RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.Sc. Degree in Information and Communication Technology

Fourth Year Semester I Examination, June 2015

ICT 4303 – ADVANCED COMPUTER NETWORKS

Time allowed: 3 hours

INSTRUCTIONS TO CANDIDATES

- This paper consists of four (04) questions on 4 pages including this page.
- Answer **ALL** questions.
- This examination accounts for 60% of the module assessment. The total maximum mark attainable is 100. The marks assigned for each question and section thereof are indicated in square brackets.
- This is a **closed book** examination.
- Mobile phones or any other communication devices are not permitted.
- Clearly state the assumptions you make. If you have any doubts regarding the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Q1 An ISP offers datacenter services to organisations who need to run public application servers. Some organisations have their intranet-based corporate application servers. Further, some of them have distributed branches that are connected to their respective intranets using the links and VPN facilities provided by this ISP. If an organisation gets this datacenter service, that organisation would be given a set of virtual servers for which administrative access would be given through a separate VPN. Some organisations decided to subscribe to this datacenter services and to transfer their publicly accessible servers. Some other organisations decided to keep their public servers within their own network infrastructure, i.e. within the subnet designated as the de-militarised zone (DMZ).

Many customer organisations of this ISP still use IPv4, where public addresses are used for the public servers, and private addresses are used within the intranets. The datacenter of the ISP uses IPv6. Considering the administrative convenience, IPv4 mapped IPv6 addresses are used in the datacenter for those organisations who would transfer their publicly accessible application servers to this datacenter.

(a) Consider two organisations: (1) an organisation that will host the public servers in the ISP datacenter, (2) an organisation that will have an intranet with a DMZ and distributed branches connected over VPNs.

Suggest a list of application servers together with their Internet domain names, IPv4 addresses and IPv6 addresses (if applicable) as follows:

i. four (04) application servers that are suitable to be hosted in the ISP datacenter by the organisation (1) above, and, [6 marks]

ii. four (04) application servers that are suitable to be hosted within the DMZ of the intranet of the organisation (2) above. [4 marks]

(b) Draw a network diagram to illustrate the connectivity of the two organisations given in (a) above as follows:

i. mention network devices, links, VPNs and server farms, [5 marks]

ii. indicate suitable IPv4 addresses for the router interfaces of the organisations, and, [6 marks]

iii. indicate suitable IPv4 blocks for two (02) subnets of each organisation in CIDR format. [4 marks]

Q2 **(a)** OSI recommends the use of connection-oriented protocols for any application that needs reliable data transfer. However, many modern protocols do not use connection-oriented communications in all layers. Explain why, giving examples. [6 marks]

(b) Compare and contrast *Go-Back-N* and *Selective Retransmission* schemes used by the ARQ protocols. Use diagrams if necessary. [4 marks]

(c) ARQ is used in both datalink and transport layers, however, in different ways. List two such differences and explain the reason for each difference. [4 marks]

(d) It is stated that "MPLS is more suitable to be used by an ISP than by individual organisations". Do you agree with this statement? Provide reasons to your answer. [5 marks]

(e) Compare and contrast X.25, Frame-relay and ATM protocols. [6 marks]

Q3 **(a)** Explain how a VLAN switch with layer-3 capabilities can be used to design a network with better manageability and access control. Use diagrams if necessary. [6 marks]

(b) Although CSMA/CD or Ethernet protocol design was originally based on collision detection, this original concept is no longer used in Wireless Ethernet or optical fibre based Ethernet networks. Explain why. [5 marks]

(c) Show how a MAC address can be used to generate an IPv6 address. [3 marks]

(d) What are the security issues associated with the scheme given in (c) above? [2 marks]

(e) Compare and contrast IPv4 and IPv6 with respect to efficiency, performance and manageability of networks. [6 marks]

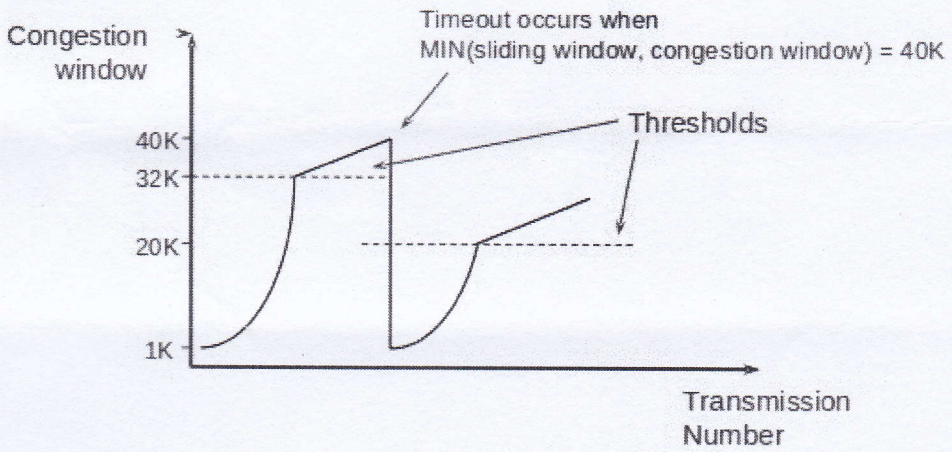
(f) Network and system administrators face many issues during the transition from IPv4 to IPv6, although IPv6 is said to be transition enabled. Outline three (03) reasons. [3 marks]

Q4 **(a)** Why RIP would not be suitable for a large network? Briefly explain. [3 marks]

(b) Consider the statement: "The operation of BGP is quite different from that of interior routing protocols such as OSPF, EIGRP, etc. This is due to the differences in the scope of applicability and the network policies." What does this statement mean? Discuss. [6 marks]

(c) What is smoothed round trip time (SRTT) in TCP? Use the relevant equation to explain your answer. [3 marks]

(d) The following is a graph showing the solution for the TCP slow start inefficiency problem.



Explain the TCP behaviour shown in the above graph. [8 marks]

(e) Explain the TCP fast re-transmit scenario using appropriate diagrams. [5 marks]