



**UNIVERSITY OF COLOMBO, SRI LANKA**

**UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING**

**DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)**

**Academic Year 2016 – Semester 4 Examination**

***IT4405: Computer Networks***

***PART 2 - Structured Question Paper***

**2<sup>nd</sup> October, 2016  
(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 11 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 (x), (e.g. 

X
---

) the numbers of the questions answered.

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

1)

(a) A class C network 200.138.1.0 is sub-netted with a subnet mask of 255.255.255.252.

(i) Estimate the number of networks available.

[2 marks]

**ANSWER IN THIS BOX**

64

(ii) Estimate the number of hosts that can be assigned for each network.

[2 marks]

**ANSWER IN THIS BOX**

2

(iii) Write down the usable address range for each of the above networks.

[2 marks]

**ANSWER IN THIS BOX**

200.138.1.0- 200.138.1.3

200.138.1.4 - 200.138.1.7

200.138.1.8 - 200.138.1.11

Usable address range of three networks:

200.138.1.1 - 200.138.1.2

200.138.1.5 - 200.138.1.6

200.138.1.8 - 200.138.1.10

- (iv) Identify the broadcast address of each of the above networks.

[2 marks]

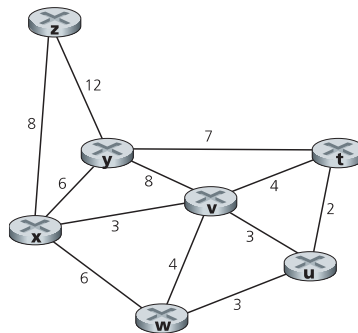
**ANSWER IN THIS BOX**

200.138.1.3

200.138.1.7

200.138.1.11

- (b) Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from node  $x$  to all other network nodes. Show how the algorithm works by computing a table indicating the costs from one node to another.



[3 marks]

**ANSWER IN THIS BOX**

$N'$	$D(t), p(t)$	$D(u), p(u)$	$D(v), p(v)$	$D(w), p(w)$	$D(y), p(y)$	$D(z), p(z)$
x	$\infty$	$\infty$	3,x	6,x	6,x	8,x
v	7,v	6,v	3,x	6,x	6,x	8,x
vu	7,v	6,v	3,x	6,x	6,x	8,x
vuw	7,v	6,v	3,x	6,x	6,x	8,x
vuwy	7,v	6,v	3,x	6,x	6,x	8,x
vuwyt	7,v	6,v	3,x	6,x	6,x	8,x
ytz	7,v	6,v	3,x	6,x	6,x	8,x

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

**[10 marks]**

<b>Software Application</b>	<b>Distributed or Centralised processing?</b>	<b>Real time or Non real time interaction?</b>	<b>1-to-1, 1-to-many, many-to-1 or many-to-many interaction?</b>	<b>Remote computation is involved (yes/no)?</b>
Text to speech translation	Centralised	Real Time	1:1	No
Message based chat	Distributed	Non-real time	Many:many	No
Road traffic and directions	Distributed	Real time	Many:many	Yes
Voice and video conferencing	Centralised	Real time	Many: many	No
Remote drone (aircraft) control	Centralised	Real time	1:1	Yes

2) (a)

- (i) Estimate the total time taken for a packet of length 1000 bytes to propagate over a link of distance 2500 km, with a propagation velocity of  $2.5 \times 10^8$  m/s, at a data transmission rate of 2 Mbps.

[2 marks]


**ANSWER IN THIS BOX**

Total time taken =  $(2500 \times 10^3 / 2.5 \times 10^8) + (1000 \times 8 / 2 \times 10^6)$  seconds  
 = 14 mseconds (10msec could also be given partial marks)

- (ii). More generally, estimate the total time taken for a packet of length  $L$  to propagate over a link of distance  $d$ , with propagation velocity of  $s$ , and a data transmission rate of  $R$  bps.

[2 marks]

**ANSWER IN THIS BOX**

$d_{\text{prop}} = m/s$  seconds 

$d_{\text{trans}} = L/R$  seconds

$d_{\text{end-to-end}} = (m/s + L/R)$  seconds

- (iii). What is the *pipe size* (bandwidth-delay product) of the link in bytes?

[1 mark]

**ANSWER IN THIS BOX**

$2 \times 10^6 / 8 \times 2500 \times 10^3 / 2.5 \times 10^8$

= 2500 bytes

(b)

Answer each of the following questions in one sentence. [10 Marks]

- (i) What happens to the data rate of a communication channel with a given bandwidth, if the signal quality of the channel is improved?

**ANSWER IN THIS BOX**

$C = w \log_2(1 + S/N)$

If  $S/N$  improves then  $C$ , the channel capacity will also improve

- (ii) If a voice stream is digitized into packets, which multiplexing would be better: TDMA or TDM?

**ANSWER IN THIS BOX**

TDM

- (iii) For a client communicating with a server using short request-short response type commands, why is TCP not good as a transport mechanism?

**ANSWER IN THIS BOX**

TCP has high overhead (e.g. connection establishment) for short messages

- (iv) For wireless LANs, why is CSMA/CA recommended over CSMA/CD as an access protocol?

