Computer Science 50

Introduction to Computer Science I

Harvard College

Week 2

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Or fher gb qevax lbhe binygvar!

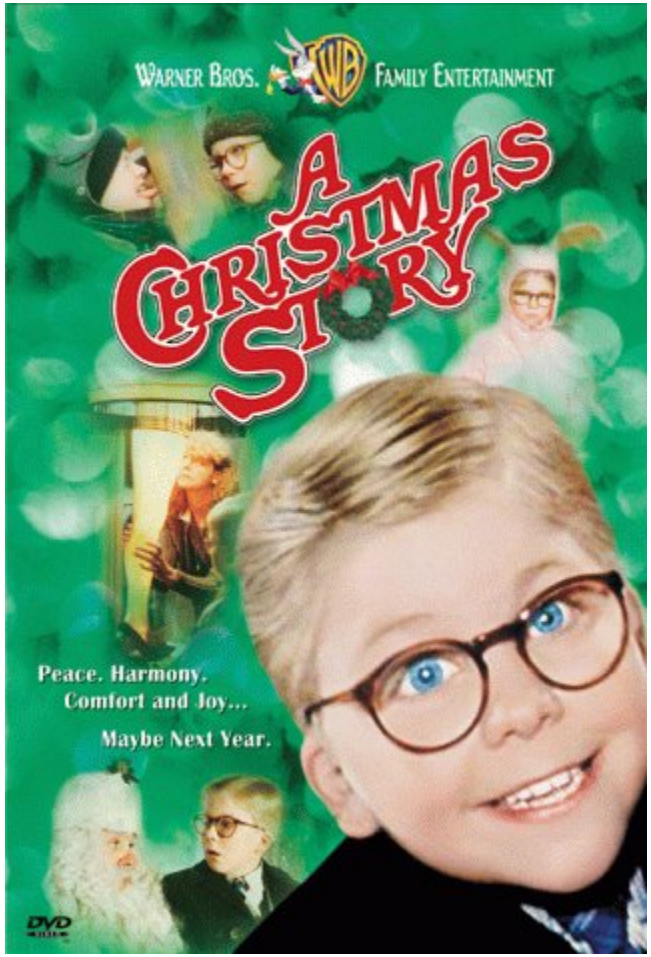


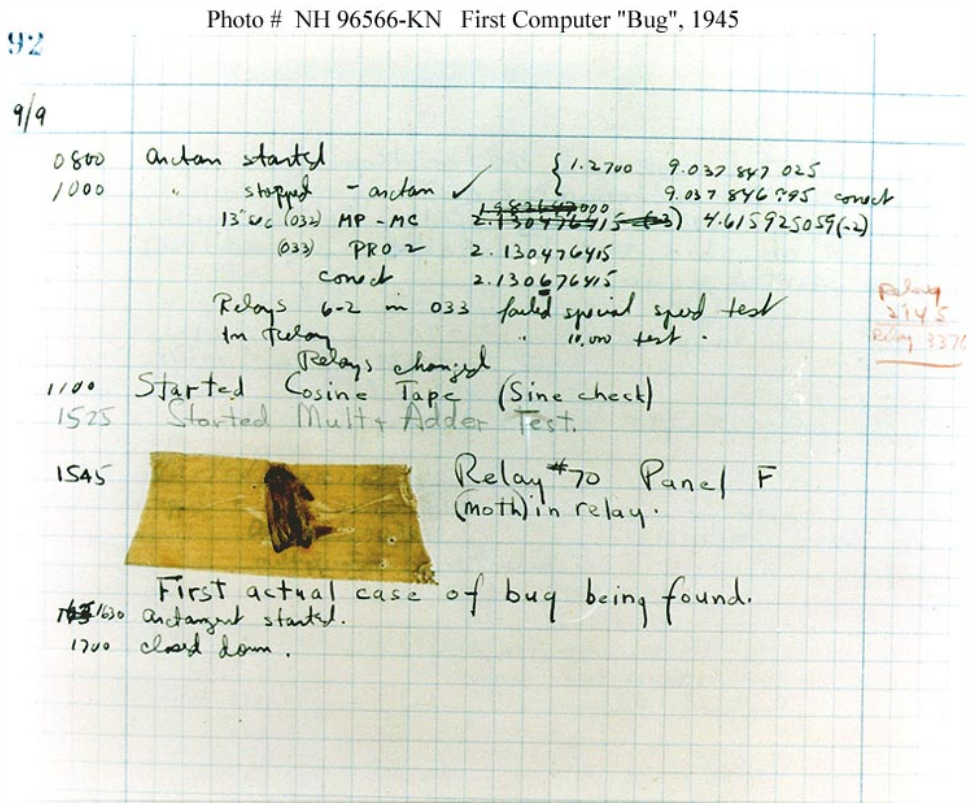
Image from http://www.questexperiences.com/quest2/movieadventures/default.asp.

