

MAKERERE UNIVERSITY

SCHOOL OF COMPUTING & INFORMATICS TECHNOLOGY

END OF SEMESTER II EXAMINATION 2015/2016

cookies, web proxies

PROGRAMME: BSE, BIT, CS

YEAR OF STUDY: II

COURSE NAME: COMPUTER NETWORKS

COURSE CODE: BSE2106

DATE: 09 December 2015

TIME: 12:00 – 3:00 pm

EXAMINATION INSTRUCTIONS

ATTEMPT ALL QUESTIONS IN SECTION A (40 MARKS)

ATTEMPT THREE (03) QUESTIONS IN SECTION B (60 MARKS)

DO NOT OPEN THIS EXAM UNTIL YOU ARE TOLD TO DO SO

ALL ROUGH WORK SHOULD BE IN YOUR ANSWER BOOKLET

SECTION A [40 Marks]

Dm

- a) Define the term computer networks (2marks)
- b) State any two reasons why it's important to change your password frequently (2marks)
- c) Challenge-response authentication can be divided into four categories: State the four categories (2marks)
 - Symmetric cipher
 - Keyed hash function
 - Digital Signature
 - Asymmetric keyed cipher (4marks)
- d) Define a hash function and briefly explain three hash function criteria (2marks)
- e) Classification of computer networks depend on three characteristics. Briefly explain them (3marks)
 - Wired, Wired, Point-to-point
- f) Explain any three factors you would consider when selecting a network topology (3marks)
- g) State the OSI layers that don't appear in the TCP/IP model and describe one service each layer provides to the upper layers (4marks)
- h) With aid of a diagram explain the components of a communication system (5marks)
 - i) Write brief notes about the following network categories (1mark@)
 - i. MAN
 - ii. WAN
- j) With aid of a diagram explain the three transmission modes (3marks)
 - Simplex, Half duplex, Full duplex
- k) With aid of a diagram explain the four basic topologies and state any one advantage of each (6marks)
 - bus-star, mesh-ring
- l) A hash function guarantees the integrity of a message and does not authenticate the sender of the message. To provide message authentication, we need to change a modification detection code to a message authentication code. If Alice was sending a message to Bob, explain how Alice uses a keyed hash function to authenticate her message and how Bob can verify the authenticity of the message. (4marks)

→ One-way
msg.

SECTION B [60 Marks]

Question 1

- a. State any two differences and two similarities between OSI and TCP/IP models (4marks)
- b. State the four fundamental characteristics that determine the effectiveness of a data communications system - ~~Integrity~~ ~~Delivery~~ ~~Confidentiality~~ ~~Authenticity~~ (4marks) ~~Access~~ ~~Traceability~~
- c. With aid of a diagram explain the difference between hop-to-hop delivery and source-to-destination delivery (4marks)
- d. State all the TCP/IP layers and describe any one protocol found on each of the layers - ~~Application - HTTP, FTP, DNS~~ ~~Internet Layer - IP~~ ~~Transport - UDP, TCP~~ ~~Network Layer - Ethernet~~ (6marks)
- e. Explain the difference between UDP and TCP - ~~confidentiality~~ ~~integrity~~ ~~authentication~~ ~~Delivery~~ ~~non-repudiation~~ ~~docs create connection~~ ~~services due to user~~ ~~accessable to user~~ (2marks)

Application

HTTP

FTP

DNS

Transport

UDP

TCP

Internet

Layer

Question 2

- a) Cryptography can provide five security services. Explain the five services (5marks)
- b) Explain the difference between asymmetric and a symmetric key cryptographies (2marks)
- c) In entity authentication, a claimant proves her identity to the verifier by using one of the three kinds of witnesses: Briefly explain them. - Some may know secret key or have access to it - Some may prove identity - Some may have access to public key (4marks)
- d) Briefly explain any four ways to distribute public keys - Public key announcement - Trusted third parties (4marks) certificate authority
- e) With aid of diagrams explain how confidentiality with Symmetric-Key Cryptography is different from confidentiality with Asymmetric-Key Cryptography (6marks)

Question 3

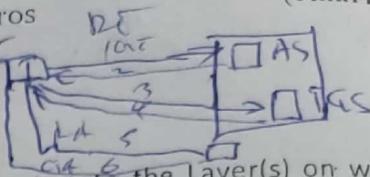
- a) A signature can either be Conventional or Digital. Discuss the differences between two types of signatures - Conventional - one to many - Signature - doc, letter
Digital - one to one - Signature - msg (4marks)
- b) Digital signature can be achieved in two ways: signing the document or signing a digest of the document. Explain how they differ - Signing - sender applies his private key to the document - msg digest - apply the function to get fixed (2marks)
- c) A digital signature can provide three out of the five security services. State and explain how these services can be achieved - Confidentiality
- Integrity
- Authentication (3marks)
- d) Symmetric-key cryptography is more efficient than Asymmetric key cryptography when we need to encrypt and decrypt large messages but needs a shared secret key between two parties. The problem with Symmetric-key cryptography is the number of keys and how to distribute them especially when dealing with a large group. Explain how Key

Ans

Distribution Center maintain and distribute secret keys.

