8F36A7DF 2B7B81F7 E793A959 6A656AB8
    Text-In       AF1785FC 0F5EA7D0 CFBA8372 46484497
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F

P
    20212223 24252627 28292A2B 2C2D2E2F


T
    3DD67149 DBD1


----------------------------

B
    56101112 13141516 17000000 00000010
    00100001 02030405 06070809 0A0B0C0D
    0E0F0000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F

----------------------------

Verify the Mac

  Block #1
    Plaintext
    56101112 13141516 17000000 00000010
```

```
    InputBlock    56101112 13141516 17000000 00000010
    OutputBlock   067CB8E5 D59D8225 A9C1ECE9 ACF1469C
  Block #2
    Plaintext
    00100001 02030405 06070809 0A0B0C0D
    InputBlock    066CB8E4 D79E8620 AFC6E4E0 A6FA4A91
    OutputBlock   B7B77DB8 7195ADBC D529D9D9 8E0EC0A8
  Block #3
    Plaintext
    0E0F0000 00000000 00000000 00000000
    InputBlock    B9B87DB8 7195ADBC D529D9D9 8E0EC0A8
    OutputBlock   38539AC0 F34ADDEF 19A699BB F7DCCF68
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    1872B8E3 D76FFBC8 318FB390 DBF1E147
    OutputBlock   3DD67149 DBD1CF3B F003B424 3B2C074C

----------------------------
Mac
    3DD67149 DBD1

Mac'
    3DD67149 DBD1


----------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F

============================================================

Example #3

Tlen = 64
Nlen = 96
Alen = 160
Plen = 192
------------------------------------------------------------

Encrypt-Generate

K is
```

```
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F
N is
    10111213 14151617 18191A1B
A is
    00010203 04050607 08090A0B 0C0D0E0F
    10111213
P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637


---------------------------

B
    5A101112 13141516 1718191A 1B000018
    00140001 02030405 06070809 0A0B0C0D
    0E0F1011 12130000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 00000000 00000000

---------------------------

Compute the Mac

  Block #1
    Plaintext
    5A101112 13141516 1718191A 1B000018
    InputBlock    5A101112 13141516 1718191A 1B000018
    OutputBlock   D58A04A4 6BEF2857 891838E9 5341BE09
  Block #2
    Plaintext
    00140001 02030405 06070809 0A0B0C0D
    InputBlock    D59E04A5 69EC2C52 8F1F30E0 594AB204
    OutputBlock   434DC2F8 D3F4EBE9 E949AABE 0EE56891
  Block #3
    Plaintext
    0E0F1011 12130000 00000000 00000000
    InputBlock    4D42D2E9 C1E7EBE9 E949AABE 0EE56891
    OutputBlock   8769579F B41C989E 93E0F1DC A682076F
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    A74875BC 9039BEB9 BBC9DBF7 8AAF2940
    OutputBlock   AC8556E9 010C8579 0FAB59F6 8827E562
  Block #5
```

```
    Plaintext
    30313233 34353637 00000000 00000000
    InputBlock    9CB464DA 3539B34E 0FAB59F6 8827E562
    OutputBlock   5AE87005 24D79808 E13EB30E BA734755

T
    5AE87005 24D79808

----------------------------

Compute S0

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000000
    OutputBlock   71A0B873 4BA9EE41 11F51341 C7FE6D3B
    Text-In       5AE87005 24D79808 00000000 00000000
    Text-Out      2B48C876 6F7E7649 11F51341 C7FE6D3B
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    02101112 13141516 1718191A 1B000001
    OutputBlock   24D9A18D 97982117 C2DC219D F2628C0E
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      04F883AE B3BD0730 EAF50BB6 DE4FA221
  Block #2
    InputBlock    02101112 13141516 1718191A 1B000002
    OutputBlock   1005D6D7 2F3B43D2 4FCF851F 1EFDC8ED
    Text-In       30313233 34353637 38393A3B 3C3D3E3F
    Text-Out      2034E4E4 1B0E75E5 77F6BF24 22C0F6D2
----------------------------


C is
    04F883AE B3BD0730 EAF50BB6 DE4FA221
    2034E4E4 1B0E75E5 2B48C876 6F7E7649

-----------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn
```

```
  Block #1
    InputBlock    02101112 13141516 1718191A 1B000000
    OutputBlock   71A0B873 4BA9EE41 11F51341 C7FE6D3B
    Text-In       2B48C876 6F7E7649 00000000 00000004
    Text-Out      5AE87005 24D79808 11F51341 C7FE6D3F
  Block #2
    InputBlock    02101112 13141516 1718191A 1B000001
    OutputBlock   24D9A18D 97982117 C2DC219D F2628C0E
    Text-In       04F883AE B3BD0730 EAF50BB6 DE4FA221
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F
  Block #3
    InputBlock    02101112 13141516 1718191A 1B000002
    OutputBlock   1005D6D7 2F3B43D2 4FCF851F 1EFDC8ED
    Text-In       2034E4E4 1B0E75E5 00000000 00000000
    Text-Out      30313233 34353637 4FCF851F 1EFDC8ED