How to Write a Program in...

- C++
- Java
- LISP
- Perl
- PHP
- ...

see
`hello.{cc,lisp,php,pl}, Hello.java`

Bugs



see
`buggy{1,2}.c`

Image from http://www.history.navy.mil/.

Casting

```
int i = (int) 'A';
char c = (char) 65;
```

see
ascii{1,2,3}.c, battleship.c

Functions

Parameters and Arguments

99 bottles of beer on the wall,

99 bottles of beer,

Take one down, pass it around,

98 bottles of beer on the wall.

see
`beer{1,2,3,4}.c`

Image from http://z.about.com/d/tvcomedies/1/7/n/5/-/-/homer_simpson.jpg.

Functions

Scope, Local Variables, Temporary Variables

```
void
swap(int a, int b)
{
    int tmp;

    tmp = a;
    a = b;
    b = tmp;
}
```

see
buggy3.c

Functions

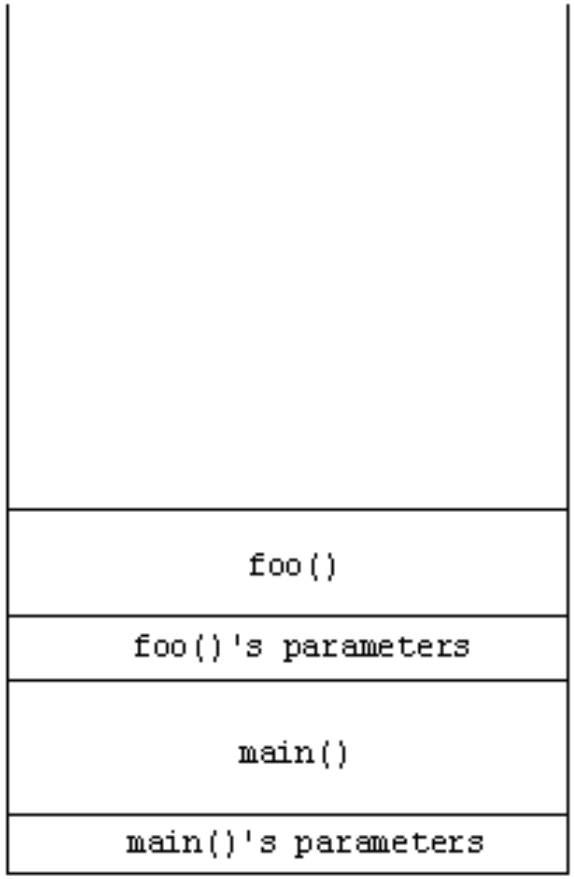
Scope, Global Variables

```
void
increment()
{
    x++;
}
```

