BAHRIA UNIVERSITY (KARACHI CAMPUS)

MIDTERM EXAMINATION –SPRING SEMESTER – 2020

(Data Communication and Computer Networks SEN-452)

Take Home Assignment

Class: **BS (CS) – 4(B)** **(Morning)**

Course Instructor: **Sir M. Iqbal** Submission Deadline: **31-May-2020**

Max Marks: 20

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Date:

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Class: CS (4-B)
Data Communication & Networking

QUESTION 1 (a)

Name Of Layer	Function Of Layer	Protocol Of Layer	Hardware
1. Application	This layer is used to handle all process communication functions as well as session establishment, maintenance and termination, character code translations, data conversion and compression and encryption.	DNS (Domain Naming System), HTTP (Hypertext Transfer Protocol), FTP (File Transfer Protocol), Telnet, DHCP (Dynamic Host Configuration Protocol) e.t.c	PC (Personal Computer), Phones, Servers, and gateway
2. Transport	The functions carried out by this layer include message segmentation, traffic control, session multiplexing, error detection and correction and message reordering	TCP (Transfer Control Protocol) and UDP (User Datagram Protocol)	Gateways and Firewall

1

Date:

3. Network	The functions of network layer include traffic routing, traffic control, fragmentation and logical addressing	IP (Internet Protocol), ICMP (Internet Control Message Protocol), ARP (Address Resolution Protocol)	Routers and Brouters (Bridge Router)
4. Link	The functions of link layer include modulation, line coding and bit synchronization, frame synchronization & error detection	ARP (Address Resolution Protocol), NDP (Network Discovery Protocol), Ethernet and Token Ring	Bridges, Modem and Network Interface Card

▲ Table 1: TCP/IP Model

Name Of Layer	Function Of Layer	Protocol at this Layer	Hardware Used
1. Application	An application layer allows a user to access files, provides facility for email forwarding & storage and it provides network services to end users.	DNS (Domain Name System), FTP (File Transfer Protocol), Telnet, HTTP (HyperText Transfer Protocol) e.t.c	Gateways, Firewalls, all end devices like PCs & phones.

