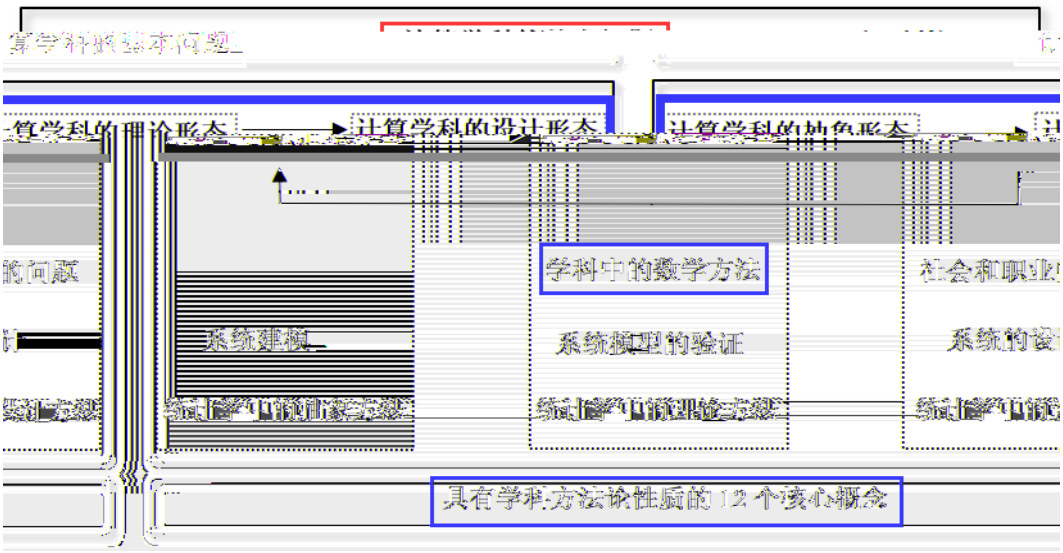
科学思维-样例：RSA 公开密钥密码系统

元认知知识

创造

1.



1976 Whitfield Diffie

Martin Hellman Diffie Hellman key exchange DH
New Directions in Cryptography

1978 R. L. Rivest A. Shamir
L. M. Adleman *A Method for Obtaining Digital Signatures and Public-Key Cryptosystems*
RSA RSA
RSA
2002

RSA=<*p*, *q*, *n*, *m*, *e*, *d*, *k*, *c*>

1 *p*, *q*, *n*, *m*, *e*, *d*, *k*, *c* *Z**, *Z**={1,2,3, }
2 *p*, *q* $n = p \times q$
3 (*e*, *n*): (*d*, *n*):
4 *m*: $m < n$
5 *c*:
6 $k(m^{k(p-1)(q-1)} (\mathrm{mod}\ n)) = 1$
7 $k(\ ed = k(p-1)(q-1)+1)$
8 $c = m^e (\mathrm{mod}\ n)$
9 $m = c^d (\mathrm{mod}\ n)$

1 *p*, *q*
2 *e* *e* $(p-1)(q-1)$ $0<e<(p-1)(q-1)$
3 *d* $k(\ ed = k(p-1)(q-1)+1)$

3. RSA
1 *m* $c = m^e (\mathrm{mod}\ n)$
2 *c* $m = c^d (\mathrm{mod}\ n)$

RSA (*e*, *n*) (*d*, *n*) *p* *q*

$k(m^{k(p-1)(q-1)} (\mathrm{mod}\ n)) = 1$ CS

例 *p*=3, *q*=11, $n = 3 \times 11 = 33$
m=2 *m*<*n* , *k*=1
$m^{k(p-1)(q-1)} (\mathrm{mod}\ n) = 2^{1\times(3-1)\times(11-1)} (\mathrm{mod}\ 33)$
$= 2^{20} (\mathrm{mod}\ 33)$
$= 1\ 048\ 576\ (\mathrm{mod}\ 33)$

= 1

m=2 $m<n$, k=2 Ä

$m^{k(p-1)(q-1)} \pmod n = 2^{2\times(3-1)\times(11-1)} \pmod{33}$

$= 2^{40} \pmod{33}$

$= 1\,099\,511\,627\,776 \pmod{33}$

= 1

m=2 $m<n$, k=3

$m^{k(p-1)(q-1)} \pmod n = 2^{3\times(3-1)\times(11-1)} \pmod{}$

p=11, q=13	RSA	9