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Tentukan message digest dari pesan "saya belajar kriptografi secara daring" dengan menggunakan algoritma SHA-1. Jelaskan langkah-langkah pengerjaannya.

- Urut nilai w tentukan sampai dengan w_4
- Urut proses H_{SHA} tentukan sampai dengan $t=2$
- Nilai message digest dari pesan tersebut.

pembahasan :

* Langkah Pertama : Convert ke binary pecannya

S : 01110011	K : 01101011	S : 01110011
a : 01100001	r : 01110010	e : 01100101
y : 01111001	i : 01101001	c : 01100011
a : 01100001	P : 01110000	a : 01100001
space : 0010 0000	t : 01110100	r : 01110010
b : 01100010	o : 01101111	a : 01100001
e : 01100101	g : 01100111	space : 0010 0000
l : 01101100	r : 01110010	d : 01100100
a : 01100001	a : 01100001	a : 01100001
j : 01101010	f : 01100110	r : 01110010
a : 01100001	i : 01101001	i : 01101001
r : 01110010	space : 0010 0000	n : 01101110
space : 0010 0000		g : 01100111

1.000...000

143 bits

00...100110000

Length of string : 304 + bit 0 sampai dgn bit 64 bits

① pesannya : "saya belajar kriptografi secara daring"

② panjang pesannya : $38 \times 8 = 304$ bit \Rightarrow ubah ke biner : 100110000

③ Maka padding bits : $448 - 304 + 1 = 143$ bits

Inisialisasi hash value h_0, h_1, h_2, h_4

Penyangan MD

A : $h_0 = 67452301$

B : $h_1 = EFCDAB89$

C : $h_2 = 98BADCFE$

D : $h_3 = 10325476$

E : $h_4 = C3D2E1F0$

* Melakukan pemecahan terhadap blok" f sudah pd lembar sebelumnya }

* Selanjutnya menentukan nilai $W_0 - W_{17}$

$$\begin{array}{l}
 07 W_0 = \begin{array}{l} \overline{0111} \overline{0011} = 73 \\ \overline{0110} \overline{0001} = 61 \\ \overline{0111} \overline{1001} = 79 \\ \overline{0110} \overline{0001} = 61 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 73617961 \\
 07 W_7 = \begin{array}{l} \overline{0110} \overline{0001} = 61 \\ \overline{0111} \overline{0010} = 72 \\ \overline{0110} \overline{0001} = 61 \\ \overline{0010} \overline{0000} = 20 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 61726126
 \end{array}$$

$$\begin{array}{l}
 07 W_1 = \begin{array}{l} \overline{0010} \overline{0000} = 20 \\ \overline{0110} \overline{0010} = 62 \\ \overline{0110} \overline{0101} = 65 \\ \overline{0110} \overline{1100} = 6C \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 2062656C \\
 07 W_8 = \begin{array}{l} \overline{0110} \overline{0100} = 64 \\ \overline{0110} \overline{0001} = 61 \\ \overline{0111} \overline{0010} = 72 \\ \overline{0110} \overline{1001} = 69 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 64617269
 \end{array}$$

$$\begin{array}{l}
 07 W_2 = \begin{array}{l} \overline{0110} \overline{0001} = 61 \\ \overline{0110} \overline{1010} = 6A \\ \overline{0110} \overline{0001} = 61 \\ \overline{0111} \overline{0010} = 72 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 616A6172 \\
 07 W_9 = \begin{array}{l} \overline{0110} \overline{1110} = 6E \\ \overline{0110} \overline{0111} = 67 \\ \overline{1000} \overline{0000} = 80 \\ \overline{0000} \overline{0000} = 00 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 6E678000
 \end{array}$$

$$\begin{array}{l}
 07 W_3 = \begin{array}{l} \overline{0010} \overline{0000} = 20 \\ \overline{0110} \overline{1011} = 6B \\ \overline{0111} \overline{0010} = 72 \\ \overline{0110} \overline{1001} = 69 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 206B7269 \\
 07 W_{10} = \begin{array}{l} \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 00000000
 \end{array}$$

$$\begin{array}{l}
 07 W_4 = \begin{array}{l} \overline{0111} \overline{0000} = 70 \\ \overline{0111} \overline{0100} = 74 \\ \overline{0110} \overline{1111} = 6F \\ \overline{0110} \overline{0111} = 67 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 70746F67 \\
 07 W_{11} = \begin{array}{l} \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 00000000
 \end{array}$$

$$\begin{array}{l}
 07 W_5 = \begin{array}{l} \overline{0111} \overline{0010} = 72 \\ \overline{0110} \overline{0001} = 61 \\ \overline{0110} \overline{0110} = 66 \\ \overline{0110} \overline{1001} = 69 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 72616669 \\
 07 W_{12} = \begin{array}{l} \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 00000000
 \end{array}$$

