MCKV Institute of Engineering

Paper Code: PC-IT602

COMPUTER NETWORKS

Time Allotted: 1* Hour** ***Full Marks: 30

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***five*** of the following: **5×1**

i. An IPv4 address in the class B category is given by

A. 125.123.123.3 B. 191.23.21.54

C. 192.200.128.56 D. 10.14.12.34

ii. What is the maximum length of a MAC address?

A. 24 bits B. 32 bits C. 48 bits D. 64 bits

iii. Which layer of the OSI model is responsible for framing and synchronization of data?

A. Physical layer B. Network layer C. Data link layer D. Transport layer

iv. Which layer of the OSI model is responsible for logical addressing and routing?

A. Physical layer B. Network layer C. Data link layer D. Transport layer

v. What is the purpose of a router in a network?

A. To provide remote access to a network

B. To provide centralized storage for network data

C. To forward network traffic between different networks

D. To establish a direct connection between two network devices

vi. Which topology is used for networks with high fault tolerance requirements?
A. Bus topology B. Star topology C. Mesh topology D. Ring topology

Group – B

(Short Answer Type Questions)

Answer any ***two*** of the following **2×5**

2. Calculate the efficiency of Sliding Window protocol. (Module 3/CO3/Apply-IOCQ) 5
3. Consider a 10Mbps Ethernet LAN that has stations attached to a 2km long Coaxial cable. Given that the transmission speed is 2×10^8 m/sec, the packet size is 125 bytes out of which 25 bytes are overhead. Find the maximum data rate and effective data rate. (Module 3/CO3/Apply-IOCQ) 5
4. Explain the concept of CSMA/CA with the help of a flowchart. (Module 3/CO3/Understand-LOCQ) 5

Group – C

(Long Answer Type Questions)

Answer any ***one*** of the following **1×15**

5.

i. Prove that the maximum throughput of Slotted ALOHA is double than that of pure ALOHA. (Module 3/CO3/Apply-IOCQ) 5

ii. Show with suitable timeline diagram how piggybacking is implemented in Stop-and-wait ARQ protocol. (Module 3/CO3/Understand-LOCQ) 5

iii. Given a network with a bandwidth of 1 Gbps and a round-trip delay of 10 milliseconds, calculate the maximum window size for a TCP connection using the TCP bandwidth-delay product. (Module 3/CO3/Apply-IOCQ) 5

6.

i. Consider a Network connecting two systems located 8000km apart. The bandwidth of the network is 500Mbps. The Propagation speed of the media is 4×10^6 m/sec. It is needed to design a Go Back N sliding window protocol for this network. The average packet size is 10^7 bits. The network is to be used to its full capacity. Assume that processing delays at nodes are negligible. Then, find the minimum size of the sequence number field in bits. (Module 3/CO3/Apply-IOCQ) 5

ii. Consider a 128×10^3 bps satellite communication link with one way propagation delay of 150msec. Selective retransmission (repeat) protocol is used on this link to send data with a frame size of IkB. Neglect the transmission time of acknowledgment. Find the minimum number of bits required for the sequence number field to achieve 100% utilization. (Module 3/CO3/Apply-IOCQ) 5

iii. CSMA/CD network with channel of 1Mbps transmits data with propagation time of 1msec. Then find minimum size of frame and also calculate efficiency at minimum frame size. (Module 3/CO3/Apply-IOCQ) 5

32000 LOC
(15000 per month)

32000

Effort = $2.4(32)^{1.05}$ PM
= 91 PM

development = $2.5(91)^{0.38}$ Months
= 14 Months

cost required to develop the product
= 14 × 15000
= Rs 210000

200kloc

Effort = $a \times KLOC^{Ab}$
($a = 2.4$ $b = 1.05$)
= $2.4 \times 200^{(1.05)}$
=

Development time = $2.5 \times (E)^{0.38}$
Average staff size = Effort/Development Time
Productivity = 200/Effort

400KLOC

$E = a_1 (KLOC)^{a2}$

$T_{dev} = b_1 (E)^{b2}$

organic
$E = 2.4(400)^{1.05} = 1295.31$ PM
$T_{dev} = 2.5(1295.31)^{0.38} = 38.07$ Months

semidetached
$E = 3.0(400)^{1.12} = 2462.79$ PM
$= 2.5(2462.79)^{35} = 38.45$ month

Embedded mode
$E = 3.6(400)^{1.20} = 4772.81$ PM
$T_{dev} = 2.5(4772.8)^{0.32} = 38$ Month

