



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: August 2015 (Old Curriculum)

Module Number: EE5315

Module Name: Digital Communication and Computer Networking

[Three Hours]

[Answer all questions, each question carries 10 marks]

- Q1 a) i) What is meant by data encapsulation in Open Systems Interconnection (OSI) protocol layered architecture?
- ii) Explain clearly the process of encapsulation and de-encapsulation in which the application level data undergo from a source node to a destination node using an appropriate diagram.

Hint : Consider all the protocol data units (PDUs) used at each layer in OSI.

[4.0 Marks]

- b) A data source produces 8-bit American Standard Code for Information Interchange (ASCII) characters. Sketch the asynchronous binary bit sequence for transmitting the ASCII character word "Hat". Assume that this method uses an odd parity data bit and two stop bits. In addition, let the start bit having a binary value of zero (0).

Hint : Use the decimal values of ASCII characters as $A \rightarrow Z \equiv 65 \rightarrow 90$ and $a \rightarrow z \equiv 97 \rightarrow 122$.

[3.0 Marks]

- c) "Packet switching requires control and data bits to be added to each packet. This causes considerable overhead in packet switching. "
- "In circuit switching, a transparent or dedicated circuit is established so that no extra bits are needed."

The following logics are made based on above phrases.

- i) There is no overhead in circuit switching.
- ii) Because there is no overhead in circuit switching, the line utilization must be more efficient than in packet switching.

However, these logics are not TRUE. Explain why.

[3.0 Marks]

Q2 a) The topology of a network is considered as the arrangement or the relationship of the network devices and the interconnections between them. What is the difference between a physical topology and a logical topology of a computer network?

[2.0 Marks]

b) When several entities of a network share the same media, some mechanism must be in place to control access. There are two basic media access control methods for shared media.

- i) What is the media access control method used in the mechanism shown in Figure Q2 b)?
- ii) Explain the other media access control method used in the Data Link layer using a suitable diagram.
- iii) What is the major drawback of the media access control method described in part ii) over the media access control method described in part i)?
- iv) What are the protocols used in conjunction with that media access control method in order to resolve the drawback mentioned part iii) ?

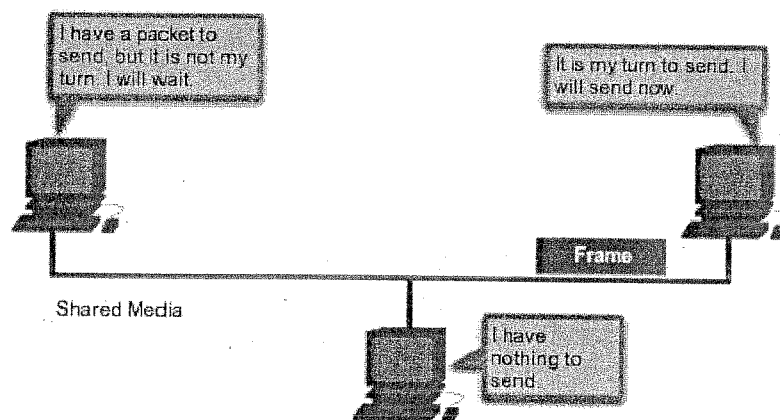


Figure Q2 b)

[3.0 Marks]

c) While the Internet Protocol (IP) address of the destination is provided by a higher OSI layer, the sending node needs a mechanism to find the MAC Media Access Control (MAC) address of the destination for a given Ethernet link. This is the purpose of the Address Resolution Protocol (ARP) used in MAC addressing. Use the Figure Q2 c) to explain the ARP process and create the Ethernet frame for each of the following scenario.

- i) Host A wants to send data to Host D but has no ARP entry.
- ii) Host A wants to send data to the IP address 176.10.10.50 but has no ARP entry.

