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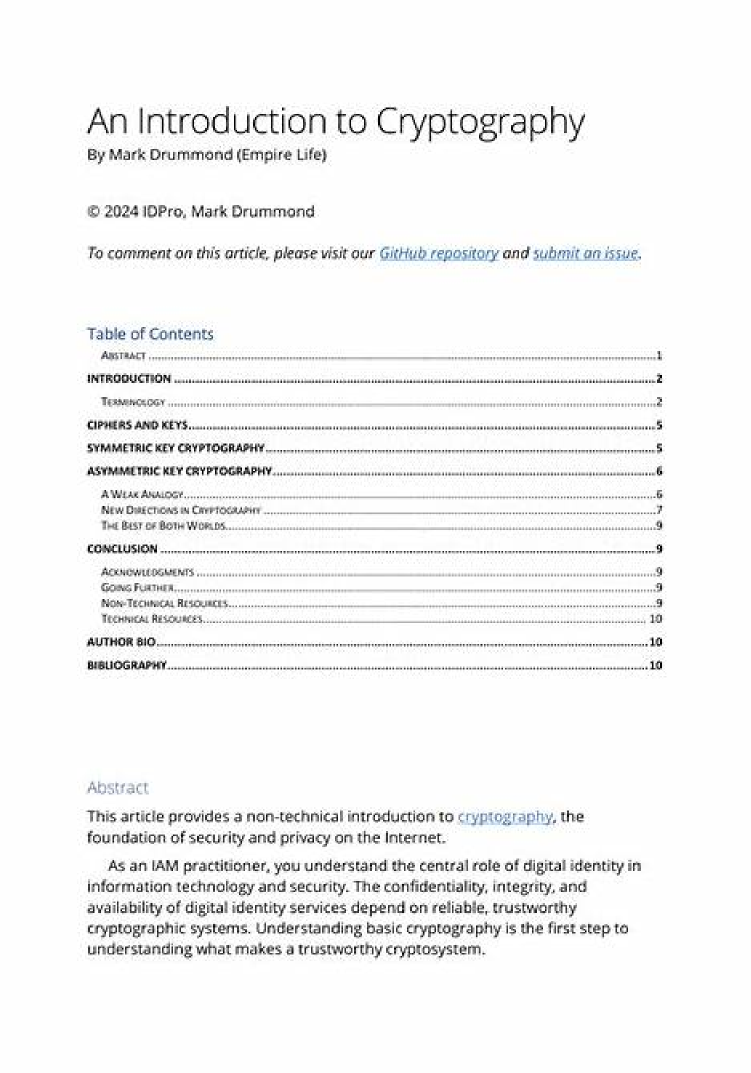

An Introduction to Cryptography

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Abstract


This article provides a non-technical introduction to cryptography, the foundation of security and privacy on the Internet.

As an IAM practitioner, you understand the central role of digital identity in information technology and security. The confidentiality, integrity, and availability of digital identity services depend on reliable, trustworthy cryptographic systems. Understanding basic cryptography is the first step to understanding what makes a trustworthy cryptosystem.


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## WGU Introduction to Cryptography HNO1 Sample Questions (Q55-Q60):

**NEW QUESTION # 55**
(Which cryptographic operation uses a single key?)

- A. Padding
- B. Symmetric
- C. Hashing
- D. Asymmetric

**Answer: B**

Explanation:
Symmetric cryptography uses a single shared secret key for both encryption and decryption. This contrasts with asymmetric cryptography, which uses a key pair (public/private). Symmetric algorithms (like AES, ChaCha20) are efficient and well-suited for bulk data encryption, but they require a secure method for key distribution because both parties must possess the same secret. Hashing is not a keyed operation by default (though HMAC is keyed); it maps arbitrary data to a fixed-size digest and is primarily used for integrity checking, fingerprints, and password hashing constructions. Padding is a data formatting technique (e.g., PKCS#7) used to align plaintext to a block size; it is not a cryptographic "operation" that uses a key. Therefore, the cryptographic operation characterized by using one key shared between parties is symmetric encryption. In real systems, symmetric encryption is frequently combined with asymmetric methods for key exchange and with MACs/AEAD for integrity, producing the standard hybrid approach used in protocols like TLS and IPsec.

