

PRINCE OF SONGKLA UNIVERSITY  
FACULTY OF ENGINEERING

**Midterm Examination:** Semester 1

**Academic Year:** 2007-2008

**Date:** July 31, 2007

**Time:** 09:00 – 12:00

**Subject Number:** 240-643

**Room:** R300

**Subject Title:** The Internet and its Protocols

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**Exam Duration:** 3 hours

**This paper has 3 pages** (including this page).

**Authorised Materials:**

- Anything the student can carry, except for mobile phones.

**Instructions to Students:**

- *Answer questions in English.* Good English is **not** required.
- Attempt all 7 questions.
- Write answers in an answer book.
- Start the answer to each question on a new page.
- **Clearly Number** the answers. It is **not** required that questions be answered in order.
- Anything illegible is incorrect.
- Answer briefly where possible, essays are **not** required.
- The marks allocated for each question are shown next to that question. There are 60 marks total for this examination. This will contribute 15% of the course total.

**Question 1.***(15 marks)*

The new version of the Internet Protocol, version 6 (IPv6) contains no checksum field in its packet headers. The previous version, IPv4, did contain a header checksum.

Give reasons why the designers of IPv6 decided that the checksum field was not necessary in IPv6.

Explain any disadvantages that omitting the checksum field might cause.

**Question 2.***(10 marks)*

The specification of the Transmission Control Protocol (TCP) uses a Finite State Machine (FSM) to (partly) specify the operations of opening and closing connections.

Explain the advantages of using an FSM in a protocol specification (you can use TCP as an example.)

Contrast the use of the FSM with other specification methods.

**Question 3.***(5 marks)*

An IP datagram arrives at its destination with the Time to Live (for IPv4) or Hop Count (for IPv6) field containing the value 255.

What conclusion(s) can the receiving node draw from this fact, and why?

*You can assume either IPv4 or IPv6 for your answer. Nothing in this question, other than the name of the header field, depends upon which IP version is in use.*

**Question 4.***(5 marks)*

In what circumstances (if any) might IPv6's Duplicate Address Detection fail to detect a duplicate address. How can this happen? What, if anything, prevents duplicate addresses from ever existing?

**Question 5.***(5 marks)*

UDP packets carry a checksum that protects the UDP header, UDP payload (user data) and parts of the IP header (the pseudo-header). Use of the checksum is optional, when the packet is carried over IPv4. When the checksum is not present the checksum field has all bits set to zero.

However, when using IPv6, the checksum is mandatory, and may not be omitted (a zero value is an error).

Explain why that change was made.

**Question 6.***(10 marks)*

Explain the role of the sequence number in the TCP 3-way handshake, used to initialise a new instantiation (instance) of a connection.

Why is the 3-way handshake required?

Are there any circumstances in TCP, or any TCP derived protocol, where the 3-way handshake can be avoided? If so, explain those circumstances and how TCP operates correctly without the 3-way handshake.

**Question 7.***(10 marks)*

The Internet Protocol checksum algorithm cannot detect the insertion or deletion of (16 bit) words of all zero bits, or all one bits, or detect cases where some (16 bit) words are re-ordered in a packet with respect to other (16 bit) words.

Explain why this is the case.