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| *This question paper consists of 5*  *printed pages, each of which is*  *identified by ELEC547101M* | *Drawing instruments and electronic calculators may be used.*  *Approved dictionaries may be used* |

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**Examination for the Degree of MEng or MSc**

**(January 2014)**

**School of Electronic and Electrical Engineering**

**ELEC5471M: Data Communications and Network Security**

Time allowed: 3 hours

*Attempt any* **three** *questions*

**Do not write or draw with red ink or red pencil**

* *To obtain full marks candidates must show how answers are derived*
* *All symbols not specifically defined have their normally accepted meanings*

**Question 1**

1. Layered protocol architectures are used in communications network designs. Why?

[4 marks]

1. List and describe disadvantages of using a layered protocol architecture in the design of a communications system.

[2 marks]

1. The International standards organisation (ISO) open systems interconnect (OSI) model is the generic architecture which is referred to worldwide. Name the layers, in the correct order of this architecture and give a key function performed at each layer.

[8 marks]

1. Describe the main architectural differences between the ISO/OSI open systems interconnect architecture and the TCP/IP architecture.

[3 marks]

1. Describe the advantages and disadvantages of adherence to the layering model in the TCP/IP architecture as compared to the ISO/OSI open systems interconnect architecture.

[3 marks]

**Question 2**

This question is about the Internet Protocol, IP.

1. What does an IP address refer to?

[1 mark]

1. ‘128.85.170.3’ is a IPv4 Internet address expressed in dotted decimal notation. Give the binary equivalent of this address.

[1 mark]

1. What is the binary equivalent of the following IPv6 address: ‘FFFF**::**5050**:**A0A**:**’

[1 mark]

The Internet Protocol is currently moving from version 4 to version 6.

1. List the improvements offered by IPv6 as compared to IPv4.

[7 marks]

During the transition period both IPv4 and IPv6 need to function on the Internet simultaneously.

1. How does a packet indicate that it needs to be processed as IPv4 or IPv6?

[1 mark]

1. How can different IPv4 and IPv6 hosts both communicate with a single server?

[2 marks]

1. How can two different hosts running only IPv6 communicate with one another across sections of the Internet which only use IPv4?

[2 marks]

1. Describe why two ways are needed for an IPv6 host to communicate with an IPv4 host and describe how these function.

[5 marks]

**Question 3**

1. In the operation of TCP what is the objective of Flow Control and what particular parameters does TCP use to provide it?

[3 marks]

1. TCP provides Flow Control and Congestion Control. How do the objectives of Flow Control and Congestion Control differ?

[4 marks]

1. Using the ‘stop and wait’ Flow Control mechanism explain (with the aid of diagrams) how the loss of a corrupted information segment can be overcome.

[2 marks]

1. Using the ‘stop and wait’ Flow Control mechanism explain (with the aid of diagrams) how the loss of a corrupted acknowledgement segment can be overcome.

[2 marks]

1. A series of information frames of length 125 Bytes are transmitted over the following links using the ‘stop and wait’ Flow Control mechanism. The velocity of propagation across these links is 2 x 108 m.s-1. For each link determine the link efficiency.
2. a 1000 km link with a data transmission rate of 1 Gbps.

[3 marks]

1. a 10m link with a transmission rate of 1 Mbps.

[3 marks]

1. Comment on this result and use a table to compare alternative flow control mechanisms. Include the advantages and disadvantages of each mechanism in your table.

[3 marks]

**Question 4**

1. Describe the Internet data transfer service offered by TCP.

[3 marks]

1. Describe the Internet data transfer service offered by UDP.

[2 marks]

1. Since both TCP and UDP provide their services using the same layer below. Describe how the difference in service provided by TCP, as compared to UDP, is achieved and any parameters used in provision.

[5 marks]

1. Describe the process within the TCP entity of establishing a TCP connection.

[6 marks]

1. What applications might chose to use UDP and why?

[4 marks]

**The End**