- e) Kerberos is an authentication protocol and at the same time a Key Distribution Center that has become very popular. Explain the operation of Kerberos (5marks)

- AS (Authentication Server)
- TGS (Ticket Granting Server)
- KDC (Key Distribution Center)



Question 4

- a) Write brief notes about the following network devices and state the Layer(s) on which they operate (2marks@)

- I. Three-Layer Switch - used at network layer, kind of integrated in Bridge
- II. Bridge - carries frame & operates in the physical & data link layers
- III. Transparent Bridge - can forward & filter frames & automatically build MAC table
- IV. Gateway - takes an application message, reads it & interprets it.

- b) State any four characteristics that can be used by vendors to group stations in a VLAN?

Port numbers, MAC addresses, IP addresses, (2marks)

- c) State any three advantages of using VLANs. - Cost & time reduction. (3marks) ~~convenience of broadcast domain~~

- d) In a multi-switched backbone, each switch must know not only which station belongs to which VLAN, but also the membership of stations connected to other switches. State the three methods that have been devised for this purpose: - ~~TDM~~

- (3marks)
 - Table maintenance
 - frame tags

- e) Write brief notes about the following architectures as used in backbone networks

- I. The bus (2marks)

- II. The star (2marks)

Question 5

- a. Define the following terms as far as Cellular telephone and Satellite Networks are concerned

- i. Roaming (1mark)
- ii. Footprint (1mark)
- iii. Reuse factor (1mark)
- iv. Period of a satellite (1mark)

- b. Explain the three categories of satellites (1mark)

- c. Explain the two types of handoff (3marks)
(2marks)

- d. Define the term Orbit and explain the three types of satellite orbits (4marks)
- e. According to Kepler's law, what is the period of a satellite in hours that is located at an orbit approximately 35,786 km above the Earth? Assume the diameter of the earth is 9813miles
(1mile=1.3km) (5marks)
- What is the relationship between the Van Allen Belts and satellites? (2marks)

GOOD LUCK

MAKERERE UNIVERSITY
COLLEGE OF COMPUTING AND INFORMATION SCIENCES

ROUND TWO TEST
PROGRAMME:
YEAR OF STUDY:
COURSE NAME:
COURSE CODE:
DATE:

BIT, BCSC, BSE
II
COMPUTER NETWORKS
BSE 2106
21/11/2015

- a. Briefly explain any 3 ways to distribute public keys (3marks)
- b. Define the following terms as far as Cellular telephone and satellite networks are concerned (1mark)
- i. Roaming (1mark)
 - ii. Footprint (1mark)
 - iii. Reuse factor (1mark)
 - iv. Period of a satellite (1mark)
- c. Explain the three categories of satellites (3marks)
- d. Explain the two types of handoff (2marks)
- e. Define the term Orbit and explain the three types of satellite orbits (4marks)
- f. According to Kepler's law, what is the period of a satellite in hours that is located at an orbit approximately 35,786 km above the Earth? Assume the diameter of the earth is 9813 miles (1mile=1.3km) (4marks)
- g. What is the relationship between the Van Allen Belts and satellites? (2marks)
- h. Write brief notes about the following network devices (4marks)
- I. Repeater - It regenerates signals on the media
 - II. Bridge
 - III. Passive hub - It passes signals thru it and doesn't add any
 - V. Transparent Bridges

State any 4 characteristics that can be used by vendors to group stations in a VLAN? (4marks)

Thermal noise, induced noise,
Crosstalk, impulse noise

- Distorted signal changes to form a shape.

passive hub - connector.

active hub - multiplex repeater.

