Group 1:

Q: Generate all the steps in table format and give good explanation of each step, also make a video over this (30 mins maximum). Send the PDF and video to me. For help kindly refer my video.

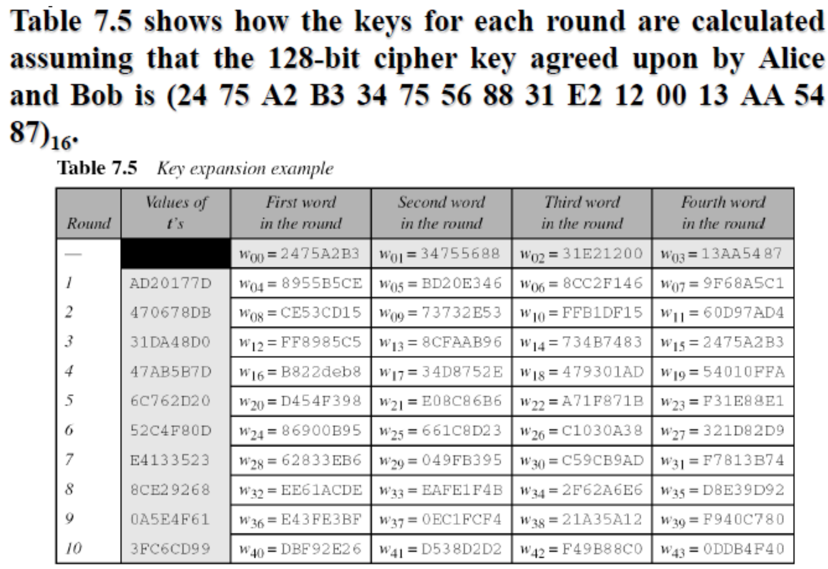


Table 7.5 shows how the keys for each round are calculated assuming that the 128-bit cipher key agreed upon by Alice and Bob is (24 75 A2 B3 34 75 56 88 31 E2 12 00 13 AA 54 87)$_{16}$.

Table 7.5 *Key expansion example*

Round	*Values of t's*	*First word in the round*	*Second word in the round*	*Third word in the round*	*Fourth word in the round*
—		w_{00} = 2475A2B3	w_{01} = 34755688	w_{02} = 31E21200	w_{03} = 13AA5487
1	AD20177D	w_{04} = 8955B5CE	w_{05} = BD20E346	w_{06} = 8CC2F146	w_{07} = 9F68A5C1
2	470678DB	w_{08} = CE53CD15	w_{09} = 73732E53	w_{10} = FFB1DF15	w_{11} = 60D97AD4
3	31DA48D0	w_{12} = FF8985C5	w_{13} = 8CFAAB96	w_{14} = 734B7483	w_{15} = 2475A2B3
4	47AB5B7D	w_{16} = B822deb8	w_{17} = 34D8752E	w_{18} = 479301AD	w_{19} = 54010FFA
5	6C762D20	w_{20} = D454F398	w_{21} = E08C86B6	w_{22} = A71F871B	w_{23} = F31E88E1
6	52C4F80D	w_{24} = 86900B95	w_{25} = 661C8D23	w_{26} = C1030A38	w_{27} = 321D82D9
7	E4133523	w_{28} = 62833EB6	w_{29} = 049FB395	w_{30} = C59CB9AD	w_{31} = F7813B74
8	8CE29268	w_{32} = EE61ACDE	w_{33} = EAFE1F4B	w_{34} = 2F62A6E6	w_{35} = D8E39D92
9	0A5E4F61	w_{36} = E43FE3BF	w_{37} = 0EC1FCF4	w_{38} = 21A35A12	w_{39} = F940C780
10	3FC6CD99	w_{40} = DBF92E26	w_{41} = D538D2D2	w_{42} = F49B88C0	w_{43} = 0DDB4F40

Group 2 and Group 16:

Q: Generate the round keys for each set of cipher key in tabular format and state that the dependency in round key generation is non-linear. Give good explanation of each step, also make a video over this (30 mins maximum). Send the PDF and video to me.

