COMP4108 Final Exam Practice

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Contents

1 Preamble

1.1 Textbook

- here is a link to "Tools and Jewels"

1.2 General

1. Please follow the provided format
2. We should prioritize the mock exam over notes

Part I

Mock Exam

1 Basic Concepts and Principles

1. Provide definitions for the following:

   a) Confidentiality

   b) Data integrity

   c) Authentication

   d) Authorization

   e) Availability

f) Accountability

2. Briefly explain how repudiation violates accountability.

3. Describe the difference between a *trusted* and *trustworthy* actor.

4. Compare and contrast *privacy*, *protection*, and *anonymity*.

5. Come up with a simple example of a security policy for a house and describe a way it might be violated.

6. Label each number in Figure 1.1 using the following terms:

a) target asset

b) vulnerability

c) attacker

d) attack vector

e) threat agent

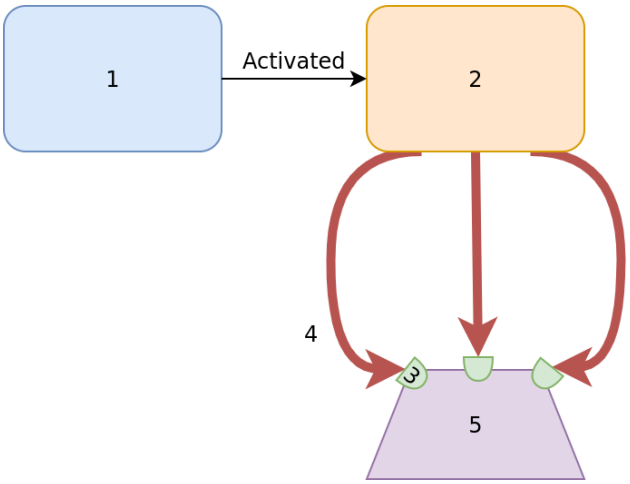


Figure 1.1

7. Draw a state machine diagram of a system's transition from a secure state to either a secure state or an insecure state.

8. Compare and contrast quantitative and qualitative risk assessment. Consider the advantages and disadvantages of each, as well as how each might work in theory/practice.

Qualitative	Quantitative

9. Consider $R = T \times V \times C$.

   a) What is this equation for?

   b) Describe each variable in this equation. How does each variable relate to the equation's purpose?

   c) Which two variables may be combined into P? What does the simplified equation look like? What does P represent?

10. Describe two risk assessment challenges.

11. Which of the following is not an adversary attribute?

    a) objectives

    b) outsider/insider

    c) methods

    d) funding level

    e) capabilities

    f) attack vector

12. What is a categorical schema? How is it different from a capability-level schema?

13. Compare and contrast a formal security evaluation with penetration testing.

Formal Security Evaluation	**Penetration Testing**

14. What is white-box pen testing? Black-box?

15. Consider STRIDE. What does each letter stand for?
    a) S:
    b) T:
    c) R:
    d) I:
    e) D:
    f) E:

16. Draw a tree model for compromising the password to a bank account. Include at least three leaf nodes.

17. Is it possible to completely test a comprehensive (and practical) set of security mechanisms for a system? Why or why not?

18. Explain the observability (or lack thereof) of security in the context of *negative goals*.

19. Assurance in security is best described as which of the following?

a) Simple, effective

b) Difficult, partial

c) Simple, practical

d) Difficult, complete

e) None of the above

2 Cryptographic Building Blocks

20. Suppose Alice encrypts a message to Bob using $E_k(m) = c$. How does Bob decrypt the message?

21. What is an exhaustive key search? What does the attacker try to do? Is this the worst case for attacking a cryptosystem?

22. Label each of the following attacks as either an action by an *active* or a *passive* adversary. Once you have labeled the attack, describe it.

a) Known plaintext attack

b) Ciphertext only attack

c) Chosen plaintext attack

d) Chosen ciphertext attack

23. What is the main advantage of a one-time pad? Describe three disadvantages. Why are one-time pads not used?

24. What is the current standard for block ciphers?

25. Describe a situation in which we would need to use a stream cipher. Why can't you use another type of cipher?

26. What is a mode of operation used for?

27. What is one major flaw with the ECB mode of operation?

28. Draw a picture of the CBC mode of operation.

29. Draw a picture of the CTR mode of operation.

30. If Alice wants to send a message to Bob using public-key encryption, _____ is used to encrypt and _____ is used to decrypt.

a) Bob's private key, Alice's public key

b) Bob's public key, Alice's private key

c) Bob's public key, Bob's private key

d) Alice's private key, Alice's public key

e) None of the above

31. If Alice wants to send a message to Bob using a public-key signature scheme, _____ is used to sign and _____ is used to verify

a) Bob's private key, Alice's public key

b) Bob's public key, Alice's private key

c) Bob's public key, Bob's private key

d) Alice's private key, Alice's public key

e) None of the above

32. How does hybrid encryption work? What role does symmetric key encryption play? Public-key encryption?

33. What three security properties do digital signature schemes provide? To whom to they provide them?

34. What two security properties do MACs provide? To whom do they provide them?

35. What security property does a cryptographic hash provide? To whom does it provide the property?

36. Describe each of the following properties of cryptographic hash functions.

a) Preimage resistance

b) Second preimage resistance

c) Collision resistance

37. How are hash functions used for password storage and verification? What property or properties of hash functions make this a desirable use case?

