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Internal Assessment Test 1 – December 2023

Sub:	**Computer Networks**					Sub Code:	**21CS52**	Branch:	**AIML**
Date:	**18/12/23**	Duration:	**90 minutes**	Max Marks:	**50**	Sem/Sec:	**V**		**OBE**

		Answer any FIVE FULL Questions	MARKS	CO	RBT
1	a	How would you describe the working of Go-Back-N protocol and how it is different from Selective Repeat ARQ?	[10]	2	L3
2	a	List out the layers of OSI reference model with diagram and explain any two layers in detail.	[10]	1	L1
3	a	How would you compare between guided media and unguided media with examples?	[10]	1	L2
4	a	With a neat diagram, explain CRC the working of CRC and calculate CRC for the bit stream 10011101 if generator codeword is x^3+1 and check on receiver end also.	[10]	2	L3
5	a	Explain CSMA/CA with flow diagram? How it is different from CSMA/CD.	[05]	2	L2
	b	A Pure ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. What is the throughput if the system (all stations together) produces a. 1000 frames per second b. 500 frames per seconds c. 250 frames per second.	[05]	2	L3
6	a	What is checksum? List the steps taken by sender and receiver for error detection with suitable example.	[10]	2	L2

CI **CCI** **HoD**

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Internal Assessment Test II –Dec. 2023

Sub:	Computer Networks					Sub Code:	21CS52		Branch:	AIML	
Date:	18/12/2023	Duration:	90 mins	Max Marks:	50	Sem / Sec:	A	Time	08.00 – 10.00 AM	OBE	

Answer any FIVE FULL Questions

		MARKS	CO	RBT
1	**How would you describe the working of Go-Back-N protocol and how it is different from Selective Repeat ARQ?**	[10]	CO2	L3

The Go-Back-N ARQ protocol is a variant of the Automatic Repeat Request (ARQ) protocol.

The sender sends several frames determined by a window size even if the receiver does not respond with an acknowledgment (ACK) packet.

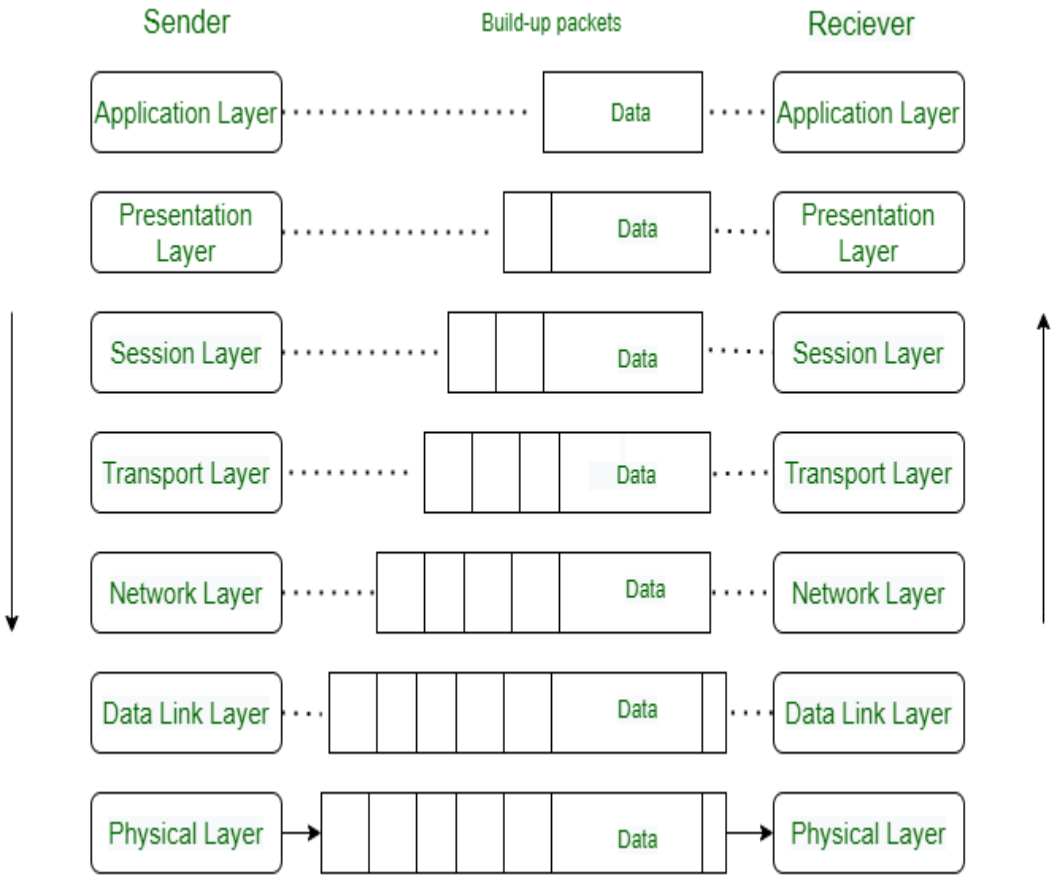
- A transmit window size of N, and a receive window size of 1 is a particular case of the basic **sliding window protocol**. It can send **N** frames to the peer before requesting an acknowledgment.
- It works on the notion of protocol pipelining, which allows numerous frames to be delivered before the first frame is acknowledged.
- The shelves in Go-Back-N ARQ are numbered consecutively because Go-Back-N ARQ provides multiple brackets at once, necessitating a numbering strategy to identify one frame from another. These numbers are referred to as sequential numbers.
- The maximum number of frames that can be sent at once is entirely dependent on the sender's window size. All structures in the current window will be retransmitted if a frame's acknowledgment is not received within the agreed-upon time frame.