P
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637


T
    5AE87005 24D79808


----------------------------

B
    5A101112 13141516 1718191A 1B000018
    00140001 02030405 06070809 0A0B0C0D
    0E0F1011 12130000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 00000000 00000000

----------------------------

Verify the Mac

  Block #1
    Plaintext
    5A101112 13141516 1718191A 1B000018
    InputBlock    5A101112 13141516 1718191A 1B000018
    OutputBlock   D58A04A4 6BEF2857 891838E9 5341BE09
  Block #2
    Plaintext
    00140001 02030405 06070809 0A0B0C0D
```

```
    InputBlock    D59E04A5 69EC2C52 8F1F30E0 594AB204
    OutputBlock   434DC2F8 D3F4EBE9 E949AABE 0EE56891
  Block #3
    Plaintext
    0E0F1011 12130000 00000000 00000000
    InputBlock    4D42D2E9 C1E7EBE9 E949AABE 0EE56891
    OutputBlock   8769579F B41C989E 93E0F1DC A682076F
  Block #4
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    A74875BC 9039BEB9 BBC9DBF7 8AAF2940
    OutputBlock   AC8556E9 010C8579 0FAB59F6 8827E562
  Block #5
    Plaintext
    30313233 34353637 00000000 00000000
    InputBlock    9CB464DA 3539B34E 0FAB59F6 8827E562
    OutputBlock   5AE87005 24D79808 E13EB30E BA734755

----------------------------
Mac
    5AE87005 24D79808

Mac'
    5AE87005 24D79808


----------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637

============================================================

Example #4

Tlen = 32
Nlen = 56
Alen = 0
Plen = 512
------------------------------------------------------------

Encrypt-Generate
```

```
K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F
N is
    10111213 141516
A is
    <empty>
P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F


---------------------------

B
    0F101112 13141516 00000000 00000040
    00000000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

---------------------------

Compute the Mac

  Block #1
    Plaintext
    0F101112 13141516 00000000 00000040
    InputBlock    0F101112 13141516 00000000 00000040
    OutputBlock   054408C9 5B192F76 3C5CC14A 1CEF6D3C
  Block #2
    Plaintext
    00000000 00000000 00000000 00000000
    InputBlock    054408C9 5B192F76 3C5CC14A 1CEF6D3C
    OutputBlock   EE74C312 43147769 E039C306 6E473B79
  Block #3
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    CE55E131 6731514E C810E92D 426A1556
    OutputBlock   E54C31FA 7648149D 53EAF04B 5F4F55C2
  Block #4
    Plaintext
    30313233 34353637 38393A3B 3C3D3E3F
```

```
    InputBlock    D57D03C9 427D22AA 6BD3CA70 63726BFD
    OutputBlock   22A10A2C A209DE21 5B048A3F D1E5BDB4
  Block #5
    Plaintext
    40414243 44454647 48494A4B 4C4D4E4F
    InputBlock    62E0486F E64C9866 134DC074 9DA8F3FB
    OutputBlock   BAED8D0D 62686FCB 956EE6A8 87BE1DE7
  Block #6
    Plaintext
    50515253 54555657 58595A5B 5C5D5E5F
    InputBlock    EABCDF5E 363D399C CD37BCF3 DBE343B8
    OutputBlock   AC5B5983 1BA5295A 654CFEE7 DF142AFA

T
    AC5B5983

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   6746FB60 9785DCD1 6A4A5203 5D2E067B
    Text-In       AC5B5983 00000000 00000000 00000000
    Text-Out      CB1DA2E3 9785DCD1 6A4A5203 5D2E067B
----------------------------

Compute S1..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   AA908A57 D2A01903 6B8CBF2B DBA03908
    Text-In       20212223 24252627 28292A2B 2C2D2E2F
    Text-Out      8AB1A874 F6853F24 43A59500 F78D1727
  Block #2
    InputBlock    07101112 13141516 00000000 00000002
    OutputBlock   1D5C0BEC 92E5D066 3F883D3B FEF3A0D7
    Text-In       30313233 34353637 38393A3B 3C3D3E3F
    Text-Out      2D6D39DF A6D0E651 07B10700 C2CE9EE8
  Block #3
    InputBlock    07101112 13141516 00000000 00000003
    OutputBlock   267C7C69 4587A76B 7AA07D3F 0E6E576F
    Text-In       40414243 44454647 48494A4B 4C4D4E4F
    Text-Out      663D3E2A 01C2E12C 32E93774 42231920
  Block #4
    InputBlock    07101112 13141516 00000000 00000004
```