SECTION A (40 MARKS)

1. Why are standards needed in data communication? [2 marks]
2. State the three steps involved in Pulse Code Modulation. [3 marks]
3. Match the following to one or more layers of the OSI model. [4 marks]
 - i. Route determination
 - ii. Flow control
 - iii. Interface to transmission media
 - iv. Providing access for the end user
4. a) What is attenuation? [2 marks]
b) Apart from attenuation, name the other types of transmission impairment. [2 marks]
c) A signal travels from point A to point B. At point A, the signal power is 100 W. At point B, the power is 90 W. What is the attenuation in decibels? [3 marks]
5. Explain the following terms in regard to network security. [8 marks]
 - i. Message authentication
 - ii. Message integrity
 - iii. Message confidentiality
 - iv. Non-repudiation.
6. Five channels, each with a 100 kHz bandwidth, are to be multiplexed together.
 - i. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference?
 - ii. Show the configuration using the frequency domain. [4 marks]
7. Explain the role of each of the following network devices and state the layer of the OSI model that the device operates on.
 - i. Hub [2 marks]
 - ii. Bridge [2 marks]
 - iii. Router - Network layer [2 marks]
8. What do you understand by the following terms as used in cellular telephony?
 - i. Hard hand-off? [2 marks]
 - ii. Soft hand-off? [2 marks]
 - iii. Roaming? [2 marks]

Internet Connection for Assignments
ICAN → IP address

SECTION B (60 Marks)

~~60 Marks~~ → 28 marks

Question One

- Define the term Multiplexing [1 mark]
- Which of the three multiplexing techniques is commonly used for
 - Fibre optic links? [2 marks]
 - Digital data? [2 marks]
- Ten sources, six with a bit rate of 200 kbps and four with a bit rate of 400 kbps are to be combined using multilevel TDM with no synchronizing bits. Calculate:
 - The size of a frame in bits? [2 marks]
 - The frame rate? [2 marks]
 - The duration of a frame? [2 marks]
 - The data rate? [2 marks]
- Give any four applications of Frequency Division Multiplexing. [4 marks]
- Define Spread Spectrum and cite any three of its advantages. [5 marks]

Question Two

- State Shannon's law as applied in communication networks. [2 marks]
- Give any THREE types of noise in transmission of signals in data communication.
- UBC has a channel with 4 MHz band width. If the company needs to send data at a rate of 100 Mbps, calculate
 - The SNR? [3 marks]
 - The SNR in decibels? [2 marks]
 - The theoretical number of signal levels. [3 marks]
- A non-periodic composite signal has a bandwidth of 300 MHz, with a middle frequency of 150 MHz and peak amplitude of 55 V. The two extreme frequencies have an amplitude of 25 V.
 - Calculate the values of the extreme frequencies. [4 marks]
 - Draw the frequency spectrum of the signal. [2 marks]

Question Three

- Define the following terms as applied to encoding.
 - Signal element [2 marks]
 - Data element [2 marks]
 - bit rate [2 marks]
 - pulse rate / [2 marks]

Find an 8-bit data stream for each of the cases below if the first bit was 1.

MAKERERE UNIVERSITY

WDM
WA
+22+23

Engg & Infrastruc
Security request
B, M, 15 321
TR, 19

COLLEGE OF COMPUTING AND INFORMATION SCIENCES
DEPARTMENT OF NETWORKS

19/12/14
Engineering
Dept

END OF SEMESTER I EXAMINATION FOR 2014/2015

COURSE NAME: COMPUTER NETWORK

COURSE CODE: BSE 2106

YEAR OF STUDY: II



DURATION: 3 HOURS

Date: 9th December 2014 Time: 12.00PM-3.00PM

INSTRUCTIONS:

1. All answers must be written in the answer sheet provided.
2. Attempt ALL questions in section A and ANY FOUR questions in B
3. Clearly indicate the question Number that you are attempting
4. Begin Each question in section B on a new Page

Each page has to
may not need same
page.

Identity provided by the party

Attenuation \Rightarrow Reduction in amplitude
is produced by reflection

of signal during data transmission
in communication line

SECTION A [40 Marks]

a) Layering is a key design principle in computer networks.

- (i) Use no more than three sentences to describe two advantages of layering.
Modularity \rightarrow protocols are easier to manage and maintain.
Abstraction clarity \rightarrow lower level layers can be changed without affecting the upper layers. (2 marks)
- (ii) Use no more than three sentences to describe one disadvantage of layering.

Parity

Que

is talk \rightarrow carry error in data mostly transmitted over telephone wire. (Causes errors)

b) Explain any three transmission impairments. Noise, Interference, Cross talk may corrupt the signal. (3 marks)

c) Distinguish Any undesired change in wave form of an electric signal. (3 marks)

d) Explain why the Internet DNS uses caching. (3 marks)

DNS cache containing entries (Data) that translates Internet domain name to IP address. (2 marks)
Three cache providers are efficient way for DNS to efficiently keep the Internet stable and quick.

e) Differentiate between Twisted pair Cable, Co-axial, and Fiber optic cable. (3 marks)

Twisted pair \rightarrow finds a suitable path for Pkt from sender to destination / forwarder. (3 marks)

f) Give three differences between routing and forwarding? Please briefly explain. (3 marks)

each of them tells where to send data while forwarder is way to send data across the network.

Routing determines the next hop IP address where it will send Pkt based on destination IP.