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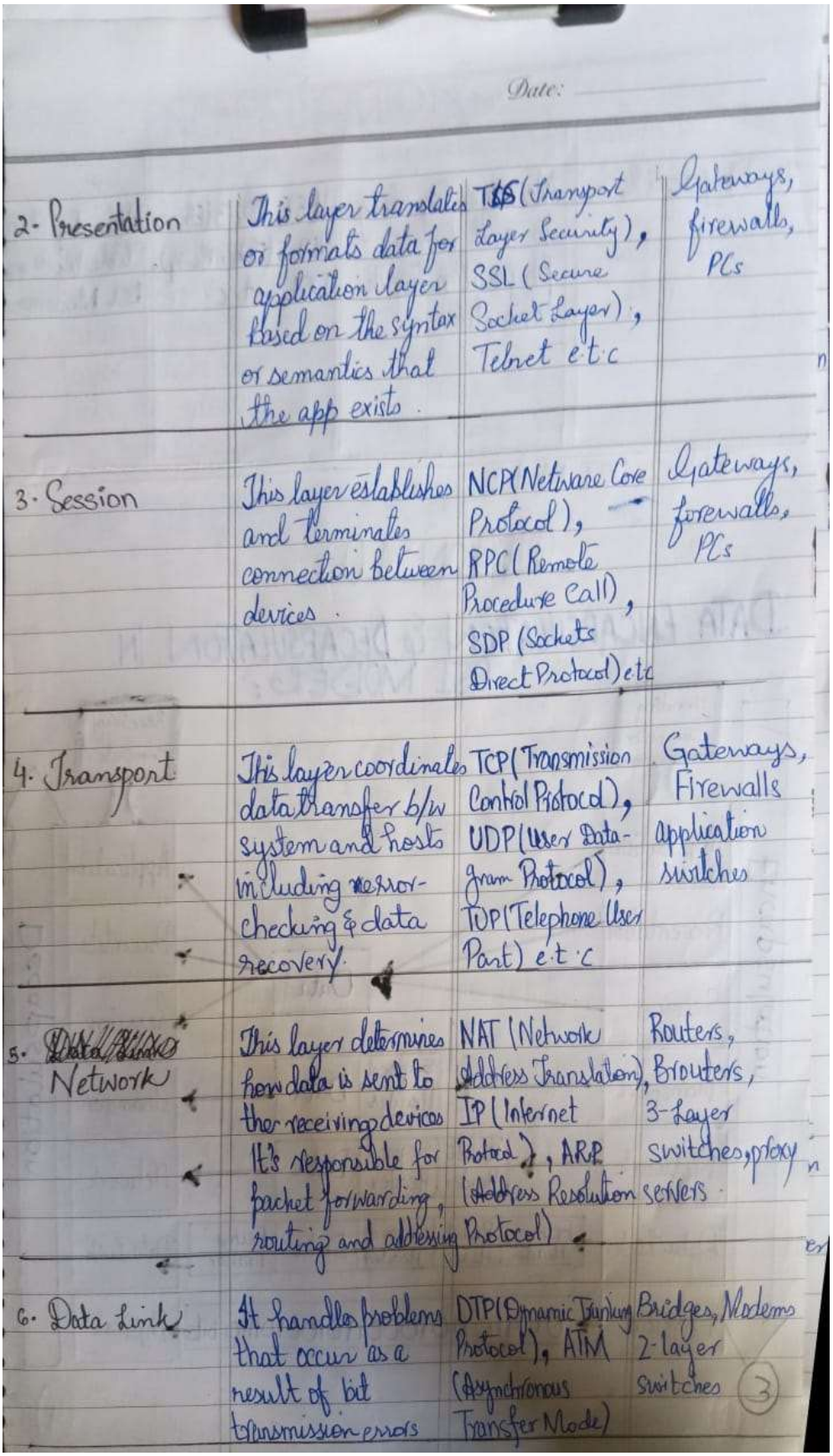

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2- Presentation	This layer translates or formats data for application layer based on the syntax or semantics that the app exists.	TLS (Transport Layer Security), SSL (Secure Socket Layer), Telnet e.t.c	Gateways, firewalls, PCs
3- Session	This layer establishes and terminates connection between devices.	NCP (Netware Core Protocol), RPC (Remote Procedure Call), SDP (Sockets Direct Protocol) e.t.c	Gateways, firewalls, PCs
4- Transport	This layer coordinates data transfer b/w system and hosts including error-checking & data recovery.	TCP (Transmission Control Protocol), UDP (User Data-gram Protocol), TUP (Telephone User Part) e.t.c	Gateways, Firewalls application switches
5- Network	This layer determines how data is sent to the receiving devices It's responsible for packet forwarding, routing and addressing	NAT (Network address Translation), IP (Internet Protocol), ARP (Address Resolution Protocol)	Routers, Brouters, 3-Layer switches, proxy servers
6- Data Link	It handles problems that occur as a result of bit transmission errors	DTP (Dynamic Trunking Protocol), ATM (Asynchronous Transfer Mode)	Bridges, Modems 2-layer switches (3)

