Announcements

- Check class announcements daily
- You must implement programming projects by yourself
Security (Email)

- Least secure of internet protocols
- Avoid sending sensitive information (e.g., passwords) over e-mail
- Provide e-mail addresses in web sites in a way is not easily recognized by spam programs
  - Use at rather than @
  - Put an image with the e-mail
  - Avoid mailto
- Encrypt the message using PGP (Pretty Good Privacy) or GPG (GNU Privacy Guard)
- [http://www.wbwip.com/wbw/emailencoder.html](http://www.wbwip.com/wbw/emailencoder.html)
Security (Password-Protected Sites)

- **Approach not recommended**
  - Store encrypted password
  - Decrypt password and compare against user provided password
- **Better approach**
  - Store encrypted password
  - Encrypt provided password and compare against stored password
Security (Encryption)

- **Encryption** → process of converting plaintext into ciphertext
- **Decryption** → process of converting ciphertext into plaintext
- **Symmetric cryptography** → sender and receiver share the same key
- **Asymmetric (Public Key) cryptography** → sender and receiver have different, complementary keys

**Symmetric cryptography**
- Relatively fast compared to asymmetric

**Drawbacks**
- Keys must be change frequently
- How to distribute the key safely
Security (Encryption)

- Branches of public key cryptography
  - Public key encryption
  - Digital signatures
- Public key Encryption
  - Example algorithm: RSA
  - Relatively slowed compared to symmetric
  - How it works?
    - Each user has a public/private key pair.
    - Public key is widely known
    - Private key only known by user that generated it
    - If user A wants to send user B a message, user A encrypts message with B’s public key. B will decrypt the message with B’s private key. The only way to decrypt the message is by using B’s private key
- Digital signature
  - Message signed with sender’s private key can be verified by anyone with sender’s public key thereby proving message authenticity
Digital Certificates (Certificates)

- **Digital Certificates** → electronic documents that contain information about a public key and the owner (name, address, etc.)
- Employed to verify a public key corresponds to a particular organization
- Certificates must be issued by a trusted third party known as certificate authority (CA) which guarantees the information is correct

**About certificates**
- Have a validity period and can expire
- They can be revoked
- Browsers have a collection of root certificates
  - In Firefox – Tools → Options → Advanced → View Certificates
- Main standard X.509
Message Digests

- Message digest $\rightarrow$ fixed-length representation of a message
- Expected properties for message digest (“Hashing”) algorithm
  - Original message cannot be obtained from the digest
  - Two different messages should have different digests
- Example algorithms: MD5 and SHA
Need For Security

- **SSL (Secure Sockets Layer) Protocol** → Protocol that enable us to satisfy the need for security in client-web server transactions
- The algorithm provides support for confidentiality, integrity and authentication
- **SSL connection is established as follows:**
  - User connects to web server through the browser
  - Browser and server exchange public keys and certificate information
  - Browser checks server certificate validity (certificate not expired, issued by CA, etc.)
  - Optional: server can request a valid certificate from the client
  - Using public keys server and client determine a symmetric key to use
  - Communication from this point on is through symmetric cryptography
**https**

- **https →** http where
  - A different default port (443) is used
  - An extra layer of encryption/authentication exists between HTTP and TCP
- **https →** is not a separate protocol but a combination of HTTP over encrypted SSL or TLS transport mechanism
- **TLS →** Transport Layer Security
  - IETF standard designed to standardize SSL as an Internet protocol
  - Slight differences between SSL 3.0 and TLS 1.0
Social Consequences of Security

- Recent report on how social security numbers can be predicted
- Confidentiality of medical information
- National Security Information
- What other scenarios can you think of?
Security Sites

- www.securityfocus.com/
- www.cert.org/