$L = C_k K^{1/3} t_d^{4/3}$

$K = L^3 / C_k^3 t_d^4$

or, $K = C / t_d^4$

$C = L^3 / C_k^3$ is constant

or, $K_1 / K_2 = t_{d2}^4 / t_{d1}^4$

or, $K \propto 1/t_d^4$

or, cost $\propto 1/t_d^4$

Putrom

MCKV Institute of Engineering

Paper Code: PC-IT602

Paper Name: Computer Networks

Time Allotted: **3 Hours** ***Full Marks:*** **70**

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Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***ten*** of the following: 10×1=10

(i) Which topology has the highest fault tolerance?

a) Bus topology b) Star topology c) Mesh topology d) Ring topology

(ii) Which layer of the OSI model is responsible for framing and synchronization of data?

a) Physical layer b) Network layer c) Data link layer d) Transport layer

(iii)Which type of cable is commonly used for cable TV networks?

a) Coaxial cable b)Fiber optic cable c) Twisted pair cable d) Parallel cable

(iv) The bandwidth of a signal is 5 kHz and the lowest frequency is 52 kHz. What is the highest frequency?

a) 5 kHz b) 10 kHz c) 57 kHz d) 47 kHz

(v) Which protocol is used for dynamic allocation of IP addresses on a network?

a) DHCP b) DNS c) SNMP d) FTP

(vi) The hamming distance between 10001001 and 10110001 is

a) 2 b) 3 c) 0 d) 4

(vi)An IPv4 address in the class B category is given by

a) 125.123.123.3 b) 191.23.21.54 c) 192.128.128.56 d) 10.14.12.34

(vii)What is the maximum speed of a Fast Ethernet network?

a) 10 Mbps b) 100 Mbps c) 1 Gbps d) None of them

(viii) What is the purpose of a firewall?

a) To encrypt data on a network

b) To provide secure remote access to a network

c) To filter network traffic based on a set of rules

d) To establish a network connection

(ix)What is the purpose of DNS?

a) To encrypt data on a network b) To provide secure remote access to a network

c) To translate domain names to IP addresses d) All of these

(x)Which protocol is used for secure web browsing?

a) HTTP b) FTPS c) HTTPS d) SFTP

(xi) What is the maximum length of a MAC address?

a) 24 bits b) 32 bits c) 48 bits d) 64 bits

Group - B

(Short Answer Type Questions)

Answer any *three* of the following 3×5=15

2. Generate the CRC code for the data word 1100 10101 if the generator polynomial is $x^4 + x^2 + 1$.
[Module 2/CO2/Apply-IOCQ] 5

3. If 1000 packets are to be sent using Stop-and-wait ARQ then find the total packets to be sent if error probability is 80%.
[Module 3/CO3/Apply-IOCQ] 5

4. Determine the subnet address, broadcast address, and the range of usable IP addresses for the subnet 192.168.20.0/29.
[Module 4/CO3/Apply-IOCQ] 5

5. Explain the differences between connection less and connection oriented communication.
[Module 5/CO3/ Understand -LOCQ] 5

6. Find the maximum bit rate for a channel having bandwidth 3100 Hz and S/N ratio of 10 dB.
[Module 2/CO3/Apply-IOCQ] 5

Group - C

(Long Answer Type Questions)

Answer any *three* of the following 3×15=45

7. Identify the layers in OSI reference model and illustrate their functions with a neat diagram.
[Module 1/CO1/Remember-LOCQ] [1+(7×2) =15]

8.a) A binary data 10110100101 is transmitted over a baseband channel. Draw the waveforms for transmitted data using the following formats:
[Module 2/CO3/Apply-IOCQ] 5 × 2

i. Unipolar NRZ
ii. Polar RZ
iii. Bipolar NRZ (AMI)
iv. Manchester
v. Differential Manchester

b) What is attenuation? How does it affect the signal strength during data transmission?
[Module 2/CO2/Understand-LOCQ] 2+3

9.a)Prove that the maximum throughput of Slotted ALOHA is double than that of pure ALOHA.
[Module 3/CO3/Apply-IOCQ] 5

b) Show with suitable timeline diagram how piggybacking is implemented in Stop-and-wait ARQ protocol.
[Module 3/CO3/Understand-LOCQ] 5

c)Given a network with a bandwidth of 1 Gbps and a round-trip delay of 10 milliseconds, calculate the maximum window size for a TCP connection using the TCP bandwidth-delay product.
[Module 3/CO3/Apply-IOCQ] 5