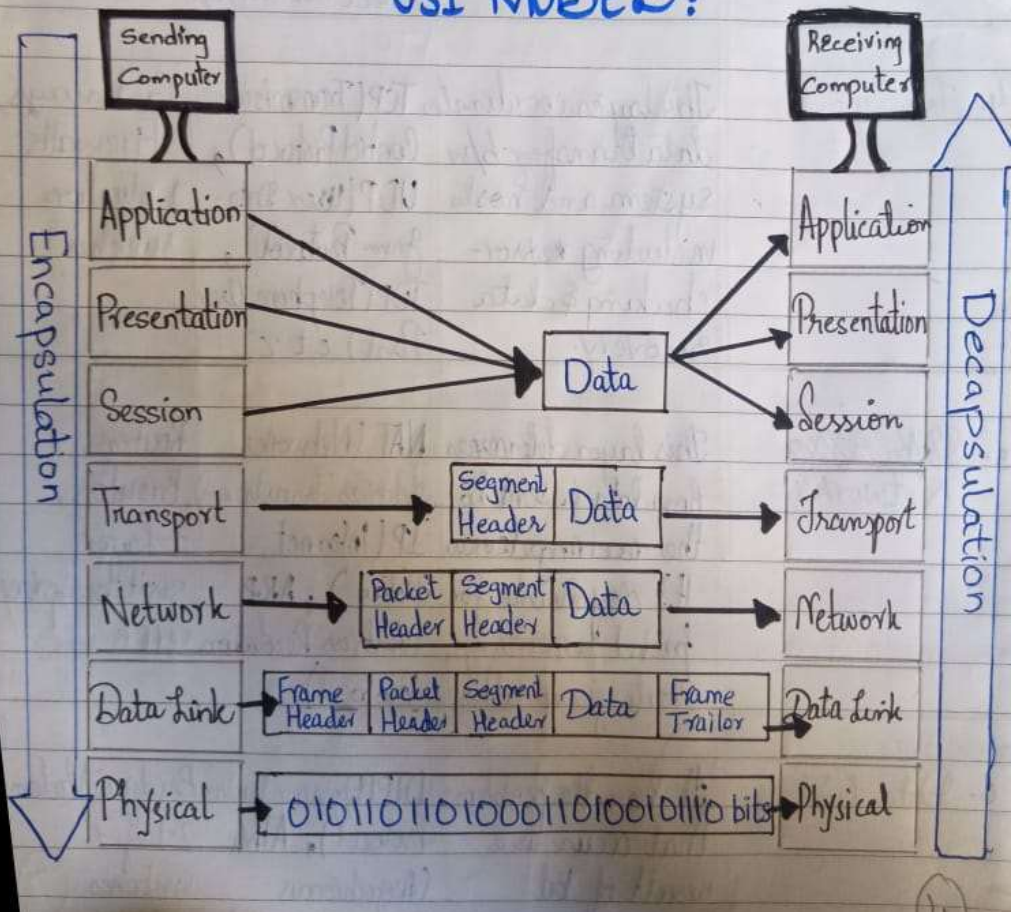
Date:

7. Physical	Manages signaling to and from physical network connection	IEEE 802-3 (Ethernet) 802-5 (Token Ring), DSL etc	Hubs, Repeater Cable Modem DSL Modems

▲ Table 2: OSI Model

QUESTION 1(b)

DATA ENCAPSULATION & DECAPSULATION IN OSI MODEL:



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DATA ENCAPSULATION:

"A process in which some extra information is added to the data item to add some features to it."

The data is encapsulated on the sender's side, starting from the application layer to the physical layer. Each ~~data~~ layer takes the encapsulated data from the previous layer and adds some more information & functionalities with the data to encapsulate it.

DATA DE-ENCAPSULATION:

"It is the reverse process of data encapsulation. The encapsulated information is removed from the received data to obtain the original data."

The data is de-encapsulated at the receiver's end. As the data moves up from the lower layer to the upper layer, each layer unpacks the corresponding header and uses the information contained in the header to deliver the packet to the exact network application waiting for data.

QUESTION 1(c)

PORT NUMBER:

"A port number is the logical address of each process or application that uses a network or internet to communicate. A port number uniquely identifies a network-based application on a computer."

Significance: Ports identify what process on the host the received traffic should be sent to. When the computer receives data, the port information allows it to give the data to the correct process.

In other words, IP address identifies the computer host & the port number specifies the particular process running on the host.

