



**UNIVERSITY OF COLOMBO, SRI LANKA**

**UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING**

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

**Academic Year 2018 – 2<sup>nd</sup> Year Examination – Semester 4**

***IT4405 – Computer Networks***  
***Part 2 - Structured Question Paper***

**30<sup>th</sup> September, 2018**  
**(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 **13 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. 

×
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) the numbers of the questions answered.

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

- 1) (a) Araliya Corporation has been assigned the /16 network address block 165.87.0.0, that needs to be divided into ten usable subnets.

- (i) What subnet mask should be applied to the network to provide the most number of hosts per subnet?

(2 marks)

**ANSWER IN THIS BOX**

3 bits gives  $2^3 = 8$  subnets, and 4 bits give  $2^4 = 16$  subnets. Therefore we need to use 4 bits to have at least 10 subnets with the most number of hosts.

The subnet mask would be 255.255.240.0 or /20.

- (ii) What are the network addresses of the first 2 subnets?

(2 marks)

**ANSWER IN THIS BOX**

Subnet 0 (1<sup>st</sup>) would have address 165.87.0.0

Subnet 1 (2<sup>nd</sup>) would have address 165.87.16.0

(iii) What is the usable range of host addresses on the 4<sup>th</sup> subnet?

(2 marks)

**ANSWER IN THIS BOX**

Subnet 3 (4<sup>th</sup>) would have the address range 165.87.48.0 to 165.87.63.255. Leaving out 165.87.48.0 for the network address and 165.87.63.255 for the broadcast address, the usable host address range would be;

165.87.48.1 to 165.87.63.254

(iv) What is the broadcast address of the 6<sup>th</sup> subnet?

(2 marks)

**ANSWER IN THIS BOX**

Subnet 4 (5<sup>th</sup>) would have address 165.87.64.0

Subnet 5 (6<sup>th</sup>) would have address 165.87.80.0

Subnet 6 (7<sup>th</sup>) would have address 165.87.96.0

So;

Subnet 5 (6<sup>th</sup>) would have the broadcast address 165.87.95.255

(b) Answer the following questions briefly (in 1 to 3 sentences).

(i) What is **routing**?

(2 marks)

**ANSWER IN THIS BOX**

Routing is the process of finding a path through a network on which data can pass from source to destination. Routing is done by devices called routers, which are network layer devices.

(ii) What is the purpose of the data link layer in the OSI model?

(2 marks)

**ANSWER IN THIS BOX**

The job of the Data Link layer is to check that messages are sent to the right device. Another function of this layer is framing.

(iii) What is the key advantage of using switches?

(2 marks)

**ANSWER IN THIS BOX**

When a switch receives a signal, it creates a frame out of the bits that were from that signal. With this process, it gains access and reads the destination address, after which it forwards that frame to the appropriate port. This is a very efficient means of data transmission, instead of broadcasting it on all ports.

(iv) When does network congestion occur?

(2 marks)

**ANSWER IN THIS BOX**

Network congestion occurs when too many users are trying to use the same bandwidth. This is especially true in big networks that do not resort to network segmentation.

(v) What is a **window** in networking terms?

(2 marks)

**ANSWER IN THIS BOX**

A window refers to the number of segments that are allowed to be sent from source to destination before an acknowledgment is sent back.

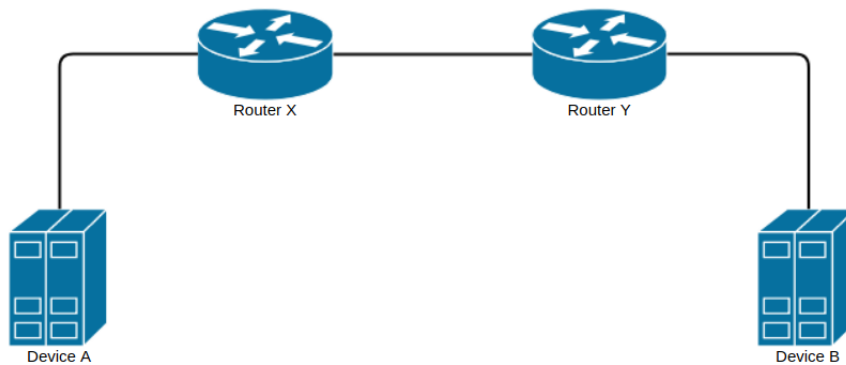
(vi) How does RIP differ from IGRP?

(2 marks)

**ANSWER IN THIS BOX**

RIP relies on the number of hops in order to determine the best route to a network, while IGRP takes into consideration many factors before it decides the best route to take, such as bandwidth, reliability, MTU and hop count.

2) (a) Consider the following network arrangement.



The links from devices to routers (A to X and B to Y) have bandwidths of 100 Mbps with a one-way propagation delay of 5  $\mu$ s. Link between the routers (X to Y) has a bandwidth of 8 Mbps and a one-way propagation delay of 200  $\mu$ s. All links are dedicated, meaning that 100% utilization can be assumed.

A data stream is being transmitted from device A to B in 500 byte packets. Note that all units should use the decimal metric scheme.