see
buggy4.c, global.c, buggy5.c

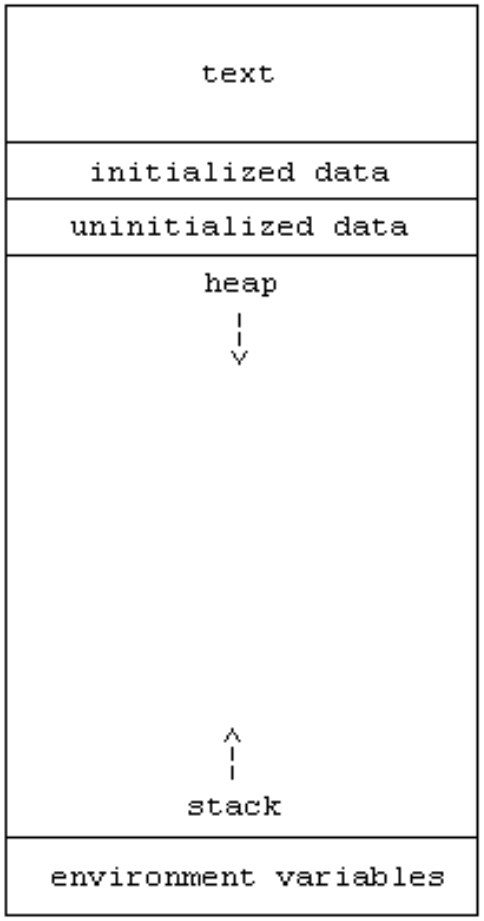
The Stack

Frames



Memory Management

Sneak Preview



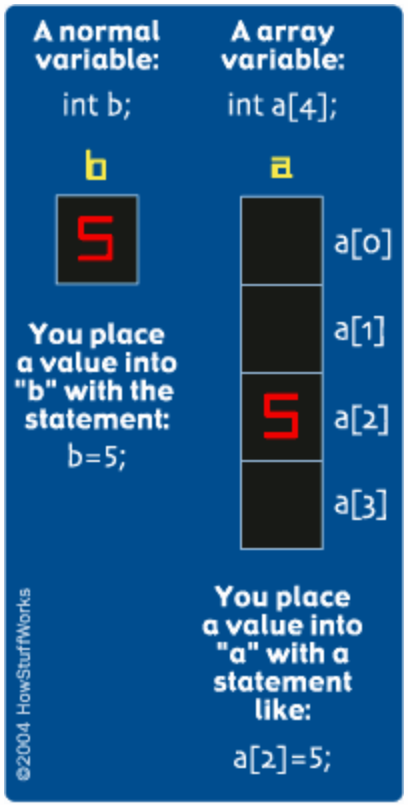
Functions

Return Values

```
int
cube(int a)
{
    return a * a * a;
}
```

see
`return{1,2}.c`

Arrays



see

`array.c, buggy6.c, string{1,2}.c, capitalize.c`

Image from http://computer.howstuffworks.com/c10.htm.

Wonderful (Free) Resources

Use These!

http://www.cppreference.com/

http://www-ccs.ucsd.edu/c/

Command-Line Arguments

`argc, argv`

```
int main(int argc, char * argv[]);
```

see
`argv{1,2}.c`

CS 50's Library

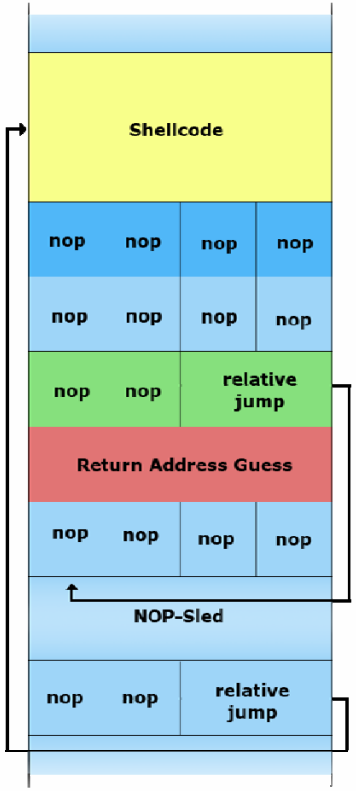
(Memory Leaks)

- `bool`
- `string`

- `char GetChar();`
- `double GetDouble();`
- `float GetFloat();`
- `int GetInt();`
- `long long GetLongLong();`
- `string GetString();`

see
`cs50.{c,h}`

“Security flaw lets hackers pwn iPhone”



Images from http://www.mobiletracker.net/archives/images/apple-iphone-in-hand.jpg
and http://en.wikipedia.org/wiki/Buffer_overflow

Cryptography

Radio Orphan Annie's Decoder Pin

Or fher gb qevax lbhe binygvar!