(5)

Date:

Range Of Port Numbers

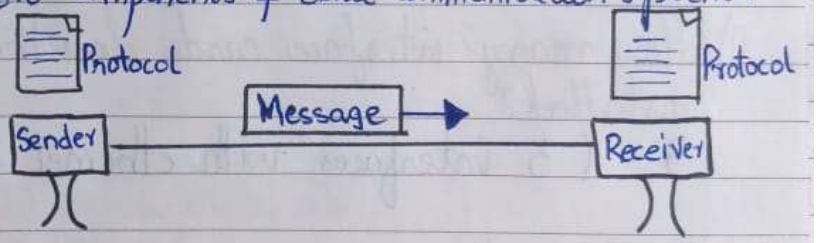
Port numbers range from 0 to 65,535, but only port numbers from 0 to 1023 are reserved for previliged sources & designated as well-known ports.

QUESTION 2(a)

COMPONENTS OF DATA COMMUNICATION SYSTEM.

Following are the components of data communication system:

1. Message
2. Sender
3. Receiver
4. Medium
5. Protocol



Message:

The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio and video.

Sender:

The sender is the device that sends the data message. It can be a computer, workstation, telephone, handset, video camera and so on.

(6)

Date:

Receiver:
A device that receives the message. It can be a computer, workstation, telephone handset, television and so on.

QUESTION 2(b)

i) Which command is used to produce the output?
ifconfig

ii) How many interface cards does the computer have installed?
3 (3 interfaces with ethernet links)

iii) What is the maximum size of Ethernet frame that can be sent to eth 1?
1500 Bytes (since the Maximum Transmission Unit (MTU) is 1500)

iv) Do you agree that NIC cards are manufactured by different company? Explain your answer.
Yes all NIC cards are manufactured by different company. The first 6 digits of the MAC address uniquely identifies a manufacturer, eth 0 and eth 1 are the same, however eth 4 is different, indicating a different manufacturer.

(7)

Date: _____

V. What is the function of lo interface & how it is used in communication networks?

The lo interface is the loopback interface. A computer that sends a packet to the loopback interface has the packet delivered to itself. This can be used for example for testing application on the computer such as seeing if the application or protocol software can send packets or to see if a server is running on the computer.

QUESTION 2(c)

(a)

$$t_{trans} = \frac{L}{R}$$

$$= \frac{2 \cdot 20^{20} \text{ bytes} \cdot 8 \text{ bits/byte}}{4 \cdot 10^{6} \text{ bits/sec}}$$

$$= \frac{16,777,216 \text{ bits}}{4,000,000 \text{ bits/sec}}$$

$$\boxed{t_{trans} = 4.19 \text{ seconds}} \text{ Ans}$$

(b)

$$t_{prop} = \text{distance} / \text{speed}$$

1 m = 1000 km
385,000,000 = 385 000 km

$$t_{prop} = 385,000,000 \text{ m} \,/\, 300,000,000 \text{ m/sec}$$

$$\boxed{t_{prop} = 1.28 \text{ sec.}} \text{ Ans}$$

Date:

QUESTION 3(a)

Circuit Switched	Packet Switched
1. Circuit switching is connection oriented that means a path is established b/w source & destination before the transmission occurs.	Packet switching is connectionless that means a dynamic route is decided for each packet while transmission
2. Transmission of data is done by the source.	Transmission of data is not only done by source, but also by intermediate routers.
3. It is a traditional telephone network design	It is a data network design for internet.
4. It is implemented at Physical Layer.	It is implemented at Network Layer.
5. Delay b/w data units is uniform	Delay b/w data units is not uniform

(9)

Date:

	Client Server	Peer-To-Peer
1.	A distributed application based on resource or servers & service requesters are called clients.	A distributed application architecture that partitions tasks or workloads b/w peers.
	Client requests for service & Server responds with service.	Each node can request for services and provide services.
	A centralized network.	A decentralized network
	Clients depend on server, so failure in the server will disrupt the functioning of all clients.	Reliable as there are multiple nodes providing services.
	It is used in small & large networks.	Normally used in small networks with less than 10 computers.