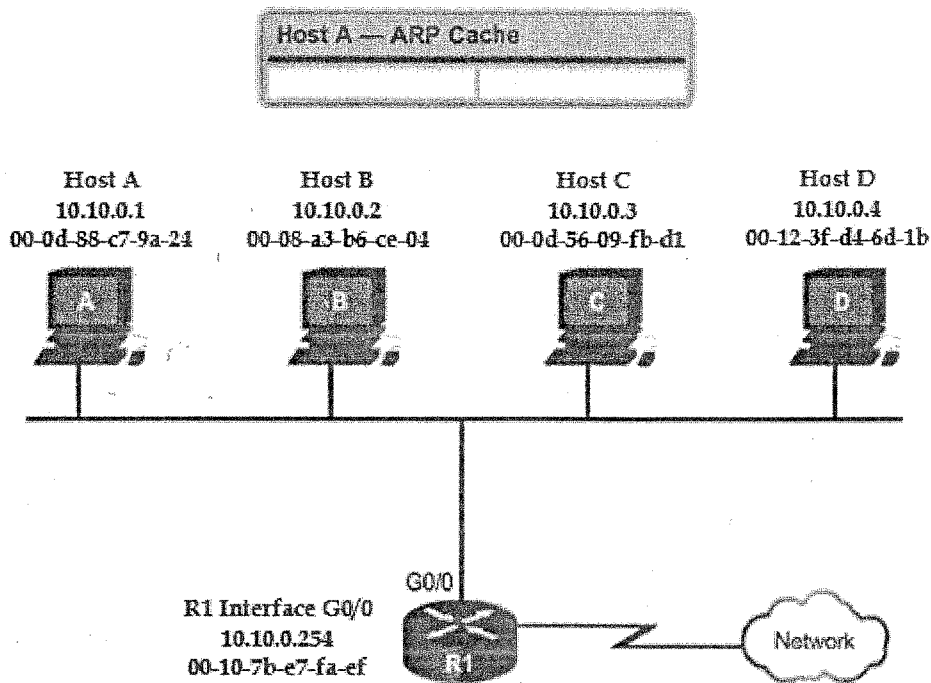


Figure Q2 c)

[5.0 Marks]

Q3 a) IP is the network layer service implemented by the Transmission Control Protocol / Internet Protocol (TCP/IP) protocol suite. Explain the three basic characteristics of IP.

[3.0 Marks]

b) Suppose that you are a network administrator at Britex (Pvt) Ltd. and asked to propose a Variable Length Subnet Masking (VLSM) addressing scheme. The company has three departments and all departments are connected with each other via Wide Area Network (WAN) links as shown in Figure Q3.

Hint : You may provide the answers for the following questions in the proposal.

- How many subnets are there?
- How many bits should you borrow to create each subnet?
- How many usable host addresses per each subnet are in this addressing scheme?
- What is the new subnet mask in dotted decimal format?
- How many subnets are available for future use?

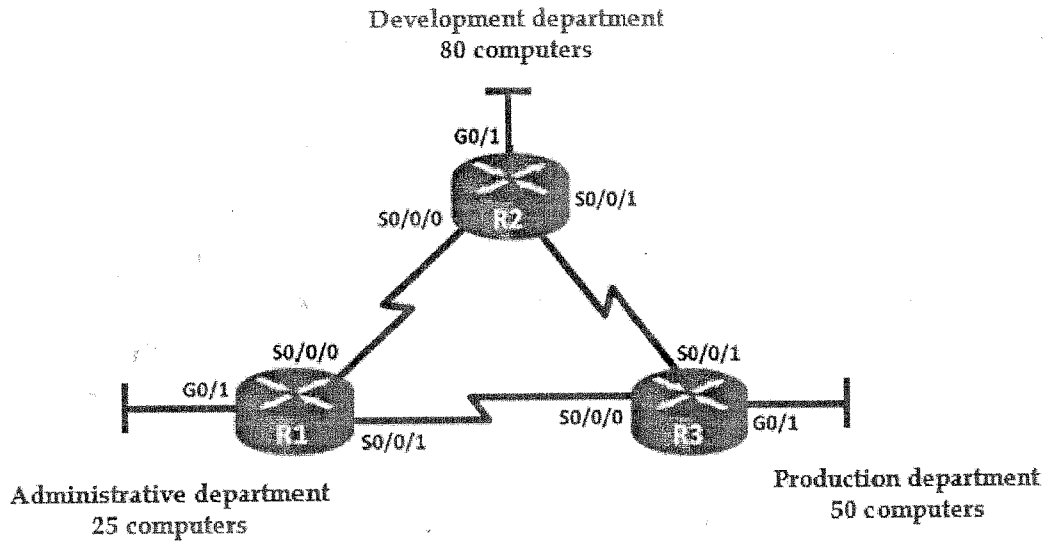


Figure Q3

[7.0 Marks]

- Q4 a) i) What is meant by Static Routing?
 ii) Discuss the advantages of Static Routing over Dynamic Routing.

[2.0 Marks]

- b) Determine a single summary route for routing table entries of R-Main.