10.a) What is a firewall? Explain how does it work?
[Module 7/CO3/Understand-LOCQ] 1+

b) Explain the concept of CSMA/CA with the help of a flowchart.
[Module 3/CO3/Understand-LOCQ]

c) What is the purpose of the Address Resolution Protocol (ARP)? How does it work?
[Module 3/CO1/Understand-LOCQ] 2+

11.a) Explain how DNS works?
[Module 6/CO3/ Understand -LOCQ]

b) Compare between Message and Packet Switching.
[Module 2/CO2/Understand-LOCQ]

c) Explain with diagram, how lost frame, delayed and lost ACK are handled in Selective Repe ARQ.
[Module 3/CO1/Understand-LOCQ]

MCKVIE/B.TECH/IT/CA-2/2023-24/PC-IT602

MCKV Institute of Engineering

Paper Code: PC-IT602

COMPUTER NETWORKS

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Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***five*** of the following: **5×1**

i. Which layer of the OSI model is responsible for routing and forwarding data?
A. Physical layer B. Network layer C. Data link layer D. Transport layer

ii. What is the function of a router?
A. To connect devices on the same network B. To transmit data between networks
C. To encrypt data on a network D. To establish a network connection

iii. Which topology has the highest fault tolerance?
A. Bus topology B. Star topology C. Mesh topology D. Ring topology

iv. Which type of cable is commonly used for Ethernet networks?
A. Coaxial cable B. Fiber optic cable C. Twisted pair cable D. Parallel cable

v. Which protocol is used for dynamic allocation of IP addresses on a network?
A. DHCP B. DNS C. SNMP D. FTP

vi. Which layer of the OSI model is responsible for establishing, maintaining, and terminating connections between network devices?
A. Physical layer B. Network layer C. Data link layer D. Transport layer

Group – B

(Short Answer Type Questions)

Answer any ***two*** of the following **2×5**

2. Explain circuit switching in details. (Module 2/CO2/Understand-LOCQ)
3. Explain time-division multiplexing (TDM) and frequency-division multiplexing (FDM). (Module 2/CO2/Understand-LOCQ) 2.5+2.5 = 5
4. Describe the different types of network topologies used in LANs. (CO1/Understand/LOCQ)

Group – C

(Long Answer Type Questions)

Answer any ***one*** of the following **1×15**

5. Mention the layers of OSI reference model and explain briefly about each layer functions. (Module 1/CO1/Remember-LOCQ)
6. Given a bit sequence 10110100101, encode the binary string using: (Module 2/CO3/Apply-IOCQ)
   a) NRZ-Unipolar b) NRZ-Polar c)AMI d)Manchester e) Differential Manchester. 3 X 5 = 15

Transport → Segment
network → Packet
Data link → Frame
Bits → Physical

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Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***five*** of the following: 5×1=5

i. What is the purpose of a firewall?

A. To prevent unauthorized access to a network
B. To increase network speed
C. To encrypt data on a network
D. To establish a network connection

ii. Which protocol is used for file transfer?

A. FTP B. SMTP C. HTTP D. POP3

iii. What is the purpose of a subnet mask?

A. To identify a device on a network
B. To transmit data between devices
C. To encrypt data on a network
D. To identify the network and host portion of an IP address

iv. What is the purpose of a hub?

A. To connect devices on the same network
B. To transmit data between networks
C. To encrypt data on a network
D. To establish a network connection

v. Which topology has the highest fault tolerance?

A. Bus topology B. Star topology
C. Mesh topology D. Ring topology

vi. What is the maximum length of a MAC address?

A. 24 bits B. 32 bits C. 48 bits D. 64 bits

vii. Which type of cable is commonly used for Ethernet networks?

A. Coaxial cable B. Fiber optic cable
C. Twisted pair cable D. Parallel cable

Group – B

(Short Answer Type Questions)

Answer any *two* of the following 2×5=10

2. Explain the concept of CSMA/CD with the help of a flowchart. (Module 3/CO3/Understand-LOCQ) 5
3. Explain frame format of HDLC in details. (Module 3/CO3/Understand-LOCQ) 5
4. Explain the different fields of an ARP packet. (Module 4/CO3/Understand-LOCQ) 5

Group – C

(Long Answer Type Questions)

Answer any *one* of the following 1×15=15

5. (a) Define IP address. Explain different classes of IPv4 addresses with block diagram. 3+7
(Module 4/CO3/Understand-LOCQ)
(b) A company is granted the site address 192.168.100.0, the company needs 10 subnets. 5
Design the subnets. (Module 4/CO3/Apply-IOCQ)