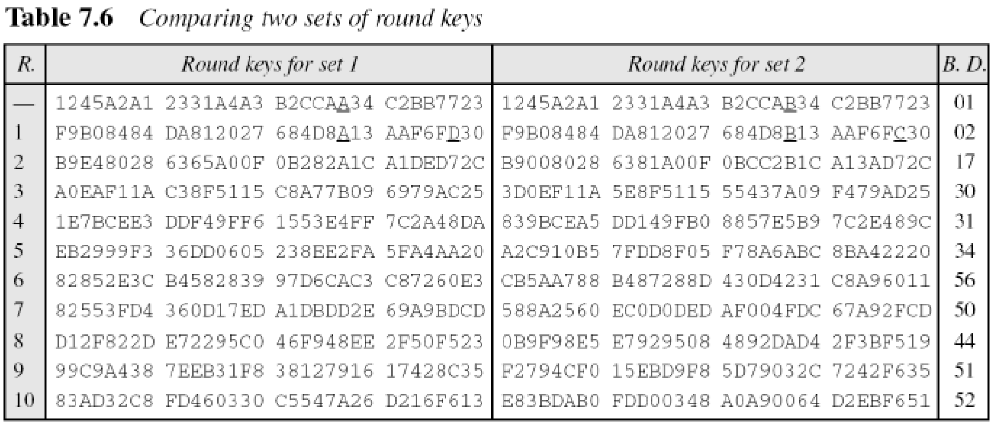
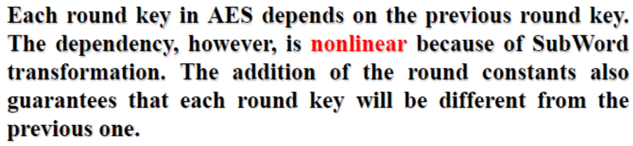
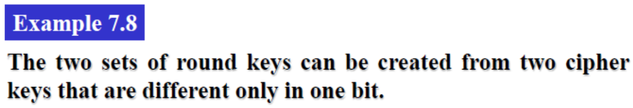


Table 7.6 *Comparing two sets of round keys*

R.	*Round keys for set 1*	*Round keys for set 2*	*B. D.*
—	1245A2A1 2331A4A3 B2CCAA34 C2BB7723	1245A2A1 2331A4A3 B2CCAB34 C2BB7723	01
1	F9B08484 DA812027 684D8A13 AAF6FD30	F9B08484 DA812027 684D8B13 AAF6FC30	02
2	B9E48028 6365A00F 0B282A1C A1DED72C	B9008028 6381A00F 0BCC2B1C A13AD72C	17
3	A0EAF11A C38F5115 C8A77B09 6979AC25	3D0EF11A 5E8F5115 55437A09 F479AD25	30
4	1E7BCEE3 DDF49FF6 1553E4FF 7C2A48DA	839BCEA5 DD149FB0 8857E5B9 7C2E489C	31
5	EB2999F3 36DD0605 238EE2FA 5FA4AA20	A2C910B5 7FDD8F05 F78A6ABC 8BA42220	34
6	82852E3C B4582839 97D6CAC3 C87260E3	CB5AA788 B487288D 430D4231 C8A96011	56
7	82553FD4 360D17ED A1DBDD2E 69A9BDCD	588A2560 EC0D0DED AF004FDC 67A92FCD	50
8	D12F822D E72295C0 46F948EE 2F50F523	0B9F98E5 E7929508 4892DAD4 2F3BF519	44
9	99C9A438 7EEB31F8 38127916 17428C35	F2794CF0 15EBD9F8 5D79032C 7242F635	51
10	83AD32C8 FD460330 C5547A26 D216F613	E83BDAB0 FDD00348 A0A90064 D2EBF651	52

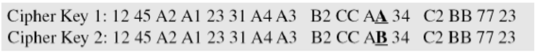


Each round key in AES depends on the previous round key. The dependency, however, is nonlinear because of SubWord transformation. The addition of the round constants also guarantees that each round key will be different from the previous one.



Example 7.8

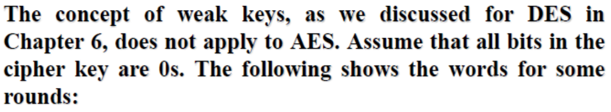
The two sets of round keys can be created from two cipher keys that are different only in one bit.