- 1 Mbps = 1,000 kbps = 1,000,000 bps
- 1 MB = 1,000 kB = 1,000,000 bytes

(i) Calculate the maximum effective data transmission rate from device A to B in packets per second.

(2 marks)

### **ANSWER IN THIS BOX**

Maximum transmission rate is determined by the slowest link in the path from device A to B, which is the link between the routers at 8 Mbps.

A single packet is 500 bytes = 500 x 8 bits = 4 kb

Maximum packet rate = 8 Mbps / 4 kb = 2,000 packets/s

- (ii) Calculate the time taken to transfer a 1 MB from device A to B, assuming that there are no packet losses. You may omit effects of propagation delay from this calculation.

(2 marks)

**ANSWER IN THIS BOX**

Packets needed to transfer 1 MB =  $1,000,000 / 500 = 2,000$

Time required for the transfer =  $2,000 / 2,000 = 1$  s

- (iii) Calculate the maximum number of packets in transit, assuming that each packet is acknowledged and that transmission time of acknowledgment packets are negligible.

(4 marks)

**ANSWER IN THIS BOX**

Total transmission time for a packet =  $2 \times (500 \times 8 / 100 \text{ Mbps}) + (500 \times 8 / 8 \text{ Mbps}) = 580 \mu\text{s}$

Total propagation delay of a packet =  $2 \times 5 \mu\text{s} + 200 \mu\text{s} = 210 \mu\text{s}$

Time from a packet transmission to acknowledgment =  $580 \mu\text{s} + 2 \times 210 \mu\text{s} = 1 \text{ ms}$

Packets in transit =  $2,000 \text{ pps} / 1 \text{ ms} = 2$



(b) Answer the following questions briefly (with 1 to 3 sentences).

- (i) In what scenarios does the Domain Name System (DNS) use TCP as the underlying transport protocol?

(3 marks)

**ANSWER IN THIS BOX**

DNS uses TCP as the transport protocol when the request or response exceeds the MTU size allowed by UDP. This is commonly used with DNSSEC responses and for transfer requests.

- (ii) What is a Management Information Base (**MIB**) used in SNMP?

(3 marks)

**ANSWER IN THIS BOX**

A MIB is part of every SNMP managed device. Each SNMP agent has the MIB database that contains information about the devices status, performance, connections and configuration. SNMP is used for querying the MIB.

(iii) What is the difference between interior and exterior neighbor gateways?

(2 marks)

**ANSWER IN THIS BOX**

Interior gateways connect LANs of one organization, whereas exterior gateways connect the organization to the outside world.

(iv) What is a **multi-homed** host?

(2 marks)

**ANSWER IN THIS BOX**

It is a host that has multiple network interfaces connecting it to multiple networks.

(v) What is an autonomous system?

(2 marks)

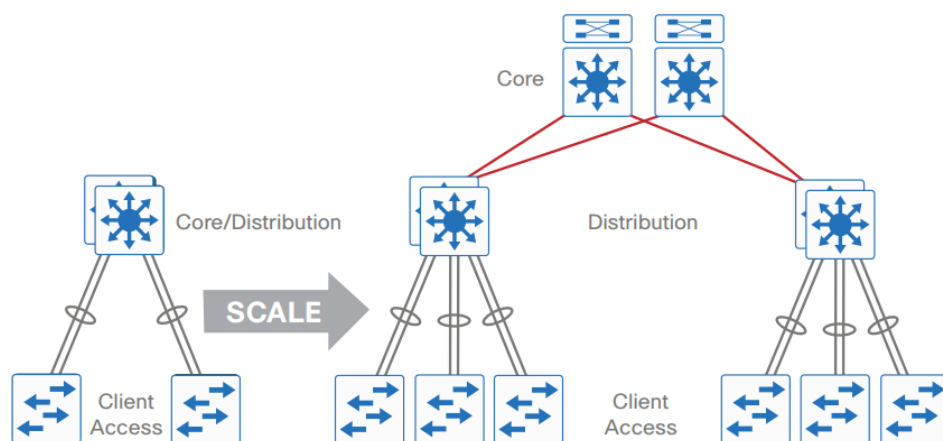
**ANSWER IN THIS BOX**

It is a collection of routers under the control of a single administrative authority and that uses a common Interior Gateway Protocol.

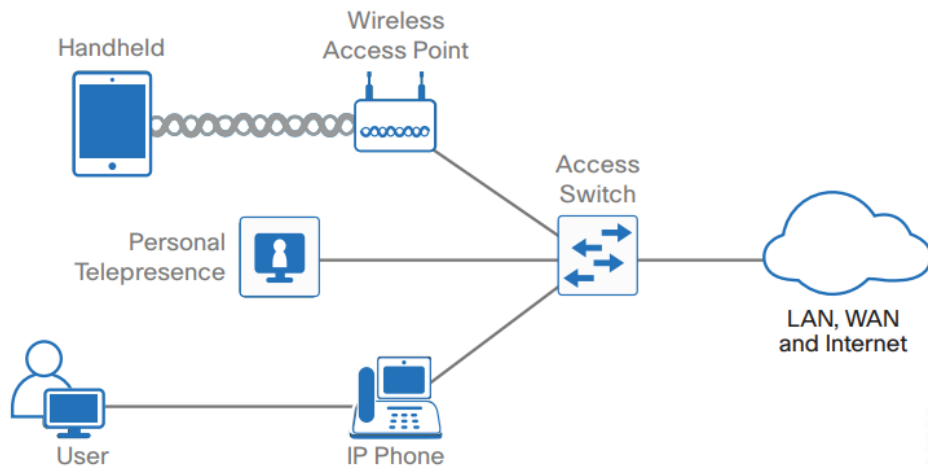
3) (a) Using a diagram, show how a two tier modular switch design (access, collapsed core + distribution) can be scaled up to a three tier switch arrangement (access, core, distribution).