**NEW QUESTION # 56**
(Which type of network were VPN connections originally designed to tunnel through?)

- A. Encrypted
- B. Private
- C. Protected
- D. Public

**Answer: D**

Explanation:
A VPN (Virtual Private Network) is designed to create a secure, private communication channel over an otherwise untrusted or shared infrastructure. Historically and conceptually, VPNs were built to allow organizations and users to transmit sensitive traffic across the public Internet while maintaining confidentiality, integrity, and authenticity. The "virtual" aspect means the network behaves like a private link, but the underlying transport is typically a public network where attackers could potentially observe or tamper with traffic. VPN technologies such as IPsec and SSL/TLS-based VPNs encapsulate packets and apply encryption and authentication so that the payload and session metadata are protected even when traversing public routing domains. Options like "encrypted" and "protected" describe properties of the VPN tunnel itself rather than the underlying network it traverses; the VPN provides encryption/protection precisely because the medium is not inherently secure. "Private" would describe a dedicated internal network, which generally does not require a VPN to achieve basic confidentiality. Therefore, VPNs were originally designed to tunnel through public networks.

**NEW QUESTION # 57**
(A company wants to use certificates issued by a root CA to demonstrate to customers that it is a legitimate company being hosted by a cloud provider. Who needs to trust the root CA public key?)

- A. The buyer and the Federal Trade Commission
- B. The cloud provider and the seller
- C. The seller and the buyer
- D. The Federal Trade Commission and the cloud provider

**Answer: C**

Explanation:
In a public key infrastructure, trust in a certificate ultimately depends on the relying party's trust anchor set-typically the root CA certificates preinstalled in a customer's browser/OS trust store. For customers to accept the company's certificate as legitimate, the buyer (customer) must trust the root CA public key (or an intermediate chained to it) so they can validate the certificate chain and signatures. The seller (the company) also must trust and rely on the root CA public key to build and present a valid chain and to make operational decisions based on that CA's issuance and revocation mechanisms; practically, the seller selects a CA whose root is widely trusted by customers. The cloud provider's trust is not what makes the certificate valid to customers; the provider may terminate TLS or pass traffic through, but customer validation is based on the chain to a trusted root. Government agencies like the FTC are not part of the cryptographic trust path for TLS certificate validation.
Therefore, among the given options, the correct pairing is the seller and the buyer, reflecting both the issuer selection/usage by the company and the relying-party validation by customers.

**NEW QUESTION # 58**
(What describes how Counter (CTR) mode encryption functions?)

- A. Converts the block cipher into a stream cipher, then uses a counter value and a nonce to encrypt the data
- B. Uses a self-synchronizing stream cipher where the IV is encrypted and XORed with the data stream one bit at a time
- C. Uses an IV to encrypt the first block, then uses the result of the encryption to encrypt the next block
- D. Encrypts each block with the same key, where each block is independent of the others

**Answer: A**

Explanation:
CTR mode turns a block cipher (like AES) into a stream-like construction by generating a keystream from successive encryptions of a changing input block. Specifically, CTR forms input blocks using a nonce (unique per message) combined with an increasing counter. Each nonce||counter block is encrypted with the block cipher under the shared key, producing a pseudorandom output block. That output is then XORed with plaintext to yield ciphertext (and XORed with ciphertext to recover plaintext). This design enables parallelization (blocks can be generated independently), efficient random access decryption, and avoids chaining dependencies seen in modes like CBC. Option B describes CFB-like behavior; option C describes ECB; option D describes CBC. CTR's security critically depends on never reusing the same nonce/counter sequence with the same key, because reuse would repeat keystream blocks and expose plaintext relationships. Therefore, the correct description is that CTR converts the block cipher into a stream cipher using a counter value and a nonce.

**NEW QUESTION # 59**
(Which mode of encryption converts data into a stream encryption and then uses a counter value and a nonce to encrypt the data?)

- A. Counter (CTR)
- B. Cipher Feedback (CFB)
- C. Cipher Block Chaining (CBC)
- D. Electronic Codebook (ECB)

**Answer: A**

Explanation:
CTR (Counter) mode converts a block cipher into a stream-like encryption method by generating a keystream from encrypted counter blocks. The core idea is to construct a sequence of input blocks using a nonce (unique per message/session) plus an incrementing counter. Each nonce||counter block is encrypted with the block cipher under the shared key; the output is a pseudorandom block that is XORed with plaintext to produce ciphertext. Decryption repeats the same keystream generation and XORs with ciphertext to recover plaintext. CTR offers practical benefits: it is highly parallelizable, supports precomputation of keystream blocks, and allows random access to any block without needing previous blocks (unlike CBC). ECB and CBC are block modes that do not use nonce+counter keystream generation. CFB is a feedback mode that can behave stream-like, but it does not use the explicit counter/nonce construction characteristic of CTR. CTR's security hinges on never reusing the same nonce/counter sequence with the same key, because that would reuse the keystream and enable XOR-based plaintext recovery. Therefore, the correct mode is Counter (CTR).

**NEW QUESTION # 60**
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