Image from http://www.radioarchives.org/annie/.

Cryptography
Enigma Machine

Image from http://www.kinoweb.de/film2000/U-571/film05.php3.

Cryptography

Enigma Machine

Image from http://en.wikipedia.org/wiki/Enigma_machine.

Cryptography

Secret (Symmetric) Keys

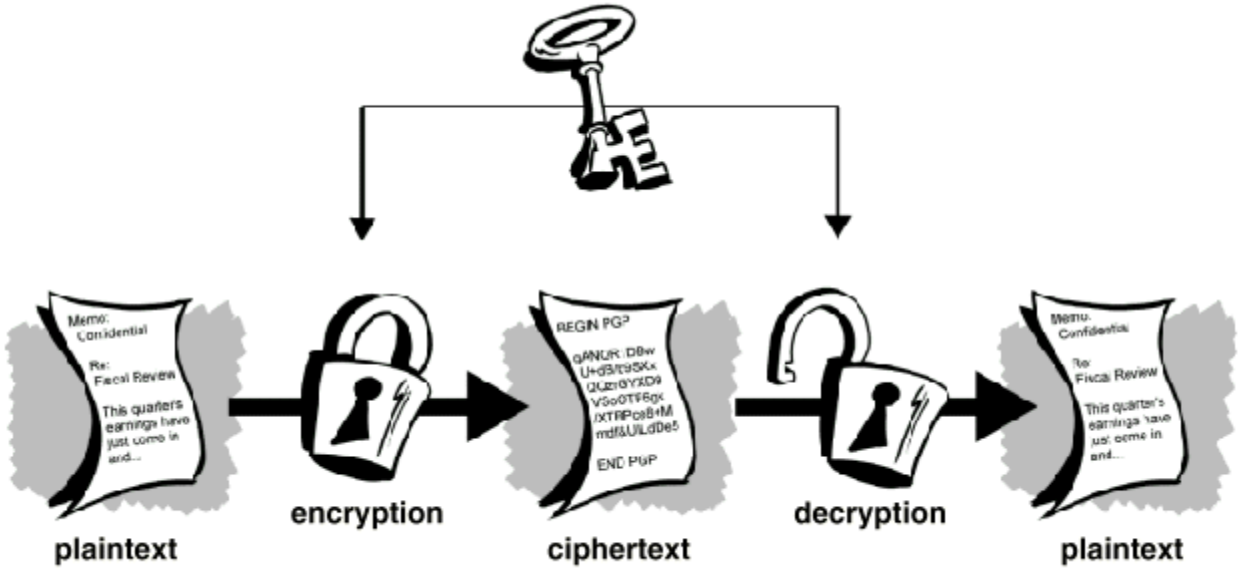


Figure from http://www.nuitari.de/crypto.html.

Cryptography
Caesar Cipher

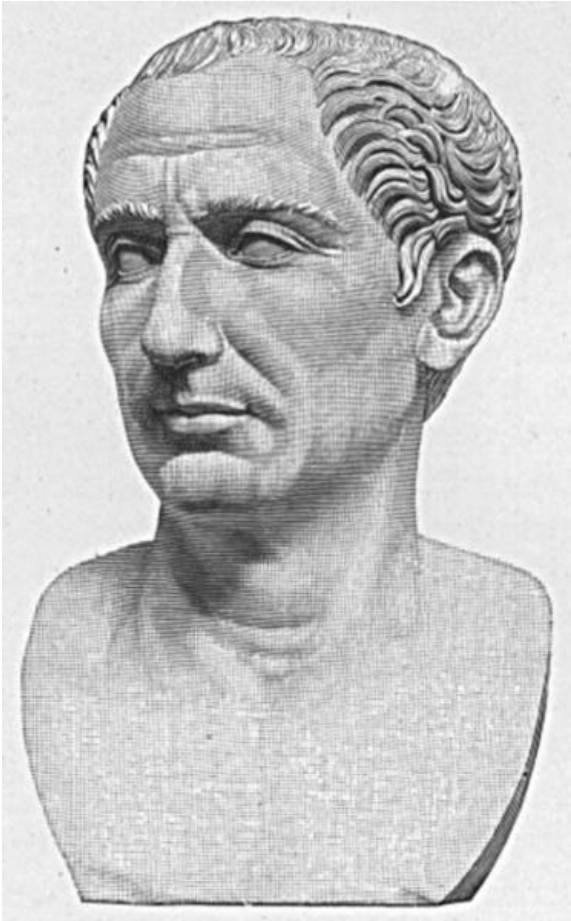


Image from http://commons.wikimedia.org/wiki/Image:Hw-caesar.jpg.