(2 marks)

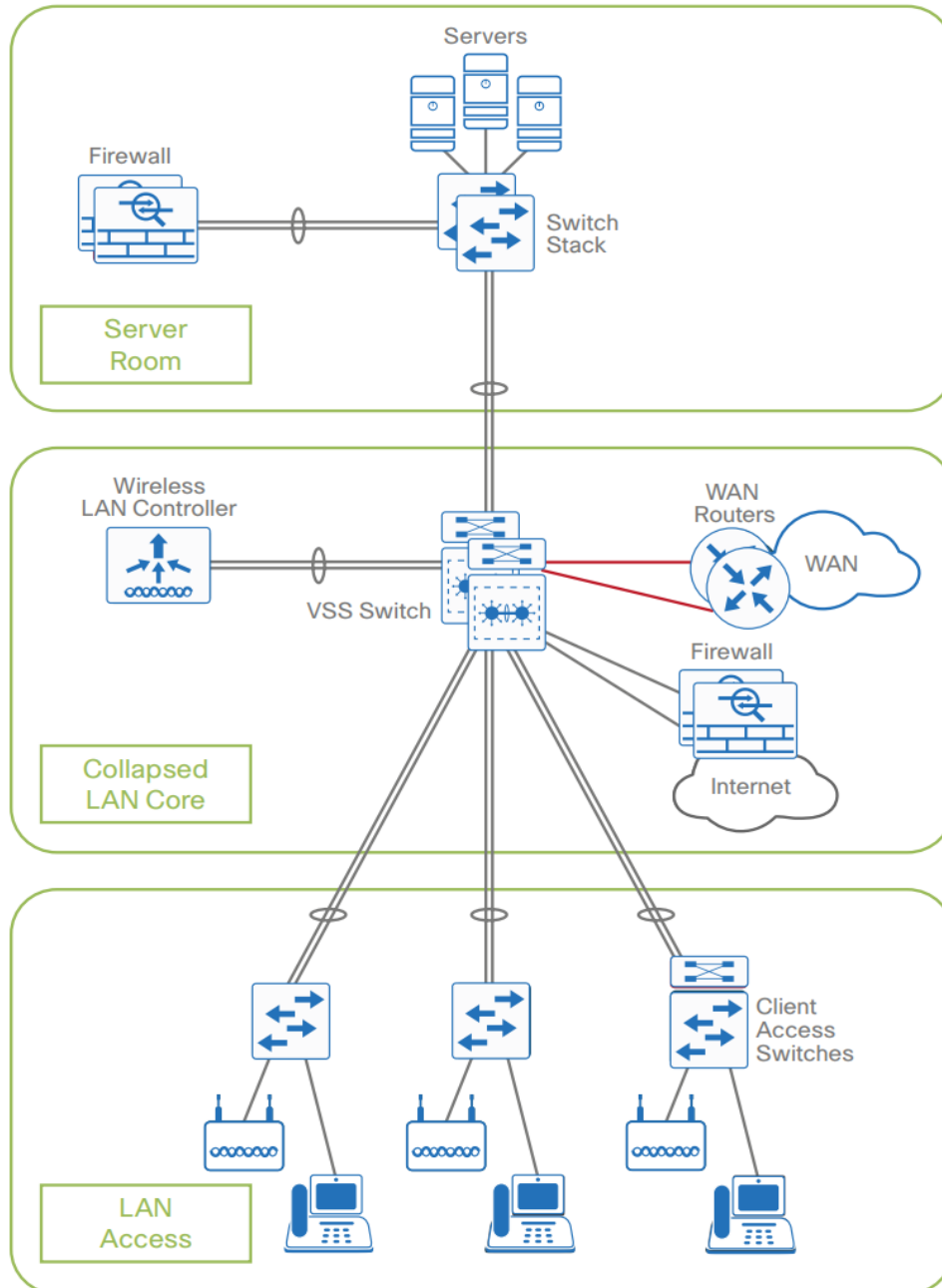
**ANSWER IN THIS BOX**



- (b) Using a diagram, show how the access layer of a network can be designed to accommodate wired and wireless user devices including IP telephones. (2 marks)

**ANSWER IN THIS BOX**

- (c) Design a campus network using two tier modular design in the form of a diagram. Clearly demarcate the LAN access, collapsed LAN core and the server room. (6 marks)

**ANSWER IN THIS BOX**

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