Forwarding determines the exist interface to use to detect send Pkt to the next hop. (3 marks)

g) Compare CSMA/CA with CSMA/CD. (2 marks)

CSMA/CD - tells the station what to do when collision detected, CSMA/CA - does not tell.

h) Why does IEEE 802.11 use CSMA/CA instead of CSMA/CD? (2 marks)

i) What is throughput measure of how fast we can send data through a link. (2 marks)

It's a measure of how fast we can send data through a network. (2 marks)

FDM \rightarrow frequency division multiplexing analog technique that can be applied over analog.

TDM \rightarrow time division multiplexing digital multiplexing technique for combining several rates into one high rate.

k) Briefly explain the difference between a network and internet. (2 marks)

Its a digital process that allows several connections to share the bandwidth of a link.

l) Briefly explain the difference between circuit switching and packet switching. (2 marks)

m) Name 2 well known data protocols provided by the Internet Transport layer and brief describe service of each. (4 marks)

(4 marks)

n) What is Instantaneous rate in throughput? (1 Mark)

o) What is average rate in throughput? (1 Mark)

need to compare multiple diff. in a deceleration holding.

age 2 of 4

Question 4

- a. Describe how congestion occurs in computer networks and name the indicators of network congestion? (3 Marks)
- b. What is the logical difference between Transport layer and network layer? (2 Marks)
- c. Explain the error detection method that operates at the transport layer? (5 Marks) *(check sum, header)*
→ Internet delay & loss in computer networks?
- d. What command can we use in windows networked computers to see the "real" Internet delay & loss in computer networks? (1 Mark) *tracert*
- e. Explain four sources of packet loss in a computer network. (4 Marks) *noise, attenuator, distortion, impulse noise, busy channel.*

Question 5

- a. Name the 3 components of a virtual circuit? (3 Marks) *source (place higher), relay (receiver place lower), target (sender place higher)*
- b. What is IP fragmentation? (definition of segmenting to prevent possible to pass through the larger network) (2 Marks)
- c. Where do ISPs get IP address blocks? (from local internet registry) (2 Marks)
- d. Describe how a host can get an IP address? (Dhcp) (5 Marks)
- e. Describe the changes made to move from IPv4 to IPv6 (name 5) (2 Marks) *→ IPv6 uses 128 bits, IPv4 uses 32 bits*
- f. Briefly explain the work of NAT in computer network. *→ A router or a server will have a large set of addresses internally and one address of small set of addresses externally*

Question 6

What nature of addressing is used to identify source and destination at the data link layer? *physical address* (1 Marks)

State four (4) Data Link layer services. *→ Frame, address, control, physical address* (4 Marks)

Describe the function of ARP in computer networks. *→ Helps physical address to find MAC address* (1 Mark)

Why is Ethernet referred to as connectionless? (none of the connectionless protocols are connectionless) (1 Mark) *any workstation can send data to any other workstation*

→ It is a connectionless service with a very low overhead. (any workstation can send data to any other workstation)

What are the differences and similarities between a switch and a router? (6 Marks) *acknowledgment received*

state two characteristics of a wireless network in ad-hoc mode. *→ short range, direct communication, no infrastructure, same channels, different distances, similar bandwidth, both use CSMA/CA, both can talk to each other, both can send data, both can receive data* (2 Marks)

Router

4 of 4
operations of network layer

Detailed notes

- Frame relay (12)
- allows to connect multiple lines

Section B (60 Marks)

Question 1

- Which devices are included in the network edge? - Computer, switch, router. (2 Marks)
- Name 2 infrastructure involved in the network core? (2 Marks)
- Describe internet as a service (2 Marks)
- Describe how DSL can be used to transmit data from the user to the service provider. (5 Marks)
- Give two examples of a human protocol. (2 Marks)
- ~~Give example close to people, And mention when we use it specially.~~ Which two important aspects do you need to keep in mind when planning to connect end systems to edge routers? (2 Marks)

Question 2

- Which application software runs on network-core devices? (2 Marks)
- Name four characteristics of a client in client/server architecture. (4 Marks)
- Name four characteristics of a network in P2P architecture? (4 Marks)
- Explain the work of a socket in computer networks. (4 Marks)
- A process must have identifier as an address. What is the identifier made up of? (2 Marks)