**ANSWER IN THIS BOX**

In wireless communications, it is very expensive (or even impossible) to detect collisions at the receiver. Therefore, the mechanism of detecting collisions used by the CSMA/CD is not suitable and CSMA/CA is preferred.

- (v) What is the advantage of ad-hoc mode mobile wireless network over infrastructure based mobile wireless networks?

**ANSWER IN THIS BOX**

ad-hoc networks can be established without prior set up, whenever wherever necessary. Even when the infrastructure network is not available for various reasons, (natural disasters, terrain conditions), ad-hoc networks could be established and data forwarding could be carried out.

- (vi) State the network, transport and application layer protocols belonging to the Internet Suite, starting from the lowest layer that should be there in order to provide a real time interaction.

**ANSWER IN THIS BOX**

IP, UDP and RTP(or RTSP)

- (vii) What is the main difference between a peer-to-peer interaction and a client-server interaction?

**ANSWER IN THIS BOX**

All parties involved are considered are equal. There is no one assigned giver of services (server)

- (viii) On a simplex communication link, which error recovery method could work, forward error correction (FEC) or automatic repeat request (ARQ)?

**ANSWER IN THIS BOX**

FEC since it is a simplex transmission and there is no possibility of sending back of messages

- (ix) In a hierarchical switched LAN based organizational network, what is the use of the VLAN concept?

**ANSWER IN THIS BOX**

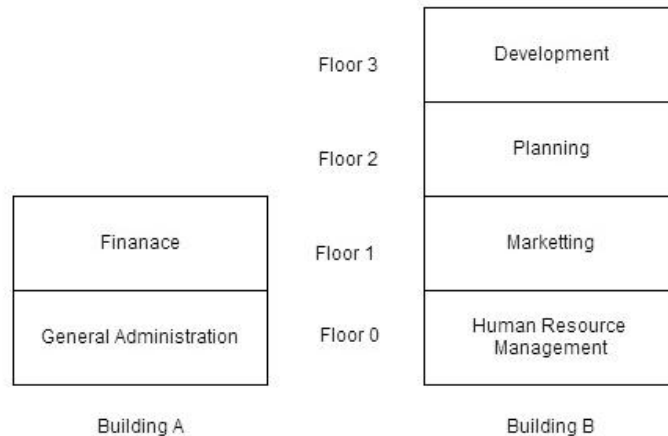
Easy administration via logical partitioning in to user groups

- (x) Routing can be done either using local neighborhood information or global information. According to which concept does OSPF (Dijkstra's algorithm) works?

**ANSWER IN THIS BOX**

OSPF allows for a logical definition of networks where routers can be divided into areas and OSPF uses IP multicast to send link-state updates to its neighbours. Therefore it works using local neighbourhood information.

- 3) A business company has island-wide branches with Head Office occupying two buildings, A and B, as shown. All branches are connected to the Head Office through leased data lines purchased from a service provider. Head Office has one physical server (virtualised to provide divisional services), in each of the buildings A and B, and access to the Internet is from the General Administration division obtained through an ISP. All branches obtain services through the Head Office. Building A has two divisions and B has four divisions.



- (a) Propose a suitable network design for the overall connectivity of the Company. Identify the key network concept that can be used to provide the Company with its 'own network' assuming the service provider caters to all types of customers. State your assumptions.

[6 marks]

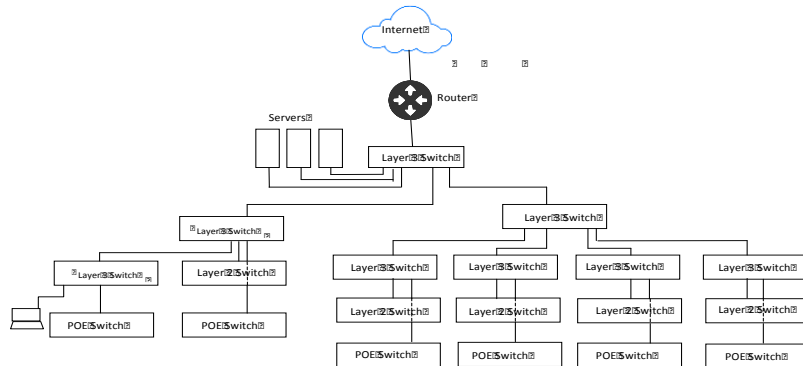
**ANSWER IN THIS BOX**

The company that has islandwide branches should be connected with the Head Office in the form of a Virtual Private Network (**VPN**). This is the key concept to have a 'own network' when borrowing services from a Service Provider (SP). Other assumptions: each branch obtains a leased line from the SP with given QoS. IP tunnelling type of VPN encryption can be optionally used.



- (b) Propose a suitable network design for the Head Office. Identify the key network concepts. State your assumptions.

[6 marks]

**ANSWER IN THIS BOX**

- (c) The ISP has provided a very limited block of IP addresses to the Company, which has over 300 computers. Propose a solution for IP allocation.

[2 marks]

**ANSWER IN THIS BOX**

There are six divisions in the institution. Therefore we need six VLANs. Since the ISP has provided a very limited block of IP addresses and the organisation has more than 300 computers, we can use private IP addresses.

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

\*\*\*\*\* END \*\*\*\*\*