```
    OutputBlock   EE0275DC 1B35FF25 EF50E14D CF7468E5
    Text-In       50515253 54555657 58595A5B 5C5D5E5F
    Text-Out      BE53278F 4F60A972 B709BB16 932936BA
----------------------------


C is
    8AB1A874 F6853F24 43A59500 F78D1727
    2D6D39DF A6D0E651 07B10700 C2CE9EE8
    663D3E2A 01C2E12C 32E93774 42231920
    BE53278F 4F60A972 B709BB16 932936BA
    CB1DA2E3

------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   6746FB60 9785DCD1 6A4A5203 5D2E067B
    Text-In       CB1DA2E3 13141516 1718191A 1B000018
    Text-Out      AC5B5983 8491C9C7 7D524B19 462E0663
  Block #2
    InputBlock    07101112 13141516 00000000 00000001
    OutputBlock   AA908A57 D2A01903 6B8CBF2B DBA03908
    Text-In       8AB1A874 F6853F24 43A59500 F78D1727
    Text-Out      20212223 24252627 28292A2B 2C2D2E2F
  Block #3
    InputBlock    07101112 13141516 00000000 00000002
    OutputBlock   1D5C0BEC 92E5D066 3F883D3B FEF3A0D7
    Text-In       2D6D39DF A6D0E651 07B10700 C2CE9EE8
    Text-Out      30313233 34353637 38393A3B 3C3D3E3F
  Block #4
    InputBlock    07101112 13141516 00000000 00000003
    OutputBlock   267C7C69 4587A76B 7AA07D3F 0E6E576F
    Text-In       663D3E2A 01C2E12C 32E93774 42231920
    Text-Out      40414243 44454647 48494A4B 4C4D4E4F
  Block #5
    InputBlock    07101112 13141516 00000000 00000004
    OutputBlock   EE0275DC 1B35FF25 EF50E14D CF7468E5
    Text-In       BE53278F 4F60A972 B709BB16 932936BA
    Text-Out      50515253 54555657 58595A5B 5C5D5E5F
```

```
P
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F


T
    AC5B5983


----------------------------

B
    0F101112 13141516 00000000 00000040
    00000000 00000000 00000000 00000000
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

----------------------------

Verify the Mac

  Block #1
    Plaintext
    0F101112 13141516 00000000 00000040
    InputBlock    0F101112 13141516 00000000 00000040
    OutputBlock   054408C9 5B192F76 3C5CC14A 1CEF6D3C
  Block #2
    Plaintext
    00000000 00000000 00000000 00000000
    InputBlock    054408C9 5B192F76 3C5CC14A 1CEF6D3C
    OutputBlock   EE74C312 43147769 E039C306 6E473B79
  Block #3
    Plaintext
    20212223 24252627 28292A2B 2C2D2E2F
    InputBlock    CE55E131 6731514E C810E92D 426A1556
    OutputBlock   E54C31FA 7648149D 53EAF04B 5F4F55C2
  Block #4
    Plaintext
    30313233 34353637 38393A3B 3C3D3E3F
    InputBlock    D57D03C9 427D22AA 6BD3CA70 63726BFD
    OutputBlock   22A10A2C A209DE21 5B048A3F D1E5BDB4
```

```
  Block #5
    Plaintext
    40414243 44454647 48494A4B 4C4D4E4F
    InputBlock    62E0486F E64C9866 134DC074 9DA8F3FB
    OutputBlock   BAED8D0D 62686FCB 956EE6A8 87BE1DE7
  Block #6
    Plaintext
    50515253 54555657 58595A5B 5C5D5E5F
    InputBlock    EABCDF5E 363D399C CD37BCF3 DBE343B8
    OutputBlock   AC5B5983 1BA5295A 654CFEE7 DF142AFA

----------------------------
Mac
    AC5B5983

Mac'
    AC5B5983


----------------------------

The Mac verifies

P is
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F

================================================================

Example #5

Tlen = 32
Nlen = 56
Alen = 512
Plen = 0
----------------------------------------------------------------

Encrypt-Generate

K is
    40414243 44454647 48494A4B 4C4D4E4F
    50515253 54555657 58595A5B 5C5D5E5F
N is
    10111213 141516
```

```
A is
    00010203 04050607 08090A0B 0C0D0E0F
    10111213 14151617 18191A1B 1C1D1E1F
    20212223 24252627 28292A2B 2C2D2E2F
    30313233 34353637 38393A3B 3C3D3E3F
P is
    <empty>