BASIS FOR COMPARISON	GO-BACK-N	SELECTIVE REPEAT
Basic	Retransmits all the frames that are sent after the frame which is suspected to be damaged or lost.	Retransmits only those frames that are suspected to be lost or damaged.

Bandwidth Utilization	If the possibility of error in transmission is high or a lot of corrupt frames are transmitted, then this protocol wastes a lot of bandwidth.	Since only the erroneous or corrupted data frames are retransmitted in the network. It saves network bandwidth and is more efficient than the Go-Back-N protocol.
Complexity	The implementation of this protocol is simpler than selective repeat. It is less complex because of its less logical implementation.	It is more complex than the Go-Back-N protocol as additional logic and sorting algorithm is applied at both the sender and receiver node. Moreover, it also requires additional storage to work efficiently.
Minimum Sequence Number	The possible minimum sequence number for the Go-Back-N protocol is N+1. Here N is the number of a data frame transmitted by the sender.	The possible minimum sequence number for the Selective Repeat protocol is 2N. Here N is the number of a data frame transmitted by the sender.
Sender Window Size	The window size of the sender node is N in the Go-Back-N protocol.	It is also N for selective repeat protocol. The Window size of the sender node is greater than 1.
Receiver Window Size	The size of the receiver window is 1.	The size of both the sender and receiver window is equal to implement selective repeat. Thus, it is N in this protocol.
Window size	N-1	<= (N+1)/2
Sorting	The data frames are not sorted at either end of the transmission.	The sorting of data frames is done at the receiving end. Maintaining the correct sequential order of the data frame is necessary to ensure the correct frame is requested.

Storing	Receivers do not store the frames received after the damaged frame until the damaged frame is retransmitted.	The receiver stores the frames received after the damaged frame in the buffer until the damaged frame is replaced.
Searching	It does not perform a search as all the nodes in the current window are represented if the sender does not receive acknowledgment of a frame. Search is not performed at either end of transmission.	The sender must perform a search operation as only the requested node is retransmitted in the network.
Supported Order	It only accepts in-order delivery at the receiver node in this protocol.	In Selective Repeat ARQ, the receiver node only accepts out-of-order delivery in the network.
Type of Acknowledgement	It sends a cumulative acknowledgment for the data frames to the sender node.	In selective repeat, the acknowledgment is individual for each frame.
ACK Numbers	NAK number represents the expected frame number of the next data frame in the network.	NAK number represents the number of the data frame that is lost during transmission.
Re-transmission	The sender node retransmits all the data frames in the current window if it does not receive the acknowledgment for the data frame. Thus, the number of re-transmission is N.	In selective repeat protocol, only the erroneous data frames are retransmitted. Thus, the number of re-transmission is 1.
Efficiency of the Protocol	The formula to compute the efficiency is N/(1+2*a), where a represents the ratio of propagation delay to transmission delay and N represents the data	The formula to compute the efficiency is N/(1+2*a), where a represents the ratio of propagation delay to transmission delay and N represents the data

		packets transmitted in the network.	packet transmitted in the network.		
	Use	It is more used because it is less complex and requires less storage.	It is less implemented. It is used where the bandwidth is limited, and efficiency is important.		