10

Date:

Q3(b)

Polynomial = $x^4 + x + 1$

The corresponding binary pattern is:

x^4	x^3	x^2	x^1	x^0
↓	↓	↓	↓	↓
1	0	0	1	1

The general polynomial is encoded as 10011
Since the generator polynomial consists of 5 bits so a string of 4 zeroes (1 less than total bits) is appended to the bit stream. The resulting bit stream is 11010110110000
Now the binary division is performed as

```
          11000010 10
      ____________________
10011 | 11010110110000
        -10011 ↓ | | | |
         10011   | | | |
        -10011 ↓ | | | |
          00001   | | | |
         -00000 ↓ | | | |
          00010   | | | |
         -00000 ↓ | | |
          00101   | | |
         -00000 ↓ | |
          01011   |
```

11

Date:

```
01011
-00000
 10110
-10011
 01010
-00000
 10100
-10011
 01110
-00000
 1110   <- Remainder
```

From here, CRC = 1110

Replacing the last 4 zeroes from the resulted bit stream with stream

The actual bit string transmitted = 11010110111110

Question 3 (c)

Mesh Topology:

$\frac{n(n-1)}{2} \Rightarrow \frac{100(99)}{2} \Rightarrow$ 4950 cable links

Ring Topology:

$n \Rightarrow$ 100 cable links

Star Topology:

$n \Rightarrow$ 100 cable links

(12)

Date:

QUESTION 4(a)

NEED OF STANDARDS:

Standards are needed to create and maintain an open and competitive market for manufacturers to coordinate protocol rules and thus guarantee compatibility of data communication technologies.

STAGES OF STANDARDIZATION:

1) Specification
2) Identification of choices
3) Acceptance

Specification:

Developing a nomenclature and identifying the problems to be addressed.

Identification Of Choices:

Those working on the standard identify the various solutions and choose the optimum solution from among the alternatives.

Acceptance:

It is the most difficult stage, defining the solution and getting recognized industry leaders to agree on a single uniform solution.

13

QUESTION 4(b)

802.3

Algorithm for 802.3 (Ethernet) Transmission:

