UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2014/2015 – 2nd Year Examination – Semester 4

IT4405: Computer Networks

PART 2 - Structured Question Paper

2nd August, 2015
(ONE HOUR)

To be completed by the candidate

BIT Examination Index No: .....

Important Instructions:

- The duration of the paper is **1 (One) hour**.
- The medium of instruction and questions is English.
- This paper has **3 questions** and **12 pages**.
- **Answer all questions.** All questions **do not** carry equal marks.
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.
  If a page is not printed, please inform the supervisor immediately.
- Calculators are **not** allowed.

Questions Answered

Indicate by a cross (×), (e.g. [X]) the numbers of the questions answered.

	Question numbers		
To be completed by the candidate by marking a cross (×).	1	2	3
To be completed by the examiners:			

Index No …….

1.

(a) Suppose a class C IP network 200.138.10.0 is to be sub-netted with a subnet mask of 255.255.255.240. For this network calculate and list the following information.

i. What is the maximum possible number of networks?

(1 marks)

The number of possible networks is 16.

ii. What is the maximum number of possible hosts on each network? **(1 marks)**

There is a possibility if having 14 hosts in each network (out of the possible 16 addresses).

(256-240 = 16)

iii. Write down the usable address ranges of the first three networks.

(1 marks)

network number 0: 200.138.10.1 - 200.138.10.14 (host addresses exclude 2)

network number 1 :200.138.10.16 - 200.138.10.30 (host addresses exclude 2)

network number 2 :200.138.10.32 - 200.138.10.46 (host addresses exclude 2)

iv. Write down the broadcast addresses for the first three networks.

(1 marks)

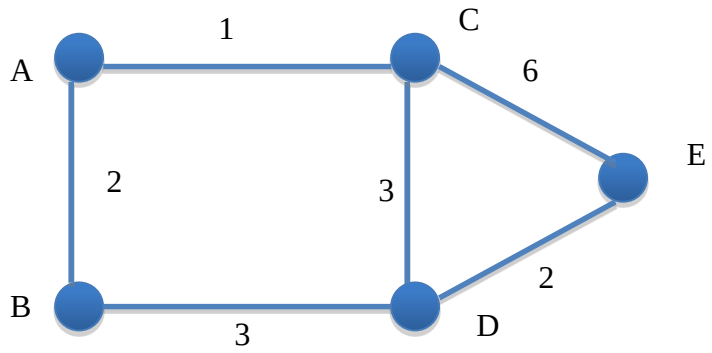
network number 0: 200.138.10.15

network number 1 :200.138.10.31

network number 2 :200.138.10. 47

(b) Consider the network topology shown below where each node initially knows the link cost of its neighbours. Assuming a distance vector routing algorithm run by each node, show the distance table entries at node E after the convergence.

(3 marks)



Node	Distance
A	6
B	5
C	5
D	2

(c) Fill in each box of the table by term or terms most appropriate for the given application type, chosen from the lists given.

(8 marks)

Application Type	**Example application protocol**	**Transport layer protocol**	**Network architecture**	**QoS requirements**
Plain old email	POP, SMTP	TCP	client server	QoS not essential
On-line game	generic	TCP	peer to peer	QoS Required
browser based application	HTTP	TCP	client server	QoS not essential
skype	RTP, RTSP	TCP	peer to peer	QoS required
software-as-a-service	HTTP	**TCP**	client server	QoS not essential

Example application protocol: POP, SMTP, HTTP, generic (that is OS specific API based application), RTP, RTSP
Transport layer protocol: TCP, UDP
Network architecture: client-server, peer to peer, hybrid of client-server and peer-to-peer
QoS requirements: QoS required, QoS not essential

2. (a) An analogue TV signal is sampled at 450x500 pixels and each pixel is digitised at 32 levels of intensity. Picture frames move at a rate of 30 frames per second. The resulting raw digital signal is compressed at a 6:1 ratio to be transmitted over a channel with a 5MHz bandwidth. What should be the minimum signal to noise ratio (in dB) of the channel to support the digitised compressed TV signal? State your assumptions and the theorems used while clearly showing all steps of calculation.

(3 marks)

Shannon's noisy channel capacity theorem states $C = W \log_2(1+s/N)$.

