TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VICTORIA
UNIVERSITY OF WELLINGTON

# EXAMINATIONS – 2019

## TRIMESTER 2

**NWEN 243**

**NETWORK APPLICATIONS**

**Time allowed:** TWO HOURS

**CLOSED BOOK**

**Permitted materials:** Paper foreign to English language dictionaries are allowed. Only silent non-programmable calculators or silent programmable calculators with their memories cleared are permitted in this examination.

**Instructions:** The examination contains SEVEN questions. You must answer ALL questions

The exam consists of 120 marks in total, distributed to each of the questions as follows:

| | |
|---|---|
| Question 1 Security | [20 marks] |
| Question 2 Application Layer | [20 marks] |
| Question 3 XML, Webservices and SOAP | [20 marks] |
| Question 4 Network Fundamentals | [14 marks] |
| Question 5 Transport Layer | [16 marks] |
| Question 6 Network Layer | [18 marks] |
| Question 7 Link Layer | [12 marks] |

**Question 1: Security** **[20 marks]**

(a) **(2 Marks)** What does it mean for a cryptographic system to be secure?

(b) **(2 Marks)** What is Kirchhoff's principle?

(c) **(2 Marks)** Why were polyalphabetic cyphers developed, and what was the alternative developed at about the same the time?

(d) **(2 Marks)** What was the essential problem that DHM was developed to solve. Hint: the answer is NOT secrecy.

(e) **(2 Marks)** What critical problem does DHM not address?

(f) Briefly define the following security threats:
   i. **(1 Mark)** Spoofing
   ii. **(1 Mark)** Repudiation of Origin
   iii. **(1 Mark)** Denial of Receipt
   iv. **(1 Mark)** Snooping

(g) **(6 Marks)** Is a CA trusted or trustworthy? Does it need to be? Justify your answer.

**Question 2: Application Layer** **[20 marks]**

(a) The socket API defines two transport protocols, UDP and TCP. Consider the following applications, and state which protocol is the **most** appropriate choice in theory (practice may be different), be sure to state your rationale.

i. **(2 Marks)** File transfer
ii. **(2 Marks)** Real-time streamed video
iii. **(2 Marks)** The WWW

(b) **(2 Marks)** How does HTTP access the transport layer?

(c) **(4 Marks)** [4 Marks] Outline two reasons why HTTP is a stateless protocol.

(d) The major difference between HTTP 1.0 and HTTP 1.1 was the addition of persistent connections.

i. **(2 Marks)** Consider you are requesting the following from the same server: two pages in sequence, one with 2 images, one with 7. How many connections are opened with HTTP 1.0 vs HTTP 1.1?
ii. **(2 Marks)** Give 1 positive and 1 negative consequence of persistent connections.

(e) **(4 Marks)** In terms of the "cache control header", what is the difference between no-store and no-cache?

**Question 3: XML, Webservices and SOAP** **[20 marks]**

(a) **(2 Marks)** What does it mean for an XML document to be well formed **and** valid?

(b) **(2 Marks)** Outline the main purpose of XML namespaces.

(c) **(6 Marks)** Consider the following XML schema:

```
<xs:element name="car">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="manufacturer" type="xs:string"/>
      <xs:element name="model_name" type="xs:string"/>
      <xs:element name="body_style" type="xs:string"/>
      <xs:element name="engine_size" type="xs:string"/>
    </xs: sequence>
  </xs:complexType>
</xs: element>
```

Give an example of an XML document that fits the above schema.

(d) **(2 Marks)** Define a Webservice.

(e) **(2 Marks)** What protocol allows Webservices to be published and discovered using a service registry?

(f) **(4 Marks)** Describe the relationship between WSDL and SOAP.

(g) **(2 Marks)** Why might a Webservice specify a one-way port-type?

**Question 4: Network Fundamentals** **[14 marks]**

(a) **(4 Marks)** The Internet is constructed by two types of networks. Explain how the Internet is structured and what the two types of networks are.

(b) **(6 Marks)** What are the Internet and the OSI protocol stacks? Explain the difference between the two.

(c) **(4 Marks)** From a router's point of view, explain how packet delay occurs.

**Question 5: Transport Layer** **[16 marks]**

(a) **(2 marks)** Name two transport layer protocols in the Internet protocol suite.

(b) **(3 marks)** Explain how a transport layer protocol identifies the correct application process when delivering data to it.

(c) **(3 marks)** Explain how a UDP checksum is obtained and used.

(d) **(5 marks)** Explain how Go-Back-N (GBN) and Selective Repeat (SR) work and the difference between the two.

(e) **(3 marks)** Explain how TCP AIMD congestion control works.

**Question 6: Network Layer** **[18 marks]**

(a) **(3 Marks)** Discuss the difference between routing and forwarding and how the two are related to each other.

(b) **(4 Marks)** Briefly explain what DHCP and NAT are used for.

(c) **(3 Marks)** Dissect an IP address: what are the portions of an address?

(d) **(4 Marks)** Briefly discuss how Dijkstra's and Distance Vector algorithms work differently.

(e) **(4 Marks)** State what type of routing BGP is used for. Explain how eBGP and iBGP work together for routing purpose.

**Question 7: Link Layer** **[12 marks]**

(a) **(3 Marks)** Explain what CRC (Cyclic Redundancy Check) is designed for. Briefly discuss its performance.

(b) **(3 Marks)** Briefly explain the difference between channel portioning and random access media access control (MAC), including their strengths and weaknesses. Name an example for each of the two MAC methods.

(c) **(4 Marks)** What is the packet unit called at MAC layer? Explain how its header is processed in terms of forwarding. For example, is it needed to change the MAC addresses? If so, how is the new MAC address obtained?

(d) **(2 Marks)** Explain what a switch table is used for.

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