$$\begin{array}{l}
 07 W_6 = \begin{array}{l} \overline{0010} \overline{0000} = 20 \\ \overline{0111} \overline{0011} = 73 \\ \overline{0110} \overline{0101} = 65 \\ \overline{0110} \overline{0011} = 63 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 20736563 \\
 07 W_{13} = \begin{array}{l} \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} = 00 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} 00000000
 \end{array}$$

$$\begin{aligned} \textcircled{2} W_{14} &= \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} &= 00 \\ \overline{0000} \overline{0000} &= 00 \\ \overline{0000} \overline{0000} &= 00 \end{aligned} \quad \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \text{cccccccc}$$

$$\begin{aligned} \textcircled{1} W_5 &= \overline{0000} \overline{0000} = 00 \\ \overline{0000} \overline{0000} &= 00 \\ \overline{0000} \overline{0000} &= 00 \\ \overline{0000} \overline{0000} &= 00 \end{aligned} \quad \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \text{cccccccc}$$

$$\begin{aligned} \textcircled{7} W_{16} &= W_{16-16} \oplus W_{16-14} \oplus W_{16-8} \oplus W_{16-3} \\ &= W_0 \oplus W_2 \oplus W_8 \oplus W_{13} \end{aligned}$$

$$W_0 = 0111 \ 0011 \ 0110 \ 0001 \ 0111 \ 1001 \ 0110 \ 0001$$

$$W_2 = 0110 \ 0001 \ 0110 \ 1010 \ 0110 \ 0001 \ 0111 \ 0010$$

$$W_8 = 0110 \ 0100 \ 0110 \ 0001 \ 0111 \ 0010 \ 0110 \ 1001$$

$$W_{13} = 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \quad \textcircled{4}$$

$$W_{16} = 0111 \ 0110 \ 0110 \ 1010 \ 0110 \ 1010 \ 0111 \ 1010$$

$$\text{Hexa} = 7 \ 6 \ 6 \ A \ 6 \ A \ 7 \ A$$

$$\begin{aligned} \textcircled{8} W_{17} &= W_{17-16} \oplus W_{17-14} \oplus W_{17-8} \oplus W_{17-3} \\ &= W_1 \oplus W_3 \oplus W_9 \oplus W_{14} \end{aligned}$$

$$W_1 = 0010 \ 0000 \ 0110 \ 0010 \ 0110 \ 0101 \ 0110 \ 1100$$

$$W_3 = 0010 \ 0000 \ 0110 \ 1011 \ 0111 \ 0010 \ 0110 \ 1001$$

$$W_9 = 0110 \ 1110 \ 0110 \ 0111 \ 1000 \ 0000 \ 0000 \ 0000$$

$$W_{14} = 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \ 0000 \quad \textcircled{4}$$

$$W_{17} = 0110 \ 1110 \ 0110 \ 1110 \ 1001 \ 0111 \ 0000 \ 0101$$

$$\text{Hexa} = 6 \ E \ 6 \ E \ 9 \ 7 \ 0 \ 5$$

* Proses HSHA ($t=0$)

$$\textcircled{1} e \leftarrow d = 10325476$$

$$\textcircled{2} d \leftarrow c = 98BADCFE$$

$$\textcircled{3} c \leftarrow \text{CLS}_{30}(b) = b = EFCDBA89$$

$$\text{biternya} : 11101111 \ 11001101 \ 10101011 \ 1000 \ 1001$$

$$\text{lokuskan CLS}_{30} : \overline{01111011} \ \overline{11110011} \ \overline{01101010} \ \overline{11100010}$$

$$7 \ 6 \ 7 \ 3 \ 6 \ A \ E \ 2$$

$$\textcircled{4} b \leftarrow a = 67452301$$

$$\textcircled{1} a \leftarrow (\text{CLS}_5(a) + f_6(b, c, d) + e + w_t + k_t)$$

$\rightarrow \text{CLS}_5(a) \Rightarrow a = 67452301$

Biner \Rightarrow 0110 0111 0100 0101 0010 0011 0000 0001

CLS₅(a) ⇒ 11101000 10100100 01100000 00101100

CLS5 (a) \Rightarrow E 8 A4 60 2C

$$\rightarrow f_t(b, c, d)$$

$$ft(b, c, d) = (b \wedge c) \vee (\sim b \wedge d)$$

[illegible]