Question 3

host name *path name*

a. www.myuniversity.edu/myclass/pic.gif

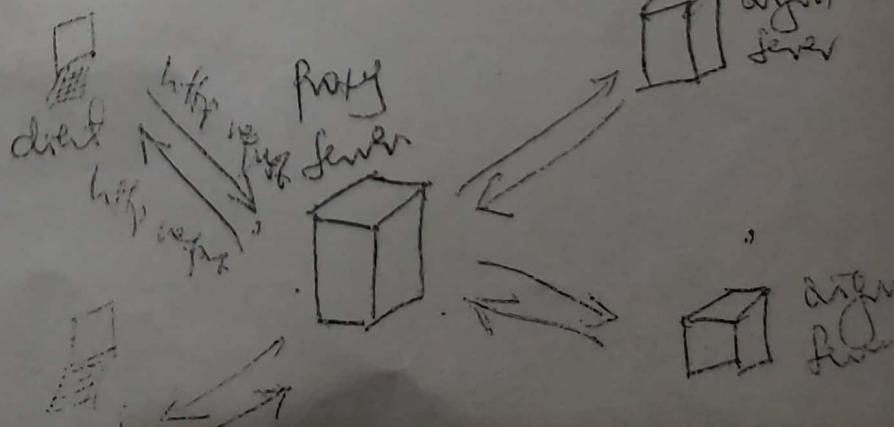
Identify the host and the path of the URL above

(2 Marks)

- With a diagram, explain how cache acts as both server and client. (2 Marks)
- What are the three major components of electronic mail? (3 Marks)
- With the aid of a diagram, explain recursive query in DNS resolution. (4 Marks)
- Explain 3 characteristics of fiber optic cable. (3 Marks)
- What is store-and-forward in computer networks? (1 Mark)

Page 3 of 4

User sets browser, web accesses via web cache.



* Client sends all http requests to web cache.
object exists, return
else, request

Section B (60 Marks)

Question 1

- a. Which devices are included in the network edge? *smart phones, PC* (2 Marks)
- b. Name 2 infrastructure involved in the network core? (2 Marks)
- c. Describe internet as a service (2 Marks)
- d. Describe how DSL can be used to transmit data from the user to the service provider. (2 Marks)
- e. Give two examples of a human protocol. (5 Marks)
(2 Marks)
- f. Which two important aspects do you need to keep in mind when planning to connect end systems to edge routers? (2 Marks)

Question 2

- a. Which application software runs on network-core devices? (2 Marks)
- b. Name four characteristics of a client in client/server architecture. (4 Marks)
- c. Name four characteristics of a network in P2P architecture? (4 Marks)
- d. Explain the work of a socket in computer networks. (4 Marks)
- e. A process must have identifier as an address. What is the identifier made up of? (2 Marks)

Question 3

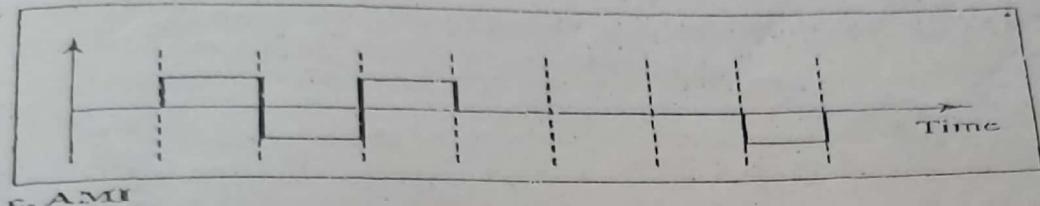
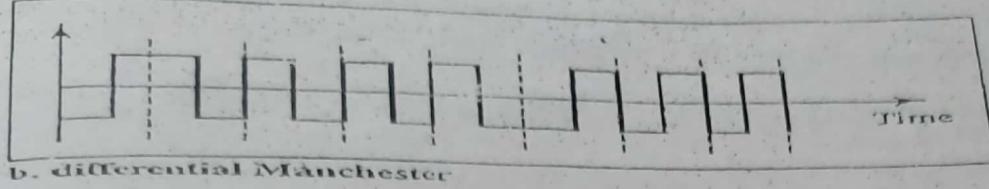
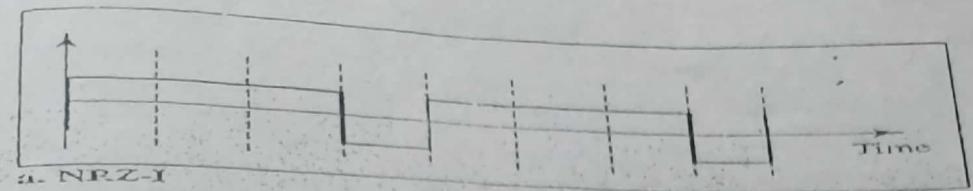
- a. www.myuniversity.edu/myclass/pic.gif (2 Marks)
Identify the host and the path of the URL above
- b. With a diagram, explain how cache acts as both server and client. (2 Marks)
- c. What are the three major components of electronic mail? (3 Marks)
- d. With the aid of a diagram, explain recursive query in DNS resolution. (4 Marks)
- e. Explain 3 characteristics of fiber optic cable. (3 Marks)
- What is end-to-end in computer networks? (1 Mark)