2	**List out the layers of OSI reference model with diagram and explain any two layers in detail.** The OSI model, created in 1984 by ISO, is a reference framework that explains the process of transmitting data between computers. It is divided into seven layers that work together to carry out specialised network functions, allowing for a more systematic approach to networking.  **7. Application Layer** The application layer is used by end-user software such as web browsers and email clients. It provides protocols that allow software to send and receive information and present meaningful data to users. A few examples of application layer protocols are the Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Post	[10]	CO1	L1

Office Protocol (POP), Simple Mail Transfer Protocol (SMTP), and Domain Name System (DNS).

6. Presentation Layer

The presentation layer prepares data for the application layer. It defines how two devices should encode, encrypt, and compress data so it is received correctly on the other end. The presentation layer takes any data transmitted by the application layer and prepares it for transmission over the session layer.

5. Session Layer

The session layer creates communication channels, called sessions, between devices. It is responsible for opening sessions, ensuring they remain open and functional while data is being transferred, and closing them when communication ends. The session layer can also set checkpoints during a data transfer—if the session is interrupted, devices can resume data transfer from the last checkpoint.

4. Transport Layer

The transport layer takes data transferred in the session layer and breaks it into "segments" on the transmitting end. It is responsible for reassembling the segments on the receiving end, turning it back into data that can be used by the session layer. The transport layer carries out flow control, sending data at a rate that matches the connection speed of the receiving device, and error control, checking if data was received incorrectly and if not, requesting it again.

3. Network Layer

The network layer has two main functions. One is breaking up segments into network packets, and reassembling the packets on the receiving end. The other is routing packets by discovering the best path across a physical network. The network layer uses network addresses (typically Internet Protocol addresses) to route packets to a destination node.

2. Data Link Layer

The data link layer establishes and terminates a connection between two physically-connected nodes on a network. It breaks up packets into frames and sends them from source to destination. This layer is composed of two parts—Logical Link Control (LLC), which identifies network protocols, performs error checking and synchronizes frames, and Media Access Control (MAC) which uses MAC addresses to connect devices and define permissions to transmit and receive data.

1. Physical Layer

The physical layer is responsible for the physical cable or wireless connection between network nodes. It defines the connector, the electrical cable or wireless

	technology connecting the devices, and is responsible for transmission of the raw data, which is simply a series of 0s and 1s, while taking care of bit rate control.			
3	**How would you compare between guided media and unguided media with examples?** **Guided Media:** In this type of media, signal energy is enclosed and guided within a solid medium. The guided media is used either for point-to-point links or a shared link with various connections. In guided media, interference is generated by emissions in the adjacent cables. Proper shielding of guided media is required to reduce the interference issue. **Unguided Media:** In the unguided media, the signal energy propagates through a wireless medium. Wireless media is used for radio broadcasting in all directions. Microwave links are chosen for long-distance broadcasting transmission unguided media. Interference is also a problem in unguided media, overlapping frequency bands from competing signals can alter or eliminate a signal.	[10]	CO1	L2