6. Differentiate between : 5
(a)Hub and Bridge. (Module 3/CO2/Understand-LOCQ) 5
(b) Router and Gateway. (Module 3/CO2/Understand-LOCQ)
(c) Pure ALOHA with slotted ALOHA. (Module 3/CO3/Understand-LOCQ)

2^5
2^7
1
32
128
160
64
×2
128

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Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***five*** of the following: 5×1=5

(i) Which type of network topology connects all devices in a loop?
A) Star B) Bus C) Ring D) Mesh

(ii) Which type of network is used within a small geographic area such as an office or a building?
(A) WAN B) LAN C) MAN D) CAN

(iii) Which protocol is used for email communication?
A) SMTP B) HTTP C) FTP D) DNS

(iv) Which type of cable is used for fast data transfer?
A) Coaxial B) Twisted pair C) Fiber optic D) All of the above

(v) Which layer of the OSI model is responsible for logical addressing?
A) Physical Layer B) Data Link Layer C) Network Layer D) Transport Layer

(vi) Which layer of the OSI model is responsible for end-to-end communication?
A) Physical Layer B) Data Link Layer C) Network Layer D) Transport Layer

(vii) Which is NOT a layer of OSI model?
A) Presentation Layer B) Management Layer C) Network Layer D) Transport Layer

Group – B

(Short Answer Type Questions)

Answer any ***two*** of the following 2×5=10

2. Describe the different types of network topologies used in LANs. (CO1/Understand/LOCQ)
3. Describe the different types of transmission media used in networking (CO1/ Understand/LOCQ)
4. Describe the functions of the physical layer. (CO1/Analyse/IOCQ)

Group – C

(Long Answer Type Questions)

Answer any ***one*** of the following 1×15=15

5. Describe the OSI model with function of each OSI layer. (CO1/Understand/LOCQ) 15

6. What is the difference between analog and digital signals? Describe how data is transmitted using both types of signals. (CO1/Understand/LOCQ) 3+12 =15

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Group – A

(Multiple Choice Type Questions)

1.Choose the correct alternatives for any ***ten*** of the following: 10×1=10

i) Which layer of the OSI model is responsible for error checking and correction?

a) Physical layer b) Data link layer c) Transport layer d) Application layer

ii) What is the purpose of a MAC address?

a) To identify a device on a network b) To transmit data between devices

c) To encrypt data on a network d) To establish a network connection

iii) What is the function of a router?

a) To connect devices on the same network b) To transmit data between networks

c) To encrypt data on a network d) To establish a network connection

iv) Which protocol is used for email communication?

a) SMTP b) HTTP c) FTP d) POP3

v) What is the purpose of a firewall?

a) To prevent unauthorized access to a network b) To increase network speed

c) To encrypt data on a network d) To establish a network connection

vi) What is the purpose of a VPN?

a) To provide secure remote access to a network b) To increase network speed

c) To encrypt data on a network d) To establish a network connection

vii) Which type of cable is commonly used for high-speed data transmission within a computer or network device?

a) Coaxial cable b) Fiber optic cable c) Twisted pair cable d) Parallel cable

viii) What is the purpose of a subnet mask?

a) To identify a device on a network b) To transmit data between devices

c) To encrypt data on a network

d) To identify the network and host portion of an IP address

ix) Which protocol is used for web browsing?
a) FTP b) SMTP c) HTTP d) POP3

x) What is a domain name server (DNS)?
a) A server that provides domain names to clients
b) A server that provides email services
c) A server that provides file sharing services
d) A server that provides web hosting services

xi) In which ARQ, if a NAK received, only the specific or lost frame is retransmitted?
a) stop-and-wait b) go-back-n c) selective repeat d) none of the above

xii) A subnet mask in class A has fourteen 1s. How many subnets does it define?
a) 8 b) 16 c) 32 d) 64

Group – B
(Short Answer Type Questions)

Answer any ***three*** of the following 3×5=15

2. What is bandwidth? Explain how it affects the data transmission rate.
(Module 2/CO2/Understand-LOCQ) [2+3]

3. The code 11110101101 was received. Using the Hamming code algorithm, find the original code sent.
(Module 2/CO3/Apply-IOCQ) [5]

4. Compare the performance of pure ALOHA with slotted ALOHA.
(Module 3/CO3/Understand-LOCQ) [5]

5. A company is granted the site address 192.168.100.0, the company needs 10 subnets. Design the subnets.
(Module 4/CO3/Apply-IOCQ) [5]

6. What is a firewall? Explain how does it work?
(Module 7/CO3/Understand-LOCQ) [1+4]

Group – C
(Long Answer Type Questions)