Cryptography

Caesar Cipher

$$c_i = (p_i + k) \% 26$$

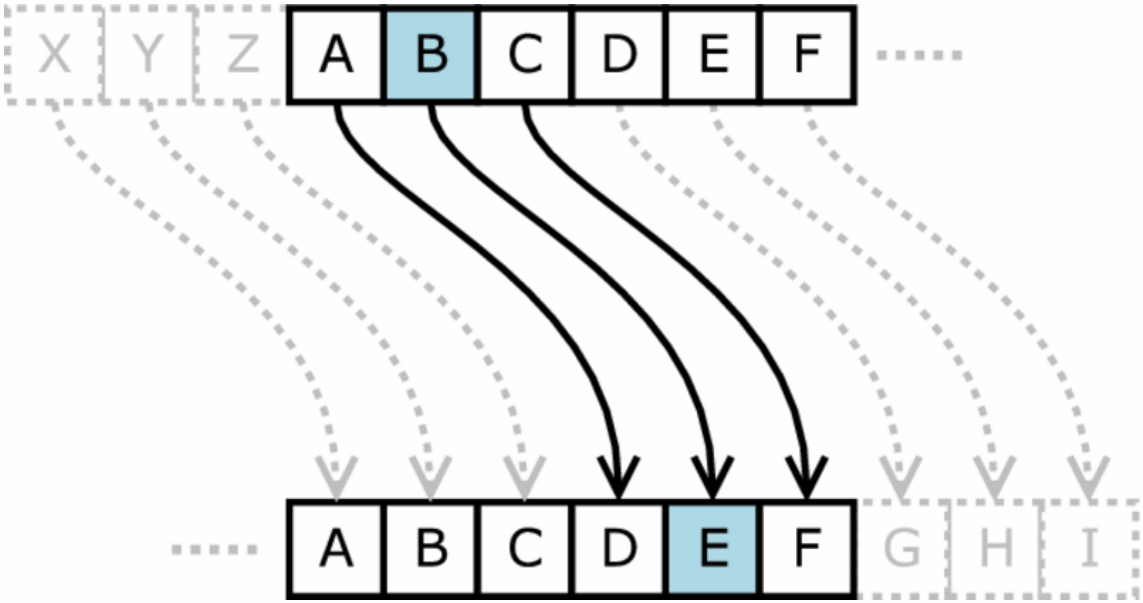


Image from http://en.wikipedia.org/wiki/Caesar_cipher.

Cryptography

Vigenère Cipher

$$c_i = (p_i + k_i) \% 26$$

p	H	E	L	L	O	,		W	O	R	L	D
	+	+	+	+	+			+	+	+	+	+
k	F	O	O	B	A			R	F	O	O	B
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
c	M	S	Z	M	O	,		N	T	F	Z	E