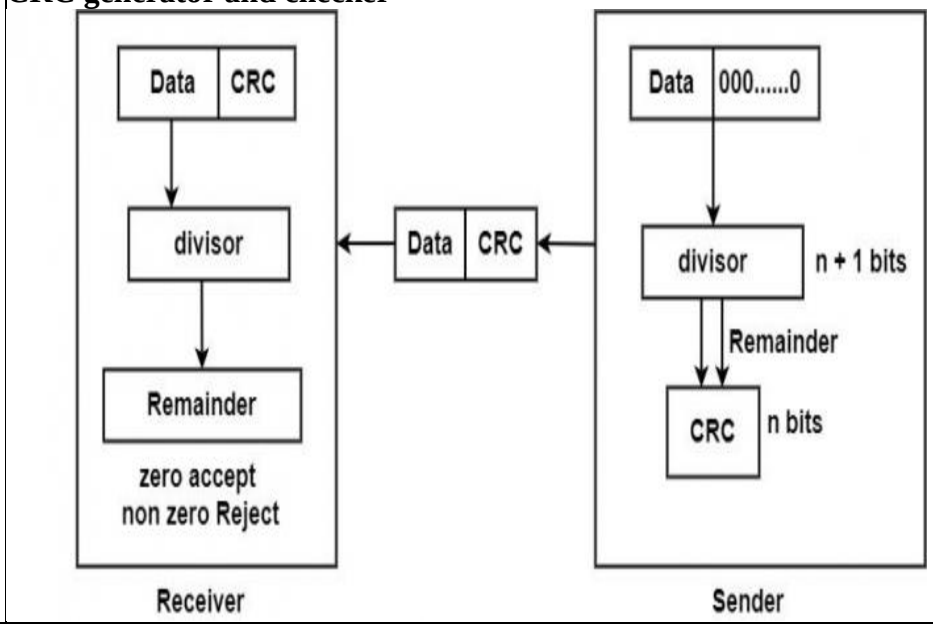
S. No.	Guided Media	Unguided Media
1.	The guided media is also called wired communication or bounded transmission media.	The unguided media is also called wireless communication or unbounded transmission media.
2.	The signal energy propagates through wires in guided media.	The signal energy propagates through the air in unguided media.
3.	Guided media is used for point-to-point communication.	Unguided media is generally suited for radio broadcasting in all directions.
4.	It is cost-effective.	It is expensive.
5.	Discrete network topologies are formed by the guided media.	Continuous network topologies are formed by the unguided media.
6.	Signals are in the form of voltage, current, or photons in the guided media.	Signals are in the form of electromagnetic waves in unguided media.
7.	Examples of guided media are twisted pair wires, coaxial cables, and optical fiber cables.	Examples of unguided media are microwave or radio links and infrared light.

	8.	By adding more wires, the transmission capacity can be increased in guided media.	It is not possible to obtain additional capacity in unguided media.			
	9.	It sends out a signal that indicates which way to go.	It does not indicate which way to travel.			
	10.	For a shorter distance, this is the best option.	For longer distances, this method is used.			
	11.	It is unable to pass through walls.	It can pass through walls.			
4 (a)	**With a neat diagram, explain CRC the working of CRC and calculate CRC for the bit stream 10011101 if generator codeword is x^3+1 and check on receiver end also.**			[10]	CO2	L3

The Cyclic Redundancy Checks (CRC) is the most powerful method for **Error-Detection and Correction**. It is given as a **kbit** message and the transmitter creates an (n – k) bit sequence called frame check sequence. The out coming frame, including n bits, is precisely divisible by some fixed number. Modulo 2 Arithmetic is used in this binary addition with no carries, just like the XOR operation.

Redundancy means **duplicacy.** The redundancy bits used by CRC are changed by splitting the data unit by a fixed divisor. The remainder is CRC.

CRC generator and checker



Process

- A string of n 0s is added to the data unit. The number n is one smaller than the number of bits in the fixed divisor.
- The new data unit is divided by a divisor utilizing a procedure known as binary division; the remainder appearing from the division is CRC.
- The CRC of n bits interpreted in phase 2 restores the added 0s at the end of the data unit.

Example

Message D = 1010001101 (10 bits)

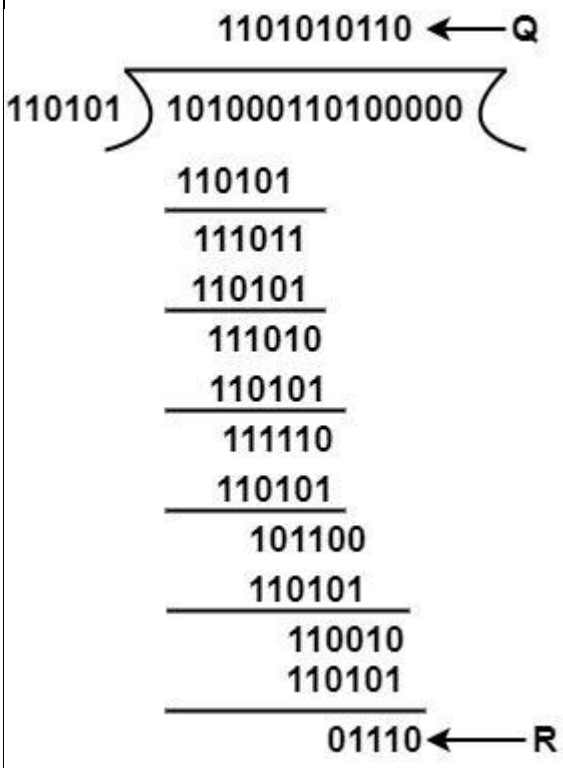
Predetermined P = 110101 (6 bits)