Here, W = 1MHz, and C = 450x500x5x30/6 bits per second.

Therefore, 1+S/N (linear) = 45/8, or S/N = 4.5 approx.

This can be converted to S/N (dB) as $10 \log_{10}(4.5)$.

(b) Consider a shared bus Ethernet running the CSMA/CD protocol. The bus has a one way propagation delay of T. **(4 marks)**

i. What is the minimum allowable packet length on the bus? State your assumptions.

In CSMA/CD collisions occur, although nodes will not attempt to transmit while the link is busy, it takes a finite time for a frame to propagate the length of the bus, so it might start transmitting when a previously transmitted frame is on its way. In the worst case the colliding terminals will be at opposite ends of the bus, and the second terminal will start to transmit just before the first frame reaches it. For the first frame to detect the collision, the signal must propagate back along the bus. This implies that the minimum packet length on a CSMA/CD system be equal to twice the propagation time over the bus length. If we assume the length of the bus as L Kms, one way propagation delay of T seconds, with a bit rate of R Mbit/s, this implies:
the round trip time = 2 x propagation delay = 2 x T seconds
minimum packet size = bandwidth x round trip time = R Mbps x 2Ts = 2RT bits

ii. What happens if a packet has a length less than this minimum?

1. Additional padding data will be added to fill the length of the minimum length of the frame.
2. If not padded, the packet appears as a collision fragment, and its existence cannot be detected.

iii. Calculate the minimum packet length permissible on a 1Gbps, 1km Ethernet. Assume a signal propagation velocity of $2x10^8$ m/s.

R = 1 Gbps, L = 1Km, S = 2 x 10^8 ms

One way propagation Delay = 1000 /(2x 10^8) = 5 micro seconds

Round trip time = 2 x propagation delay = 2 x 5 micro seconds = 10 micro seconds

minimum packet length = bandwidth x round trip time = 1Gbps x 10 microseconds =

= 10,000 bits

(c) Express whether each of the following statements is either **true** or **false**. If, **false**, briefly explain why.

(10 marks)

i. IEEE 802.3 Ethernet and IEEE 802.11 WLAN use identical frame structures.

False. They are different from each other.

ii. In IEEE 802.11, prior to the transmission of a data frame, it must first send an RTS frame and receive a corresponding CTS frame.

True

iii. ARP broadcasts are typically limited to a subnet or a VLAN.

True

iv. Token passing multi access schemes are preferred over contention based access schemes for carrying real time data.

False.
Contention based schemes are more suitable for real time data as they enable uninterrupted data delivery, where as token passing schemes allow individual stations to utilize the channel for a whole period of time and when some of the stations have no data to transfer, the token goes unused and there will be idle periods of time.

v. CSMA/CD works well with wireless LANs which are broadcast media and it is easy for any given sender to determine if its transmission is colliding with another transmission.

False.
It is difficult to measure collisions at sender in wireless networks. Therefore CSMA/CD will not work well with wireless LANS.

vi. It is possible that a network layer router implements several types of link layers

True

vii. BGP is the unique Inter-Autonomous System routing protocol available on the Internet

True

viii. In IP forwarding, two successive packets will take identical paths from a common router to the same destination, based on their source IP address.

False. In IP network, packets can take different physical paths to reach the destination.

ix. The VLAN concept saves time and money because network reconfiguration is done through software where physical reconfiguration is not necessary.

True

x. Multipath radio propagation can address the issue of poor SNR.

True

(d) On a wide area mobile IP network, a mobile node **M** visits foreign networks **A, B** and **C** in the given order, and that a source **S** establishes a connection to the mobile node when the mobile node is resident in the foreign network **A**. With the aid of a diagram list the sequence of messages exchanged between foreign agents and the home agents as the mobile node moves from network **A** to network **B** and then to network **C**.