- VC network
Connection is implemented in the work layer
- bus
- cross bar.
- Question 4**
- Describe how congestion occurs in computer networks and name the indicators of network congestion? (3 Marks)
 - What is the logical difference between transport layer and network layer? (2 Marks)
 - Explain the error detection method that operates at the transport layer? (5 Marks)
 - What command can we use in windows networked computers to see the "real" Internet delay & loss in computer networks? (1 Mark)
 - Explain four sources of packet loss in a computer network. (large 1 Marks)
 # Are datagram been several smaller data
- Question 5**
- Name the 3 components of a virtual circuit? (3 Marks)
 - VC - Connection oriented. Highly protocols. (1 Marks)
 - Where do ISPs get IP address blocks? (2 Marks)
 - Internet Corporation for Assigned Names & Numbers, allocates addresses. (12 Marks)
 - Dynamic, plug & play.
 - domain names.
 - Describe the changes made to move from IPv4 to IPv6 (name 5)? (5 Marks)
 - Briefly, explain the work of NAT in computer network. (2 Marks)
- Question 6**
- What nature of addressing is used to identify source and destination at the data link layer? (1 Marks)
 - State four (4) Data Link layer services. (4 Marks)
 - Describe the function of ARP in computer networks. (1 Mark)
 - Why is Ethernet referred to as connectionless? (1 Mark)
 - What are the differences and similarities between a switch and a router? (6 Marks)
 - State two characteristics of a wireless network in ad hoc mode. (2 Marks)

ge 4 of 4

* Examples services for:
 * individual datagrams.

Network
 - no C
 - host
 - Imp



[6 marks]

- c) Using the 8-bit stream in (b) and (c) of the diagram above, encode the following schemes respectively;

- (i) Pseudoternary [3 marks]
(ii) Manchester [3 marks]

Question Four:

- a) State one important consideration according to Nyquist for an analog signal to be reproduced at the receiver during analog to digital conversion. [2 marks]
- b) We want to digitize the human voice, calculate the bit rate assuming 8 bits per sample. [Hint the frequency of a digitized voice is between 0 – 4000 Hz] [4 marks]
- c) Define analog modulation and give one application? [2 marks]
- d) Describe the different techniques used during analog to analog conversion and state the formulae used to calculate the available bandwidth for each technique. [6 marks]
- e) Calculate the bandwidth for the following cases if we need to modulate a 15-MHz voice;
(i) AM [2 marks]
(ii) FM ($\beta = 5$) [2 marks]
(iii) PM ($\beta = 2$) [2 marks]

Question Five

- a) In cellular telephony frequencies are reused. Which is better, A low reuse or a high reuse? Explain your answer. [3 marks]
- b) What are the functions of the following in a cellular telephony? [2 marks]
- Mobile Switching Center [2 marks]
 - Base Station
- c) MTN Company is planning for cellular coverage of FOUR areas within Kawempe division. Due to the constraints in frequencies, it is contemplating on reusing frequencies. Suggestions of a frequency reuse patterns of 4 and 7 are proposed.
- Draw a cell pattern with a frequency reuse factor of 4. [3 marks]
 - If the frequency reuse factor of 7 is used. Give the pros and cons? [2 marks]
- d) Incorporating satellite into terrestrial networks is often hindered by three main characteristics possessed by satellite communication. What are they? [3 marks]
- e) According to Kepler's law, the period of the moon, is given by $\text{Period} = C \times (\text{Distance})^{\frac{3}{2}}$. C is the constant approximated to $1/100$, the period being in seconds and distance in kilometers from the centre of the earth. A communication satellite is located at an orbit approximately 35786 Km above the earth.
- What is the period (in hrs) of the satellite? [3 marks]
 - What conclusion about the satellite orbit can we draw from the answer above? [2 marks]

MAKERERE UNIVERSITY
COLLEGE OF COMPUTING AND INFORMATION SCIENCES

ROUND ONE TEST

PROGRAMME:

BIT, BCSC, BSE

YEAR OF STUDY:

II

COURSE NAME:

COMPUTER NETWORKS

COURSE CODE:

BSE 2106

DATE:

24/10/2015

- a. With aid of a diagram explain the three transmission modes (3marks)
- b. With aid of a diagram explain the four basic topologies and state any one advantage of each (8marks)
- c. State any two differences and similarities between OSI and TCP/IP models (4marks)
- d. Define a hash function and briefly explain three hash function criteria (4marks)
- e. Cryptography can provide five security services. Explain the five services (5marks)
- f. Write brief notes about the following network categories (1mark@)
- LAN
 - MAN
 - WAN
- g. State the seven OSI layers and describe one service each layer provides to the upper layers (10marks)
- h. With aid of a diagram explain the difference between hop-to-hop delivery and source-to-destination delivery (4marks)
- i. Explain the difference between asymmetric and a symmetric key cryptographies (2marks)
- j. Challenge-response-authentication can be divided into four categories: State the four categories (4marks)
- k. In entity authentication, a claimant proves her identity to the verifier by using one of the three kinds of witnesses: Briefly explain them. (3marks)

A hash function is any function that can be used to map data of any size to data of a fixed size.