Cryptography

DES

72,057,594,037,927,936

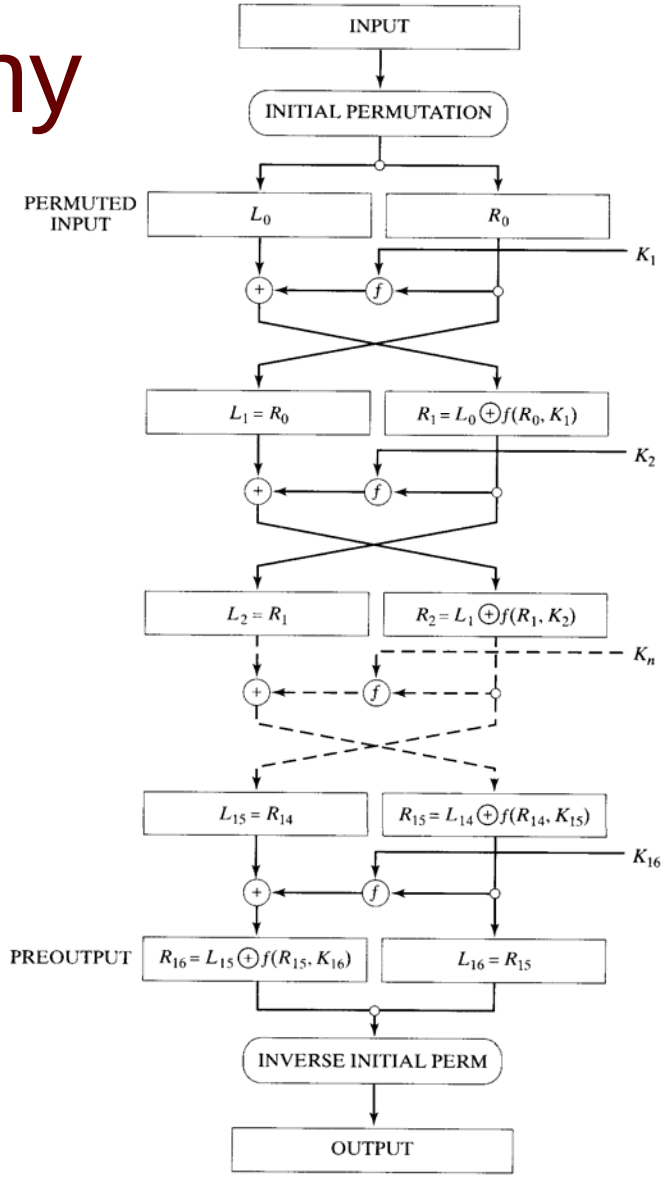


FIGURE 3–14 DES.

