Ch21

Security

CHAPTER ASSIGNMENT · 31 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from *Computer Science for Cambridge International AS & A Level Coursebook*, 2nd edition, Sylvia Langfield and Dave Duddell (Cambridge University Press), for classroom use.

Tasks and questions from the chapter

Q21.01 One method used by an unauthorised person attempting to decrypt a message is called a brute-force attack where all possible values for the key are tried. Calculate how long it would take to try all possibilities for a 64-bit or 128-bit key, assuming each attempt took 1 second.

EQ21.01 **Extended Question 21.01:** Would you like to investigate S-DES further? You could attempt an encryption and decryption.

DP **Discussion Point:** The use of encryption has always been a controversial subject. There are two important aspects to this. The first is whether powerful, unbreakable encryption algorithms should be made available to the public. The second relates to the key escrow scheme, which allows governments access to all secret keys. You might wish to consider how the content here has relevance to some of the topics in Chapter 9 and Chapter 10.

21.01 The concept of a 'shared secret' has been used in traditional encryption schemes. An example is the Diffie–Hellman key agreement method. Investigate the principles behind how this works.

RP **Reflection Point:** Chapter 21: Security has some difficult concepts. Have you made sure that you understand the overriding principles and definitions used?

Exam-style questions

1

(a) When transmitting data across a network three concerns relate to: confidentiality, authenticity and integrity.

Explain each of these terms. [4]

(b) Encryption and decryption can be carried out using a symmetric or an asymmetric key method.

Explain how keys are used in each of these methods. You are not required to describe the algorithms used. Your account must include reference to a public key, a private key and a secret key. [6]

(c) Digital signatures and digital certificates are used in message transmission.

Give an explanation of their use. [5]

2 Secure socket layer (SSL) and its upgraded version named Transport Layer Security (TLS) is described as a protocol suite.

(a) Explain the meaning of the description 'protocol suite'. [3]

(b) Describe the type of activity where SSL or TLS would be used. [4]

(c) Explain how digital certificates are used in the protocol suite. [3]

(d) Explain how encryption keys are used in the protocol suite. [5]

3 Digital certificates are used in Internet communications. A Certificate Authority (CA) is responsible for issuing digital certificates.

(a) Name **three** data items present in a digital certificate. [3]

(b) The method of issuing a digital certificate is as follows.

• i: A user starts an application for a digital certificate using their computer. On this computer a key pair is generated. This key pair consists of a public key and an associated private key.

• ii: The user submits the application to the CA. The generated ..... (i) ..... key and other application data are sent. The key and data are encrypted using the CA's ..... (ii) ..... key.

• iii: The CA creates a digital document containing all necessary data items and signs it using the CA's ..... (iii) ..... key.

• iv: The CA sends the digital certificate to the individual.

In the above method there are three missing words. Each missing word is either 'public' or 'private'.

State the correct word. Justify your choice. [6]

(c) Alexa sends an email to Beena.

Alexa's email program:

• produces a message digest (hash)

• uses Alexa's private key to encrypt the message digest

• adds the encrypted message digest to the plain text of her message

• encrypts the whole message with Beena's public key

• sends the encrypted message with a copy of Alexa's digital certificate.

Beena's email program decrypts the encrypted message using her private key.

(i) State the name given to the encrypted message digest. [1]

(ii) Explain how Beena can be sure that she has received a message that is authentic (not corrupted or tampered with) and that it came from Alexa. [2]

(iii) Name **two** uses where encrypted message digests are advisable. [2]

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4 Both clients and servers use the Secure Socket Layer (SSL) protocol and its successor, the Transport Layer Security (TLS) protocol.

(a) What is a protocol? [2]

(i)

(ii) Name the client application used in this context. [1]

(iii) Name the server used in this context. [1]

(iv) Identify **two** problems that the SSL and TLS protocols can help to overcome. [2]

(b) Before any application data is transferred between the client and the server, a handshake process takes place. Part of this process is to agree the security parameters to be used.

Describe **two** of these security parameters. [4]

(c) Name **two** applications of computer systems where it would be appropriate to use the SSL of TLS protocol. These applications should be different from the ones you named in **part (a)(ii)** and **part (a)(iii)**. [2]

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End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/computer-science/as-a-level/security/