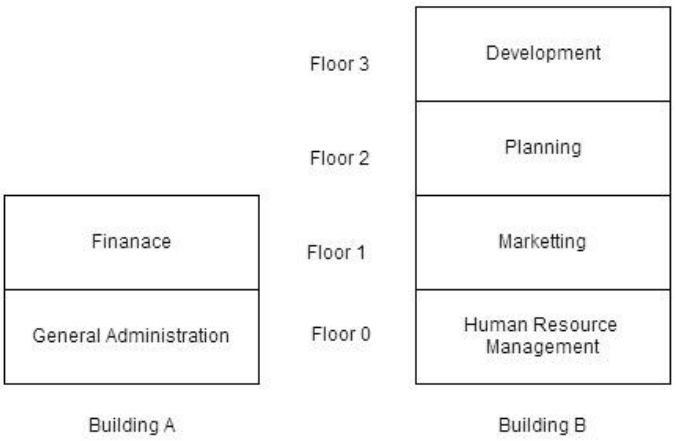
(3 marks)

The mobile node arrives at network A, then network A notifies the home agent that the mobile node MN is now visiting network A, and that datagrams to the mobile node MN should now be forwarded to the specified care-of-address (COA) in A.

•Now, the mobile node MN moves to network B. The foreign agent at network B must notify the foreign agent in network A that the mobile node MN is no longer resident in network A, but in fact is resident in network B and has the specified COA in network B. From then on, the foreign agent in network A will forward datagrams it receives that are addressed to the mobile node MN's COA in network A to the mobile node MN's COA in network B.

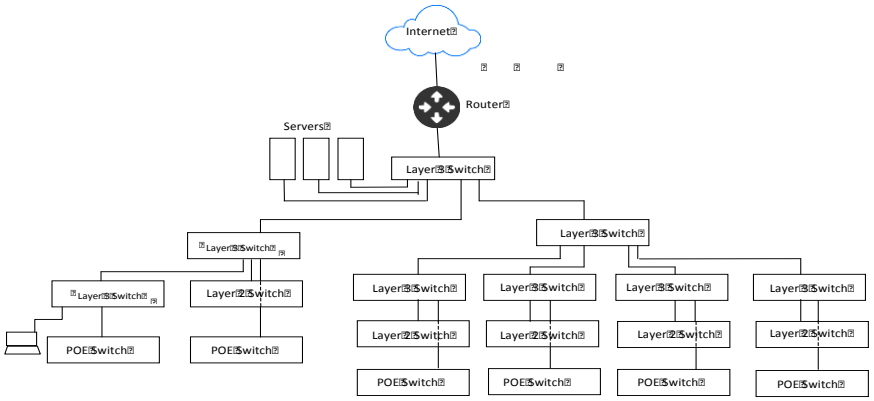
•Now the mobile node MN moves to network C. The foreign agent at network C must notify the foreign agent at network B that the mobile is no longer resident in network B but in fact is resident in network C and has the specified COA in network C. From then on, the foreign agent in network B will forward datagrams it receives (from the foreign agent in network A) that are addressed to the mobile's COA in network B to the mobile's COA in network C.

(3) A business company occupies two buildings in a compound. One building houses the general administration and finance and the other houses the HRM, marketing, planning and development departments as shown below.



(a) Propose a suitable backbone network design for the Intranet of the company. Identify key network devices, other supporting infrastructure such as servers. State your assumptions.

(8 marks)



(b) Propose a suitable VLAN and IP address plan for the company. Assume that each division has 60 terminals and will expand into 100 in the near future. Draw diagrams to support your answer.

(5 marks)

There are six divisions in the institution. Therefore we need six VLANs. We can use private IP addresses and a minimum of 600 terminals will be needed.

IP address 10.10.0.0/25

	IP address	IP address Range
General administration	10.10.0.0/25	10.10.0.1 – 10.10.1.127
Finance	10.10.0.128/25	10.10.0.128 – 10.10.0.255
H.R.M.	10.10.1.0/25	10.10.1.1 – 10.10.3.127
Marketing	10.10.1.128/25	10.10.1.128 – 10.10.1.255
Planning	10.10.2.0/25	10.10.2.1 – 10.10.2.127
Development	10.10.2.128/25	10.10.6.1 – 10.10.2.255

(c) The company's Intranet is to be connected to the Internet. Show how such a connection can be securely established. **(2 marks)**

The diagram given for part (a) can be modified to include the firewall which would sit just ahead of the router / the core switch of the network.

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