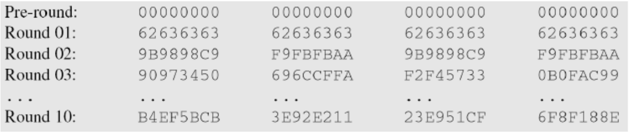
Cipher Key 1: 12 45 A2 A1 23 31 A4 A3 B2 CC AA 34 C2 BB 77 23
Cipher Key 2: 12 45 A2 A1 23 31 A4 A3 B2 CC AB 34 C2 BB 77 23

Group3:

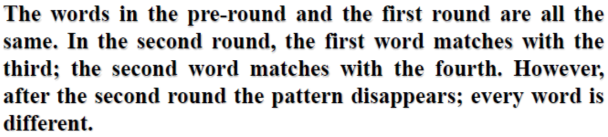
Q: prove that the concept of weak key is not applicable over AES. Generate the round keys when all the bits in cipher keys are 0 in tabular format. Give good explanation of each step, also make a video over this (30 mins maximum). Send the PDF and video to me.



The concept of weak keys, as we discussed for DES in Chapter 6, does not apply to AES. Assume that all bits in the cipher key are 0s. The following shows the words for some rounds:



Pre-round:	00000000	00000000	00000000	00000000
Round 01:	62636363	62636363	62636363	62636363
Round 02:	9B9898C9	F9FBFBAA	9B9898C9	F9FBFBAA
Round 03:	90973450	696CCFFA	F2F45733	0B0FAC99
. . .	. . .	. . .	. . .	. . .
Round 10:	B4EF5BCB	3E92E211	23E951CF	6F8F188E



The words in the pre-round and the first round are all the same. In the second round, the first word matches with the third; the second word matches with the fourth. However, after the second round the pattern disappears; every word is different.

Group 4:

Q: Make a video and pdf on key expansion process of AES-192. Give good explanation of each step and diagram, also make a video over this (30 mins maximum). Send the PDF and video to me.

Group 5:

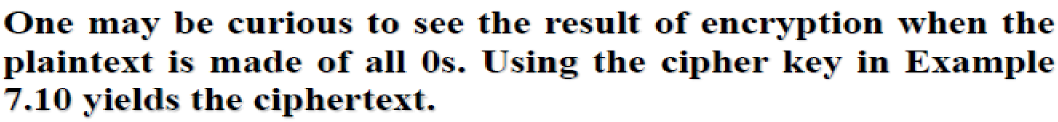
Q: Make a video and pdf on key expansion process of AES-256. Give good explanation of each step and diagram, also make a video over this (30 mins maximum). Send the PDF and video to me.

Group 6:

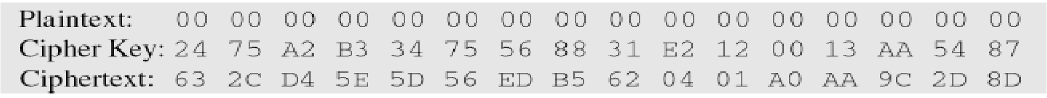
Q: Make a video and pdf on differences between AES-128,192 and 256 and state which one is best for real-time application. Give good explanation of each step, also make a video over this (30 mins maximum). Send the PDF and video to me.

Group 7:

Q: Generate the cipher text of AES when all the bits in plaintext are 0 in a tabular format. Give good explanation of each step, also make a video over this (30 mins maximum). Send the PDF and video to me.



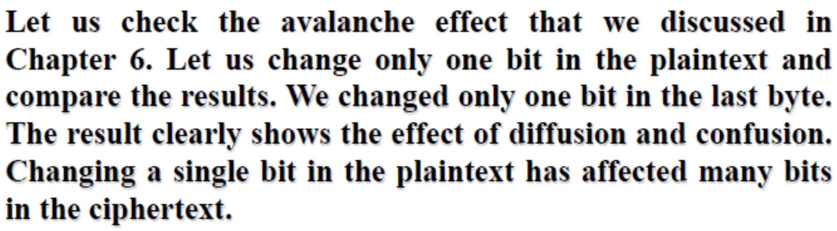
One may be curious to see the result of encryption when the plaintext is made of all 0s. Using the cipher key in Example 7.10 yields the ciphertext.