Figure from Larry Nyhoff's *C++: An Introduction to Data Structures*

Cryptography

Public and Private (Asymmetric) Keys

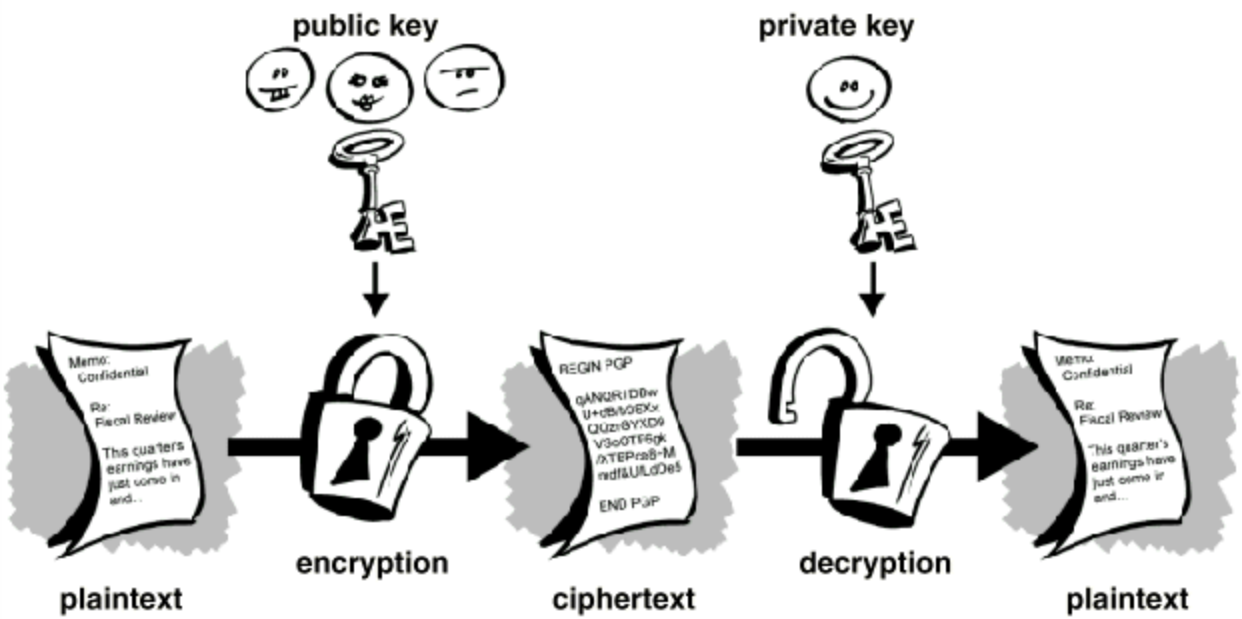


Figure from http://www.nuitari.de/crypto.html.

Cryptography

PGP


```
-----BEGIN PGP PUBLIC KEY BLOCK-----
Version: PGP Key Server 0.9.6

mQGiBEFMqoURBADaifCKsYkPBmVSMvspdLHLIAsb0xe4cyOieCA5LQCUZi9Z+Yxu
OSMkbQ+VSAvtP31/7o9pNf6LsLU4ADA5knZVB+GfZZpiGnEd62qKDKNpjVo20NRH
Xcd/4RpxE6aJWUWe2tPqLSCi3NFLPEhnfo5v9WyLRHjqdIQKc6vGAT41BQCg/5/1
vNpKhyA6VrFDIuozNWqKpAUD/1lAHxPxfxLyn8K/Gv/wl0y97dRDq0vsRqkh57IT
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DRjIA/9vOO/MZ7FspAW1ZOdC13CxVSnig4oALGbNf76RViFGO10bByVLVlBxMiIl
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Wy1i8jXNzEfyFsqmJ0RKfrzJe7jXX34ZMfbPc3r39eR4w9lo+bQmUm9uYWxkIEwg
Uml2ZXN0IDxyaXZlc3RAY3NhaWwubWl0LmVkdT6JAEYEEBECAAYFAkFMquoACgkQ
5DGedS1eYN7UGACgzEZmCLhzzVz2kc3/5curi183AiMAn3NOJx6SJOL3n2fNAAar
7B5M0z9ZiQBGBBARAgAGBQJBTK1BAAoJEKXuoAZz/b3Wi9oAoPYpdchyMLydUjzh
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wIaPdxXaS5HfEsDdwPC4rUigIg3wU7unWq8zKGy8gx+I0XgPvkUmdwb+vCZ0Zrl0
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PEXpzQ5H4i7PEqk+phVxiEhbLZbddz1y0ZK/5dub5ci5mCwGZBVb9XTecZruwOe7
ptWIvBvYhGBltUUfSF4wEwvoaxcC6EzFRpEqBRm+tgcgcfwU1V9oywoMhLQwB9LD
VjnNkRoNuaEa2o8CnheehNU05NSASsSo4z2WWbkRGErZZaWiafLe+XhDC+hImWwO
dL5ZatkQ5qJp3GuFW0FldqaYJLY1KNn9P+cpLhPEq5Hq27vcULDa1L5AMnKIbusS
SrRP9MhWiQBMBBgRAgAMBQJBTKqFBQkCak+AAAoJEIdenepUv6CUbCkAn13adk2J
HcZLgEhuNLZPTye4iNgRAKCtq+gBowVJ761YhVK2NMBi+8B3sw==
=j2zM
-----END PGP PUBLIC KEY BLOCK-----
```


Ron Rivest's public key from http://pgp.mit.edu/.

Cryptography

RSA

Public Key: (e, n)

Private Key: (d, n)

To Encrypt

$c = p^e \bmod n$

To Decrypt

$p = c^d \bmod n$

Ron Rivest's public key from http://pgp.mit.edu/.

Cryptography

RSA: Generating Keys

1) Choose 2 large primes, p and q.
2) Compute $\underline{n} = p \times q$.
3) Choose $\underline{e}$ that's coprime to $[(p - 1) \times (q - 1)]$.
4) Compute $\underline{d}$ s.t. $(e \times d) \% [(p - 1) \times (q - 1)] = 1$.

Ron Rivest's public key from http://pgp.mit.edu/.

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Week 2

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