Step 01:
- Transmit Packet

Step 02:
- Then, Assemble Packet

Step 03:
- IF defferring (delay) ~~is~~ on then
  - i) Goto step 02

ELSE
  - i) start transmission

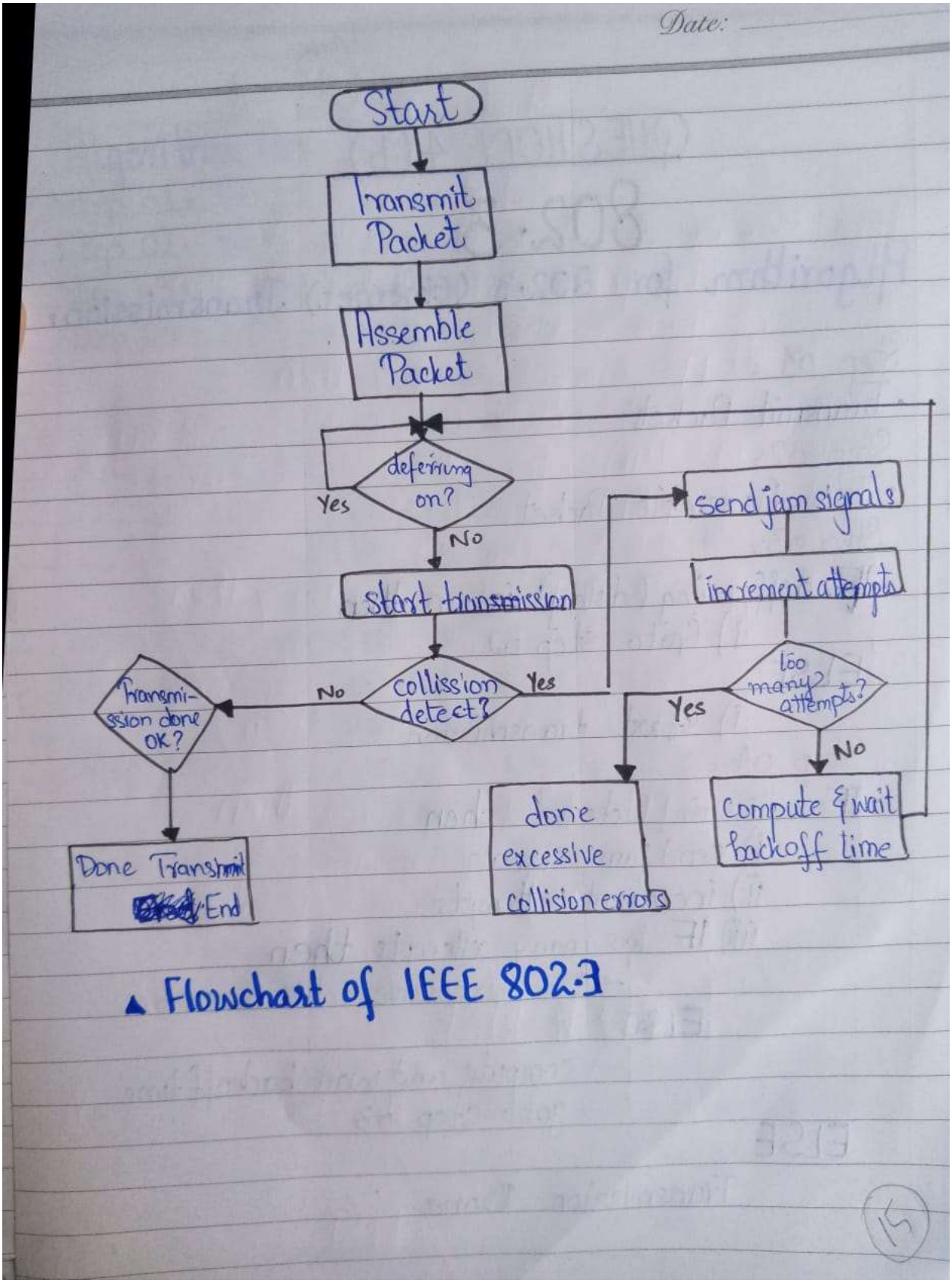
Step 04:
- IF collission detected then
  - i) send jam signals
  - ii) increment attempts
  - iii) IF too many attempts then
    - → Done excessive collission errors.

ELSE
  - → compute and wait backoff time
  - → goto step 03

ELSE

Transmission Done.