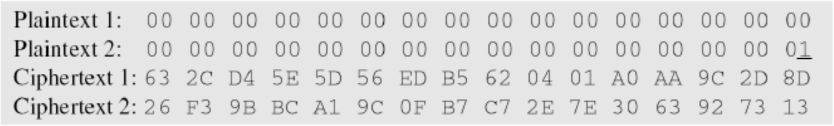
Plaintext:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Cipher Key:	24	75	A2	B3	34	75	56	88	31	E2	12	00	13	AA	54	87
Ciphertext:	63	2C	D4	5E	5D	56	ED	B5	62	04	01	A0	AA	9C	2D	8D

Group 8 and 15:

Q: Show the avalanche effect upon AES-128. Give good explanation of each step, also make a video over this (30 mins maximum). Send the PDF and video to me.



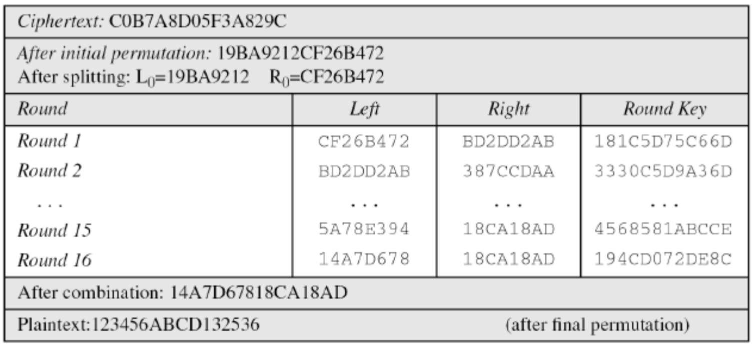
Let us check the avalanche effect that we discussed in Chapter 6. Let us change only one bit in the plaintext and compare the results. We changed only one bit in the last byte. The result clearly shows the effect of diffusion and confusion. Changing a single bit in the plaintext has affected many bits in the ciphertext.



Plaintext 1:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Plaintext 2:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01
Ciphertext 1:	63	2C	D4	5E	5D	56	ED	B5	62	04	01	A0	AA	9C	2D	8D
Ciphertext 2:	26	F3	9B	BC	A1	9C	0F	B7	C7	2E	7E	30	63	92	73	13

Group 9:

Q: Generate the plaintext from cipher text as shown in the figure. Give good explanation of each step in tabular format, also make a video over this (30 mins maximum). Send the PDF and video to me.



Ciphertext: C0B7A8D05F3A829C

After initial permutation: 19BA9212CF26B472
After splitting: L_0=19BA9212 R_0=CF26B472

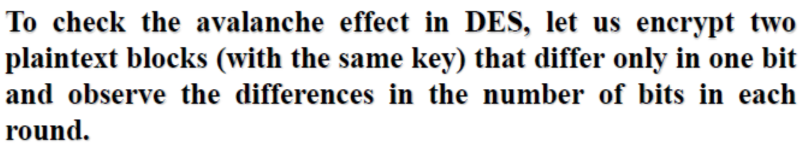
Round	*Left*	*Right*	*Round Key*
Round 1	CF26B472	BD2DD2AB	181C5D75C66D
Round 2	BD2DD2AB	387CCDAA	3330C5D9A36D
. . .	. . .	. . .	. . .
Round 15	5A78E394	18CA18AD	4568581ABCCE
Round 16	14A7D678	18CA18AD	194CD072DE8C

After combination: 14A7D67818CA18AD

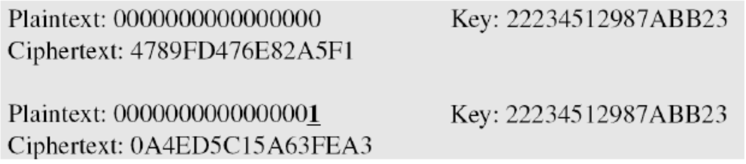
Plaintext:123456ABCD132536 (after final permutation)

Group 10 and Group 14:

Q: show the avalanche effect of DES algorithm by using the following figure. Give good explanation of each step in tabular format, also make a video over this (30 mins maximum). Send the PDF and video to me.



To check the avalanche effect in DES, let us encrypt two plaintext blocks (with the same key) that differ only in one bit and observe the differences in the number of bits in each round.



Plaintext: 0000000000000000 Key: 22234512987ABB23
Ciphertext: 4789FD476E82A5F1

Plaintext: 0000000000000001 Key: 22234512987ABB23
Ciphertext: 0A4ED5C15A63FEA3

Group 11 & 12:

Q: Generate the cipher key (56 bits) from weak keys (64 bits) as shown in the figure.