----------------------------

B
    4F101112 13141516 00000000 00000000
    00400001 02030405 06070809 0A0B0C0D
    0E0F1011 12131415 16171819 1A1B1C1D
    1E1F2021 22232425 26272829 2A2B2C2D
    2E2F3031 32333435 36373839 3A3B3C3D
    3E3F0000 00000000 00000000 00000000

----------------------------

Compute the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000000
    InputBlock    4F101112 13141516 00000000 00000000
    OutputBlock   C06556FD D639F5BF CA0816A2 E748051A
  Block #2
    Plaintext
    00400001 02030405 06070809 0A0B0C0D
    InputBlock    C02556FC D43AF1BA CC0F1EAB ED430917
    OutputBlock   E23B799F AC48BF0D 0CEB5302 51CB4D1A
  Block #3
    Plaintext
    0E0F1011 12131415 16171819 1A1B1C1D
    InputBlock    EC34698E BE5BAB18 1AFC4B1B 4BD05107
    OutputBlock   11D1D391 F7E1C1B0 BF900A98 A0C98A83
  Block #4
    Plaintext
    1E1F2021 22232425 26272829 2A2B2C2D
    InputBlock    0FCEF3B0 D5C2E595 99B722B1 8AE2A6AE
    OutputBlock   811F84F4 3CA03762 6D1B9669 6345AD8B
  Block #5
    Plaintext
    2E2F3031 32333435 36373839 3A3B3C3D
```

```
    InputBlock    AF30B4C5 0E930357 5B2CAE50 597E91B6
    OutputBlock   3B1FEBBE 43D2B0F9 7B48475C AE18418B
  Block #6
    Plaintext
    3E3F0000 00000000 00000000 00000000
    InputBlock    0520EBBE 43D2B0F9 7B48475C AE18418B
    OutputBlock   C1897950 4C660131 B4DA0E3E 718626C2

T
    C1897950

----------------------------

Compute S0

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   6746FB60 9785DCD1 6A4A5203 5D2E067B
    Text-In       C1897950 00000000 00000000 00000000
    Text-Out      A6CF8230 9785DCD1 6A4A5203 5D2E067B
----------------------------

Compute S1..Sn

  <empty payload>

----------------------------


C is
    A6CF8230

------------------------------------------------------------------

Decrypt-Verify

----------------------------

Compute S0..Sn

  Block #1
    InputBlock    07101112 13141516 00000000 00000000
    OutputBlock   6746FB60 9785DCD1 6A4A5203 5D2E067B
    Text-In       A6CF8230 0F5EA7D0 CFBA8372 46484497
    Text-Out      C1897950 98DB7B01 A5F0D171 1B6642EC
```

```
P
    <empty>


T
    C1897950


----------------------------

B
    4F101112 13141516 00000000 00000000
    00400001 02030405 06070809 0A0B0C0D
    0E0F1011 12131415 16171819 1A1B1C1D
    1E1F2021 22232425 26272829 2A2B2C2D
    2E2F3031 32333435 36373839 3A3B3C3D
    3E3F0000 00000000 00000000 00000000

----------------------------

Verify the Mac

  Block #1
    Plaintext
    4F101112 13141516 00000000 00000000
    InputBlock    4F101112 13141516 00000000 00000000
    OutputBlock   C06556FD D639F5BF CA0816A2 E748051A
  Block #2
    Plaintext
    00400001 02030405 06070809 0A0B0C0D
    InputBlock    C02556FC D43AF1BA CC0F1EAB ED430917
    OutputBlock   E23B799F AC48BF0D 0CEB5302 51CB4D1A
  Block #3
    Plaintext
    0E0F1011 12131415 16171819 1A1B1C1D
    InputBlock    EC34698E BE5BAB18 1AFC4B1B 4BD05107
    OutputBlock   11D1D391 F7E1C1B0 BF900A98 A0C98A83
  Block #4
    Plaintext
    1E1F2021 22232425 26272829 2A2B2C2D
    InputBlock    0FCEF3B0 D5C2E595 99B722B1 8AE2A6AE
    OutputBlock   811F84F4 3CA03762 6D1B9669 6345AD8B
  Block #5
    Plaintext
    2E2F3031 32333435 36373839 3A3B3C3D
    InputBlock    AF30B4C5 0E930357 5B2CAE50 597E91B6
```

```
    OutputBlock   3B1FEBBE 43D2B0F9 7B48475C AE18418B
  Block #6
    Plaintext
    3E3F0000 00000000 00000000 00000000
    InputBlock    0520EBBE 43D2B0F9 7B48475C AE18418B
    OutputBlock   C1897950 4C660131 B4DA0E3E 718626C2

----------------------------
Mac
    C1897950

Mac'
    C1897950


---------------------------

The Mac verifies

P is
    <empty>

================================================================

****************************************************************
```