Announcements

A review sheet (for material since the last exam) will be available by Wednesday

The final exam will be comprehensive, but weighted a bit more towards new material since the previous exams

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Security

Encryption encodes information to hide it from everyone else … maintaining your privacy

Security Basics

Security Worries --

- Reading info as its being transmitted
- Mischief on computer: erasing files, etc.
- Gather key info to impersonate you
- If others have your info, they can misuse it or "provide it" to unqualified persons

Security is a serious problem, and only you can prevent the loss of your info

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What Can Happen?

Viruses & worms are common ways for malicious software to enter computer

- Virus--malicious SW riding in on other SW
- Worm--SW purposely transmitting itself

Worms usually travel by attachments to email: .exe, .zip, .dmg, …

- Open attachments only if you know the sender and trust him/her

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Phishing

Stealing your information is easiest if people give it up voluntarily

- Goal: SSN, Bank Acct. #, Security Info for purposes of identity theft
- Technique: Send SPAM that looks like legit mail from bank, credit union, govt. … claiming it must verify your information
- The whole thing is a spoof trying to get you to give up private information

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Spyware

Spyware is software designed to set up shop on your computer to steal information or computer services

- Spyware most often rides along with downloads; be wary of
  - Music and video downloads
  - Software downloads

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Major Protection

You must run virus protection software to keep your computer safe

- It's easy to install and worth the $$
  - (Free to everyone at UW)
- Keep it current
- Don't open attachments

• Other concerns

- Disable 3rd party cookies
- Don't answer phishing scams
- Get music & SW from reputable sources

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Maintaining Privacy

To keep information private it must be hidden from "prying" computers

As children, most of us used "secret" codes

Most often the code was a Caesar Cipher -- an alphabetic shift by a constant amount

Clear Text: ABCDEFGHIJKLMNOPQRSTUVWXYZ
Encode ↓ ↑ Decode
Coded Text: IJKLMNOPQRSTUVWXYZABCDEFGH

LW VWB AXG WV CAI

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Breaking Caesar Cipher

Fixed substitutions don't work, 'cause letters have a known distribution

- In a large text, count the frequency of each letter, match the results to distribution
- The twelve most frequent letters account for 80% of English text
- ETAOINSHRDLU

A*ERI*A THE *EAUTI*UL

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Encryption Issue

Traditionally, encryption technology has been "breakable" with effort

- Breakable codes let law enforcement and governments watch criminals and spies
- Codes are good enough for the honest

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⇒New computer encryption is unbreakable⇐

- It's called "strong encryption" … should it be legal to be able to keep secrets absolutely?

Strong encryption: serious issue of public interest

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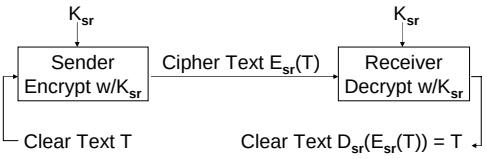
General Encryption Setup

Encryption is most important when sending information



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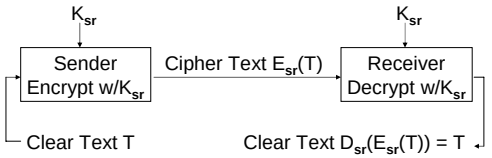
Problem: Key Exchange

To communicate securely, users must meet before sending/receiving

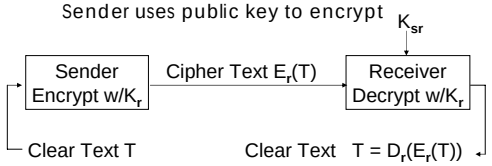


This doesn't work for eCommerce

Revise Encryption Setup

Public Key Encryption is based on publishing the key

Sender uses public key to encrypt



RSA Encryption

Rivest, Adelman and Shamir invented a PKC scheme called RSA

- The secret is to pick the key, K_r, right
- Pick two prime numbers -- numbers divisible only by themselves and 1 -- that are 2 greater than a multiple of 3 ... weird!
- Examples are 5, 11, 17, 23, 29, ...
- $K_r = p \cdot q$ so that it is 129 digits

Follow procedure given, send remainders

What Makes RSA Work?

Though the numbers get huge, computer can handle them quickly

- These codes are strong because breaking them needs s, which needs p, q, which means factoring K_r
- Factoring is computationally tough -- best methods are only somewhat better than grammar school, "try all small primes"
- Picking 129 digit key, means no computer can factor it ... so the code is unbreakable

RSA Challenge

After inventing their scheme (1977), RSA challenged people to break it

- Their first key was broken in 1994 using 1000 computers over 8 months
- Their secret message: THE MAGIC WORDS ARE SQUEAMISH OSSIFRAGE

Doomed? No. There are many other 129 digit keys, or if people get nervous make 200 digit keys or more ... breaking gets harder very fast; encrypt/decrypt doesn't

Is Strong Encryption Smart

Should we allow people to use strong encryption? Or should only breakable codes be legal?

- It hampers law enforcement and security
- Most criminals reveal plans in other ways
- PKC exists and is known, so build in escape
  - -- Trap door
  - -- Key Escrow
- But are these schemes really secure?
- And what about "good" reasons for keeping secrets?