Answer any ***three*** of the following 3×15=45

7. i) Given a bit sequence 01001110, encode the binary string using:
a) NRZ-L b) NRZ-I c) RZ d) Manchester e) Differential Manchester.
(Module 2/CO3/Apply-IOCQ) [10]

ii) Given a 10 bit sequence 1010011110 and a divisor polynomial $x^4 + x^2 + 1$, determine the CRC.
(Module 2/CO3/Apply-IOCQ) [5]

8. i) Mention the layers of OSI reference model and explain briefly about each layer functions.
(Module 1/CO1/Remember-LOCQ) [10]

ii) Explain with diagram, how lost frame, delayed and lost ACK are handled in Selective Repeat ARQ.
(Module 3/CO1/Understand-LOCQ) [5]

9. i) How does the Network Layer handle network congestion?
(Module 4/CO3/Remember-LOCQ) [5]

ii) what is a port number, and explain how is it used in the Transport Layer?
(Module 5/CO3/ Understand -LOCQ) [2+3]

iii) Differentiate between DNS and DHCP.
(Module 6/CO3/Understand-LOCQ) [5]

10. i) Suppose an organization is given the block 190.100.0.0/16. The organization needs to divide the address into three groups of customers
a) 1st group has 64 customers; each needs 256 addresses.
b) 2nd group has 128 customers; each needs 128 addresses.
c) 3rd group has 128 customers; each needs addresses.
Design the sub-blocks and find out how many addresses are still available after these allocations.
(Module 4/CO3/Apply-HOCQ) [6]

ii) What is FTP? Explain its functions?
(Module 6/CO3/Understand-LOCQ) [1+2]

iii) What is the Address Resolution Protocol (ARP), and how is it used in the Network Layer?
(Module 4/CO3/Remember-LOCQ) [2+4]

11. Explain in details about the following topics:
i) Packet Switching
ii) Message Switching
iii) Circuit Switching
(Module 2/CO2/Understand-LOCQ) [3×5]

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(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ***five*** of the following: **5×1**

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A. 125.123.123.3 *B. 191.23.21.54*

C. 192.200.128.56 *D. 10.14.12.34*

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A. 24 bits B. 32 bits C. 48 bits D. 64 bits

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Group – B

(Short Answer Type Questions)

Answer any ***two*** of the following **2×5**

2. Calculate the efficiency of Sliding Window protocol. (Module 3/CO3/Apply-IOCQ) 5

3. Consider a 10Mbps Ethernet LAN that has stations attached to a 2km long Coaxial cable. Given that the transmission speed is 2×10^8 m/sec, the packet size is 125 bytes out of which 25 bytes are overhead. Find the maximum data rate and effective data rate. (Module 3/CO3/Apply-IOCQ) 5

4. Explain the concept of CSMA/CA with the help of a flowchart. (Module 3/CO3/Understand-LOCQ) 5

Group – C

(Long Answer Type Questions)

Answer any ***one*** of the following **1×15**

5.

i. Prove that the maximum throughput of Slotted ALOHA is double than that of pure ALOHA. (Module 3/CO3/Apply-IOCQ) 5

ii. Show with suitable timeline diagram how piggybacking is implemented in Stop-and-wait ARQ protocol. (Module 3/CO3/Understand-LOCQ) 5

iii. Given a network with a bandwidth of 1 Gbps and a round-trip delay of 10 milliseconds, calculate the maximum window size for a TCP connection using the TCP bandwidth-delay product. (Module 3/CO3/Apply-IOCQ) 5

6.

i. Consider a Network connecting two systems located 8000km apart. The bandwidth of the network is 500Mbps. The Propagation speed of the media is 4×10^6 m/sec. It is needed to design a Go Back N sliding window protocol for this network. The average packet size is 10^7 bits. The network is to be used to its full capacity. Assume that processing delays at nodes are negligible. Then, find the minimum size of the sequence number field in bits. 5
(Module 3/CO3/Apply-IOCQ)

ii. Consider a 128×10^3 bps satellite communication link with one way propagation delay of 150msec. Selective retransmission (repeat) protocol is used on this link to send data with a frame size of IkB. Neglect the transmission time of acknowledgment. Find the minimum number of bits required for the sequence number field to achieve 100% utilization. 5
(Module 3/CO3/Apply-IOCQ)

iii. CSMA/CD network with channel of 1Mbps transmits data with propagation time of 1msec. Then find minimum size of frame and also calculate efficiency *at minimum frame size.* (Module 3/CO3/Apply-IOCQ) 5