END

By

MAKERERE UNIVERSITY
COLLEGE OF COMPUTING & INFORMATION SCIENCES
SCHOOL OF COMPUTING & INFORMATICS TECHNOLOGY
END OF SEMESTER 1 EXAMINATION 2019/2020

PROGRAMME: SE & CS

YEAR OF STUDY: II

COURSE NAME: COMPUTER NETWORKS

COURSE CODE: BSE 2106

DATE: 5TH DECEMBER 2019 TIME: 4PM - 7PM

EXAMINATION INSTRUCTIONS

1. ATTEMPT ALL QUESTIONS IN SECTION A (40 MARKS)
2. ATTEMPT THREE QUESTIONS IN SECTION B (20 MARKS EACH)
3. DO NOT OPEN THIS EXAM UNTIL YOU ARE TOLD TO DO SO
4. ATTEMPT EACH QUESTION IN SECTION B ON A NEW PAGE OF THE ANSWER BOOKLET
5. ALL ROUGH WORK SHOULD BE IN YOUR ANSWER BOOKLET

SECTION A [40 Marks]- COMPULSORY

- a. What is the name of the protocol data unit at each of the following layers. (3 Marks)
- i. Transport layer
 - ii. Network layer
 - iii. Data link layer
- b. Mention any four considerations the network designer takes into account while selecting media (4 Marks)
- c. Define the following terms as used in Computer Networks: (4 Marks)
- i. Protocol
 - ii. Network edge
 - iii. Network core
 - iv. Encapsulation
- d. Give three properties of a transmission medium that should be taken into consideration in designing a network. (3 Marks)
- e. Name the two sublayers of Layer 2 protocols defined by IEEE, and give the purpose of each. (4 Marks) • $4+2=6$
 $\frac{3}{3}$
- f. Discuss the three functions of the data link layer (6 Marks)
Error Correct, Error Detect.
- g. Differentiate between: (16 marks)
 $\frac{3}{3} \frac{4}{4} \frac{11}{11} = 29$
21
- i. Enterprise access networks and wireless access networks
 - ii. Routing and forwarding
 - iii. Packet switching and circuit switching
 - iv. IP Address and MAC address
 - v. IPv4 and IPv6 address
 - vi. Transmission Control Protocol (TCP) and Internet Protocol (IP)

vii. TDMA and FDMA

viii. Round robin MAC protocols and contention-based MAC protocols

ix. Transmission Control Protocol (TCP) and Internet Protocol (IP)

SECTION B [60 Marks] - ATTEMPT THREE QUESTIONS

Question 1

- a) Describe the following properties of guided media, discussing the relative performance of each of these properties by Twisted pair, coaxial cable and optical fiber media
(12 Marks)

- Attenuation
- Delay
- Repeater spacing

- b) Highlight the ~~XH2S~~ properties of unshielded twisted pair (UTP), shielded twisted pair (STP) and foiled twisted pair (FTP)
(4 Marks)

- c) Briefly Discuss the benefits of the Optical Fiber media
(4 marks)

Question 2

- a) List four examples of network applications
(2 Marks)

- b) HTTP is a request-response protocol. What are the semantics of the following HTTP response status codes:
400 - Bad req
(1 Mark)

- i. 404 Not found
(1 Mark)
- ii. 200 OK
(1 Mark)
- iii. 500
(1 Mark)
- iv. 301 Moved permanent
(1 Mark)

-) Given a base HTML file with 50 objects (images) all small enough to fit in one TCP segment. How many RTTs are required for retrieval of the base file and objects under the following conditions (Clearly show your working):

- i. Non-Persistent HTTP connection without parallel connection
(2 Marks)

Total time =

$$= 2RTT + (parallel)$$

$$2 \times (5\%)$$

$$2RTT + DRT$$

- ii. Non-persistent HTTP connection with 10 parallel connection
iii. Persistent connection $2RTT + 50ms$

(2 Marks)

(2 Marks)

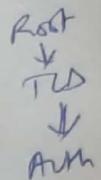
- d) Briefly explain the differences between the following terms as used in Domain Name Services (DNS)

(2 Marks)

(2 Marks)

(2 Marks)

- i. Recursive query and Iterated query
ii. Local DNS server and an authoritative DNS server
iii. Root DNS server and top level DNS server



- e) A caching DNS server normally stores DNS records locally for a period specified by the Time-to-Live (TTL) value. Describe the problems that can occur if the TTL value is too small or too large.