38. Is it generally better to MAC then encrypt, or encrypt then MAC?

3 User Authentication

39. Describe each of the following ways to defeat password authentication. For each technique you describe, provide one way to prevent it.

a) Online guessing

b) Offline guessing

c) Defeating password recovery

d) Bypassing authentication interface

e) Password capture

40. Describe 3 advantages of passwords. Describe 3 disadvantages.

41. What is a password hash salt? A pepper?

42. What is iterated hashing? What is it used for? How does it compare with other techniques to solve the same problem?

43. Explain the following:

a) Dictionary attack

b) Mangling rules

44. Describe the trade-off that occurs when using system-assigned passwords. How do these passwords help to mitigate dictionary attacks

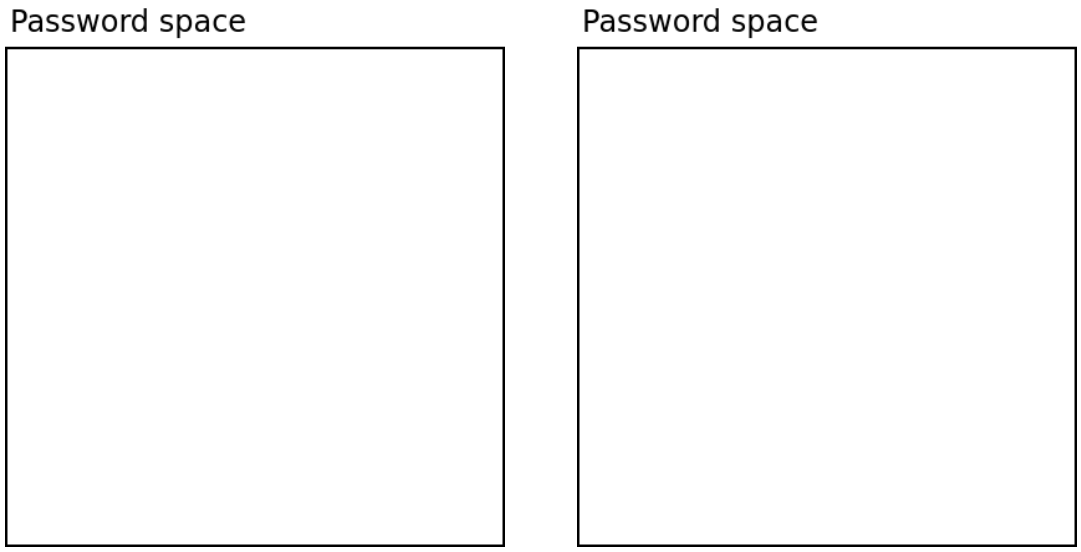
45. Suppose you had a password scheme that has an alphabet of size b and allows passwords as long as n characters. How long would it take to brute force passwords in this scheme in:

a) The worst case?

b) The average case?

46. Consider $q = GT/R$. What does this equation describe? What is each variable for?

47. Draw password distributions in Figure 3.1 according to the captions.



(a) Password distribution we want.

(b) Password distribution we see in practice.

Figure 3.1

48. Discuss rate limiting and password change policies with respect to online guessing attacks. How does $q = GT/R$ factor into making decisions regarding these policies?

49. Discuss the drawbacks of complex site login password composition policies. Suggest at least three better alternatives.

50. What is a passkey? Why are complex passwords preferred for passkeys? How can passphrases help with usability issues associated with these complex passwords?

51. How can password blacklisting be used to reduce the effectiveness of dictionary attacks?

52. Why are secret questions generally a terrible method for password recovery? Why do you think they are so widely used despite their drawbacks?

53. What is a one-time password? How can a Lamport Hash Chain be used to extend a single key word to t one-time passwords?

54. Explain how Lamport Hash Chains are vulnerable to a man-in-the-middle attack using small $n = t - i$.

55. Describe the following categories of authentication and provide an example for each:

a) What you have

b) What you are

c) What you know

d) Where you are

56. What is multi-factor authentication?

57. Describe some advantages and disadvantages of hardware token authentication.

Part II

Notes