14



▲ Flowchart of IEEE 802.3

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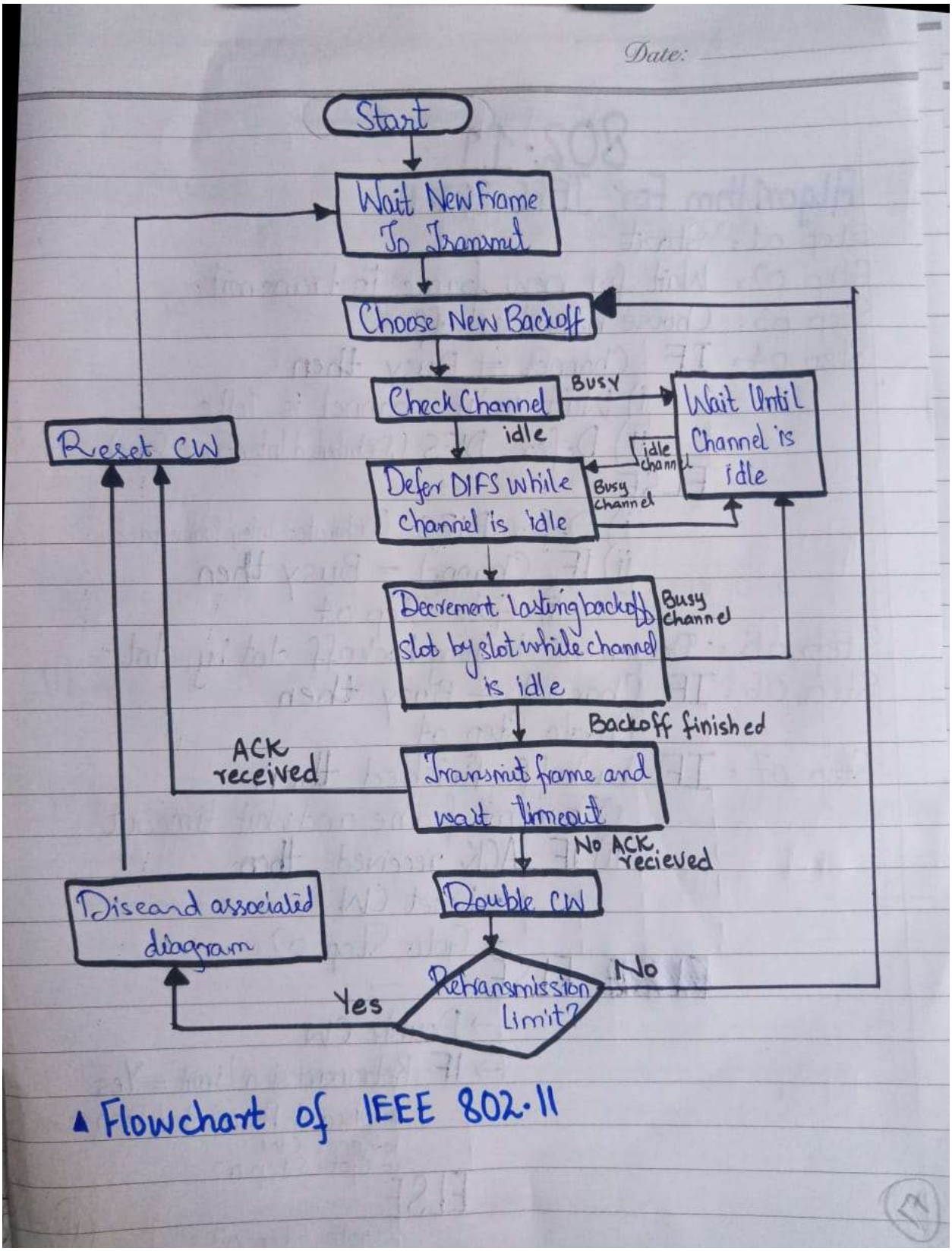
802.11

Algorithm For IEEE 802.11

Step 01: Start
Step 02: Wait for new frame to transmit.
Step 03: Choose new backoff
Step 04: IF Channel = Busy then
    i) Wait until channel is idle
    ii) Defer DIFS (Distributed Inter Frame Space)
  ELSE
    i) Defer DIFS (Distributed Inter Frame Space)
    ii) IF Channel = Busy then
      i) Goto Step 04
Step 05: Decrement lasting backoff slot by slot.
Step 06: IF Channel = Busy then
    i) Goto Step 04
Step 07: IF backoff finished then
    i) Transmit frame and wait timeout.
    ii) IF ACK received then
      → Reset CW
      → Goto Step 02
    ELSE
      → Double CW
      → IF Retransmission Limit = Yes
        ○ Discard Associated Diagram
        ○ Reset CW
        ○ Goto Step 02
      ELSE
        ○ Goto Step 03

16



▲ Flowchart of IEEE 802.11

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QUESTION 4(d)

Input Stream ⇒ A M A
0100 0001 0100 1101 0100 0001

A/c to 4B/5B mapping code table

0100 → 01010
0001 → 01001
0100 → 01010
1101 → 11011

i) Output Stream ⇒ 01010 01001 01010 11011 01010 01001

ii) The length of consecutive sequence of 0s in the input :
5

iii) The length of consecutive sequence of 0s in the output:
2

(18)