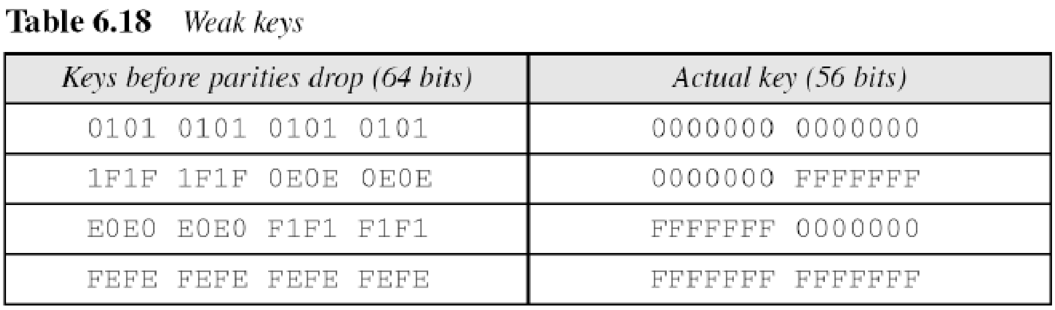
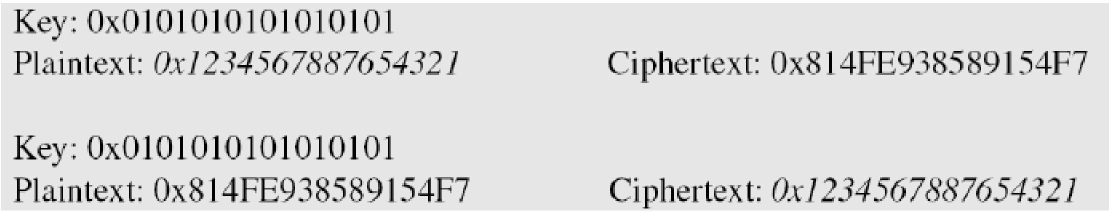


Table 6.18 *Weak keys*

Keys before parities drop (64 bits)	*Actual key (56 bits)*
0101 0101 0101 0101	0000000 0000000
1F1F 1F1F 0E0E 0E0E	0000000 FFFFFFF
E0E0 E0E0 F1F1 F1F1	FFFFFFF 0000000
FEFE FEFE FEFE FEFE	FFFFFFF FFFFFFF

Use first weak key of DES algorithm and perform the encryption two times as shown in the figure. Give good explanation of each step in tabular format, also make a video over this (30 mins maximum). Send the PDF and video to me.



Key: 0x0101010101010101
Plaintext: *0x1234567887654321* Ciphertext: 0x814FE938589154F7

Key: 0x0101010101010101
Plaintext: 0x814FE938589154F7 Ciphertext: *0x1234567887654321*

Group 13:

Q: Prove that if we have key and plaintext complement, then we can obtain the complement of previous ciphertext as shown in the figure. Give good explanation of each step in tabular format, also make a video over this (30 mins maximum). Send the PDF and video to me.

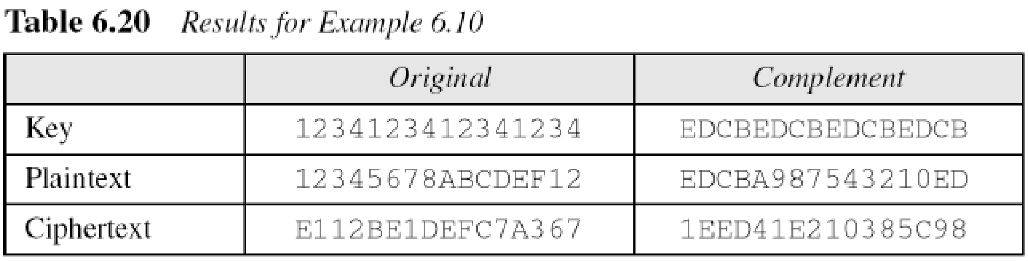


Table 6.20 *Results for Example 6.10*

	Original	*Complement*
Key	1234123412341234	EDCBEDCBEDCBEDCB
Plaintext	12345678ABCDEF12	EDCBA987543210ED
Ciphertext	E112BE1DEFC7A367	1EED41E210385C98