(2 Marks)

✓ Question 3

in hosts

(2 Marks)

- a) What are the primary roles of the network layer in an end-to-end web communication proceeding?

- b) State the new names in IPv6 for the following IPv4 fields if kept in the new IPv6 datagram structure:

(1 Mark)

- i. Type of Service priority

4 2 1

- ii. Version 128 64 32 8 4 2 1

4 2 1

(1 Mark)

- iii. Time to Live 256 128 64 16 8 4 2

(1 Mark)

- iv. Header Checksum No checksum

(1 Mark)

- c) Write the short forms for the following IPv6 addresses:

2001:0db8:3c4d:0015:0000:0000:1a2f:1a2b
2041:0000:140f:079f:0000:0000:0000:131b

- i. 2001:0db8:3c4d:0015:0000:0000:1a2f:1a2b

(2 Marks)

hierarchy

- ii. 2041:0000:140f:079f:0000:0000:0000:131b

(2 Marks)

- d) Given the network 10.0.0.0/19, find:

128 64 32 8 4 2 1
125 - 255, 255, 255, 128

- i. Total number of usable addresses

124 - 255, 255, 255, 0

(2 Marks)

- ii. The lowest and highest usable address

126 - 192

(2 Marks)

126

- iii. The subnet mask for the above network

127 - 224

(2 Marks)

125

4

128 - 240

129 - 248

130 - 252

131 - 254

25, 4, 3

0.0/19
32.0/27
255.255.224.0

- e) Suppose we have the forwarding tables shown in the following table for nodes A and F, in a network where all links have cost 1. Draw a diagram (network topology) of the smallest network consistent with these tables. **(4 Marks)**

A

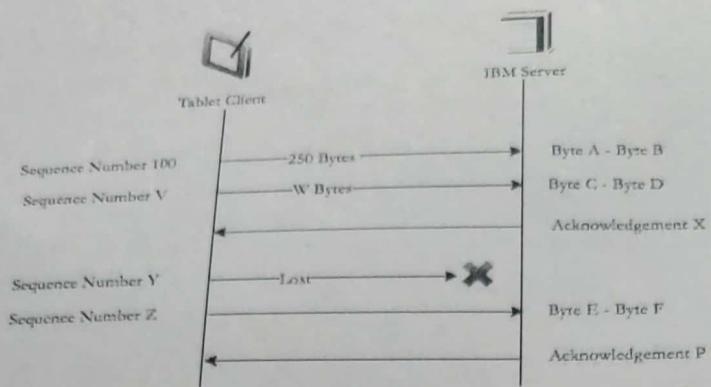
Node	Cost	Next Hop
B	1	B
C	1	C
D	2	B
E	3	C
F	2	C

F

Node	Cost	Next Hop
A	2	C
B	3	C
C	1	C
D	2	C
E	1	E

Question 4

- a) Outline the three primary functions of the transport layer. **(3 Marks)**
- b) Using a clearly labelled drawing, describe the structure of a UDP packet and state the roles of the different fields. **(6 Marks)**
- c) State the TCP ports used by the following applications:
 - i. SSH **(1 Mark)**
 - ii. SMTP **(1 Mark)**
 - iii. POP3 **(1 Mark)**
 - iv. HTTPS **(1 Mark)**
- d) Given the following FTP transaction between the Tablet client and the IBM server with a window size of 500 bytes:



- i. State the relevance of the window size in TCP (1 Mark)
- ii. Clearly showing your working, determine the values of A, B, C, D, E, F and V, W, X, Y, Z, P (0.5 Marks @)

Question 5

- a) Define the following terms in relation to network security:
 - i. Integrity (1 Mark)
 - ii. Availability (1 Mark)
 - iii. Authentication (1 Mark)
 - iv. Confidentiality (1 Mark)
- b) Briefly describe the operation of a digital signature (2 Marks)
- c) Compare and contrast the Data Encryption Standard (DES) and Advanced Encryption Standard (AES) as block cipher encryption algorithms. (4 Marks)
- d) Write an access control lists for the following firewall rules at Organization X:
 - i. Allow all external users to access the web server with the IP address 10.10.2.5. (2 Marks)
 - ii. Block internal users on the network 10.10.0.0/16 from accessing telnet services outside the organization. (2 Marks)
 - iii. Implicit deny rule for all other kinds of traffic (2 Marks)
- e) Describe the two categories of Intrusion Detection Systems (4 Marks)

END