$f_k(b, c, d)$

\Rightarrow Brnet = 10011001011010111001111110

Hexa: 9 8 B A D C F E

perhitungan :

$$\text{CLS}_5(a) = \overset{2}{E} \overset{3}{8} \overset{1}{A} \overset{3}{4} \overset{2}{6} \overset{2}{0} \overset{2}{2} \overset{2}{C}$$

$$ff(b, c, d) = 98BA DC \neq E$$

$e = C3 D_2 E1 F0$

wt $\Rightarrow 0 = 7361796$

$$K_t \Rightarrow 0 = 5A8279$$

13 16 12 14

$$A = 13161214$$

B = 67452301

C = 7BF3 6AE2

D = 98BA DCFE

$$E = 10\ 32\ 54\ 76$$

(t=1)

$$0e \leftarrow d = 98BADCFE$$

$$0d \leftarrow c = 7BF36AE2$$

$$0c \leftarrow CLS_{30}(b)$$

$$b = 67452301$$

$$\text{biner} = 01100111 \ 01000101 \ 0010 \ 0111 \ 00000001$$

$$CLS_{30}(b) = 0101 \ 1001 \ 1101 \ 0001 \ 0100 \ 1000 \ 1100 \ 0000$$

$$= 5 \ 9 \ 0 \ 1 \ 4 \ 8 \ C \ 0$$

$$0b \leftarrow a = 13161214$$

$$0a \leftarrow CLS_5(a) + ft(b, c, d) + e + wt + kt$$

$$\rightarrow CLS_5(a) \Rightarrow a = 13161214$$

$$\text{biner} = 00010011 \ 0001 \ 0100 \ 0001 \ 0010 \ 0010 \ 0010 \ 0100$$

$$CLS_5(a) = 0110 \ 0010 \ 1100 \ 0010 \ 0100 \ 0010 \ 0000 \ 0010$$

$$\text{Hexa} = 62 \ C2 \ 42 \ 82$$

$$\rightarrow ft(b, c, d)$$

$$ft(b, c, d) = (b \wedge c) \vee (\sim b \wedge d)$$

b	c	$\sim b$	d	$b \wedge c$	$\sim b \wedge d$	$(b \wedge c) \vee (\sim b \wedge d)$
0	0	1	1	0	1	1
0	0	1	0	0	0	0
0	1	1	1	0	1	1
0	1	1	0	0	0	0
1	0	0	1	0	0	0
1	0	0	0	0	0	0
1	1	0	1	1	0	1
1	1	0	0	1	0	1
0	0	1	1	0	1	1
0	0	1	0	0	0	0
0	1	1	1	0	1	1
0	1	1	0	0	0	0
1	0	0	1	0	0	0
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0	0	1	0	0	0	0
0	1	1	1	0	1	1
0	1	1	0	0	0	0
1	0	0	1	0	0	0
1	0	0	0	0	0	0
1	1	0	1	1	0	1
1	1	0	0	1		

⑥ $e \leftarrow d = 7BF36AE2$

⑥ $d \leftarrow c = 59014800$

① $C \leftarrow CLS_{30}(b)$

→ $b = 13161214$

biner: $\overline{0001}$ $\overline{0011}$ $\overline{0001}$ $\overline{0110}$ $\overline{0001}$ $\overline{0010}$ $\overline{0001}$ $\overline{0100}$

$$CL_{30}(b) = \overline{0000} \overline{0100} \overline{1100} \overline{0101} \overline{1000} \overline{0100} \overline{1000} \overline{0101}$$

Hexa = 04C58485

⑦ $b \leftarrow a =$ E9D574FB

① $a \leftarrow \text{CLS}_5(a) + \text{ft}(b, c, d) + e + \text{wt} + \text{kt}$

$\rightarrow \text{CLS}_5(q) \Rightarrow a = \text{E9D514FB}$

bits = 11101001 11010101 01101000 11110111

$$CL_5(a) = \overline{00111010} \quad \overline{10101110} \quad \overline{10011110} \quad \overline{0111101}$$

Hexa = 2A 4E 9F 7D

$\rightarrow f_t(b, c, d)$

Perhitungan :

CLS5(a) = 2 A A E 9 F T D

$$f(b|a) = 797168E2$$

c = 98BA DC7E

$$W_t(2) = 616A \ 6172$$

$$kt(2) = 5A827999 +$$

0947 C068

A = 0947 C0 68

B = E9D5 74 FB

$$C = 0.4058485$$

D = 59D1 48C0

$$E = 7B736AEO$$

Marka ft (b.c. d)

Header: 0111 1001 111 0001 0110 1000 1110 0010

Hex : 7 9 F 1 6 8 E 2

(b)

t	A	B	C	D	E
t=0	13161214	67452301	7B736AE2	98BA0CFE	10325476
t=1	E9D574FB	13161214	59D148C0	7B736AE2	98BA0CFE
t=2	0947C068	E9D574FB	04C58485	59D148C0	7B736AE0

(c) Hitung Message Digest

$$* h_0 = h_0 + A = 67452301$$

$$0947C068 +$$

$$708CE369$$

$$* h_1 = h_1 + B = EFCDABE9$$

$$E9D574FB +$$

$$09A32084$$

$$* h_2 = h_2 + C = 98BA0CFE$$

$$04C58485 +$$

$$9D806183$$

$$* h_3 = h_3 + D = 10325476$$

$$59D148C0 +$$

$$6A039D36$$

$$* h_4 = h_4 + E = C3D2E1F0$$

$$7B736AE2 +$$

$$3FC64CD2$$

Message Digest : 708CE369D9A320849D8061836A039D363FC64CD2