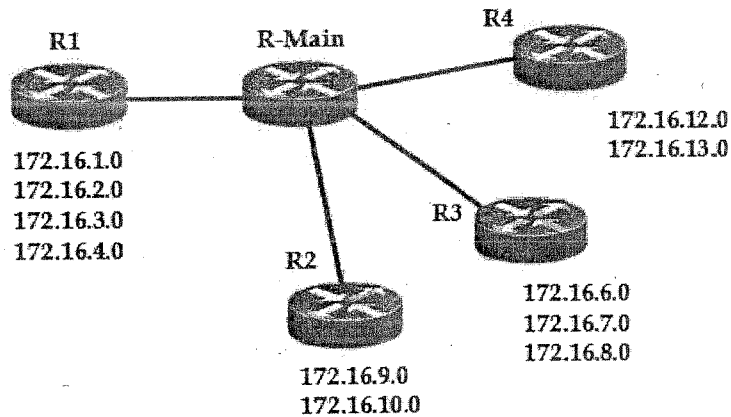


Figure Q4 b)

[3.0 Marks]

- c) i) What is the main function of a Domain Name System (DNS)?
 ii) State the difference between recursive resolution and iterative resolution in DNS resolving.
 iii) Illustrate the hierarchy of the domain spaces for the following Uniform Resource Locator (URL).

<http://www.eng.ruh.ac.lk/eie/index.php/education>

[3.0 Marks]

- d) i) What is the difference between persistent and non-persistent Hyper-Text Transfer Protocol (HTTP) connections?
- ii) Mention two e-mail protocols and give examples for applications in which they are used.

[2.0 marks]

- Q5 a) i) What is the main function of Transport Layer in the TCP/IP Protocol stack?
- ii) OSI Layer 2 network devices are already performing error handling to ensure the end-to-end delivery. What is the requirement for Layer 4 (Transport Layer) error handling?
- iii) Use a diagram to explain the three-way handshake in Transmission Control Protocol (TCP) connection establishment.
- iv) Compare the differences of TCP and User Datagram Protocol (UDP).

[3.5 Marks]

- b) Figure Q5 b) i) and Figure Q5 b) ii) illustrate the details of two packets which were captured by Wireshark software.
- i) What are the source and destination port numbers of both packets ?
- ii) What is the sequence number of the packet given in Figure Q5 b) ii) ?
- iii) State the significance of the parameter mentioned in part ii) and advantages gained from it.
- iv) Mention the sliding window size of the two packets.
- v) If both TCP Connection establishment and TCP release processes have collective set of 6 steps, what would be the step numbers for which the two packets corresponds to?

[3.5 Marks]

- c) i) Why do we need to ensure the security of computer network devices?
- ii) Mention two main types of cryptographic algorithms.
- iii) How does a firewall protect our computer network? Explain.

[3.0 Marks]

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+ Frame 29: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
+ Ethernet II, Src: HonHaiPr_0b:b6:96 (00:25:56:0b:b6:96), Dst: HuaweiTe_dc:67:90 (e8:08:8b:dc:67:90)
+ Internet Protocol Version 4, Src: 192.168.1.2 (192.168.1.2), Dst: 111.221.29.253 (111.221.29.253)
+ Transmission Control Protocol, Src Port: 57475 (57475), Dst Port: 443 (443), Seq: 0, Len: 0
  Source Port: 57475 (57475)
  Destination Port: 443 (443)
  [Stream index: 3]
  [TCP Segment Len: 0]
  Sequence number: 0 (relative sequence number)
  Acknowledgment number: 0
  Header Length: 32 bytes
+ .....0000 0000 0010 - Flags: 0x002 (SYN)
  window size value: 8192
  [Calculated window size: 8192]
+ Checksum: 0x26c3 [validation disabled]
  Urgent pointer: 0
+ Options: (12 bytes), Maximum segment size, No-Operation (NOP), window scale, No-Operation (NOP),

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Figure Q5 b) i)

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+ Frame 24: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface 0
+ Ethernet II, Src: HonHaiPr_0b:b6:96 (00:25:56:0b:b6:96), Dst: HuaweiTe_dc:67:90 (e8:08:8b:dc:67:90)
+ Internet Protocol Version 4, Src: 192.168.1.2 (192.168.1.2), Dst: 108.162.232.204 (108.162.232.204)
+ Transmission Control Protocol, Src Port: 57474 (57474), Dst Port: 80 (80), Seq: 1, Ack: 2, Len: 0
  Source Port: 57474 (57474)
  Destination Port: 80 (80)
  [Stream index: 2]
  [TCP Segment Len: 0]
  Sequence number: 1 (relative sequence number)
  Acknowledgment number: 2 (relative ack number)
  Header Length: 20 bytes
+ .....0000 0000 0001 - Flags: 0x011 (FIN, ACK)
  window size value: 64
  [Calculated window size: 64]
  [Window size scaling factor: -1 (unknown)]
+ Checksum: 0xdbfa [validation disabled]
  Urgent pointer: 0

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Figure Q5 b) ii)