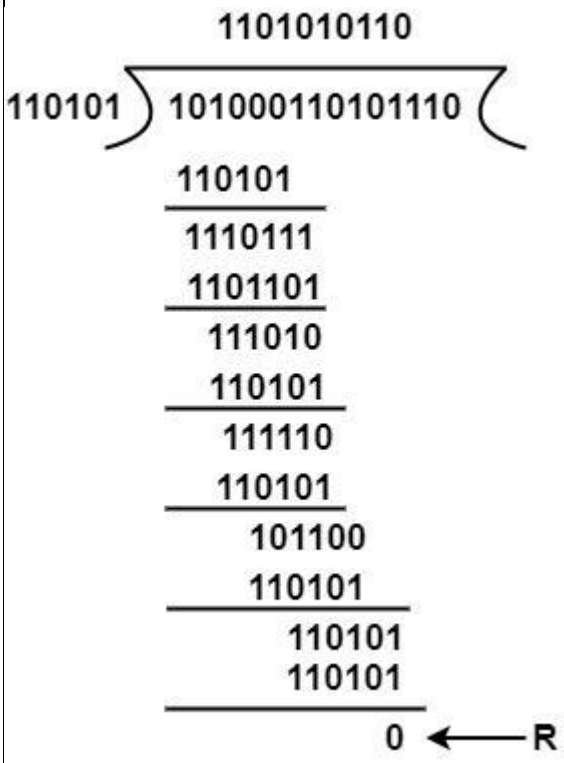
FCS R = to be calculated 5 bits

Hence, n = 15 K = 10 and (n – k) = 5

The message is generated through 2^5:accommodating 1010001101000

The product is divided by P.



	The remainder is inserted to 2^5D to provide T = 101000110101110 that is sent. Suppose that there are no errors, and the receiver gets T perfect. The received frame is divided by P.  Because of no remainder, there are no errors.			
5 (a)	**Explain CSMA/CA with flow diagram? How it is different from CSMA/CD.** **CSMA** is a mechanism that senses the state of the shared channel to prevent or recover data packets from a collision. It is also used to control the flow of data packets over the network so that the packets are not get lost, and data integrity is maintained. In CSMA, when two or more data packets are sent at the same time on a shared channel, the chances of collision occurred. Due to the collision, the receiver does not get any information regarding the sender's data packets. And the lost information needs to be resented so that the receiver can get it. Therefore we need to sense the channel before transmitting data packets on a network. It is divided into two parts, **CSMA CA** (Collision Avoidance) and **CSMA CD** (Collision Detection).	[5]	CO2	L2

CSMA/CD

The Carrier Sense Multiple Access/ Collision Detection protocol is used to detect a collision in the media access control (**MAC**) layer. Once the collision was detected, the CSMA CD immediately stopped the transmission by sending the signal so that the sender does not waste all the time to send the data packet. Suppose a collision is detected from each station while broadcasting the packets. In that case, the CSMA CD immediately sends a jam signal to stop transmission and waits for a random time context before transmitting another data packet. If the channel is found free, it immediately sends the data and returns it.

CSMA/CA

CSMA stands for **Carrier Sense Multiple Access** with **Collision Avoidance**. It means that it is a network protocol that uses to avoid a collision rather than allowing it to occur, and it does not deal with the recovery of packets after a collision. It is similar to the CSMA CD protocol that operates in the media access control layer. In CSMA CA, whenever a station sends a data frame to a channel, it checks whether it is in use. If the shared channel is busy, the station waits until the channel enters idle mode. Hence, we can say that it reduces the chances of collisions and makes better use of the medium to send data packets more efficiently.

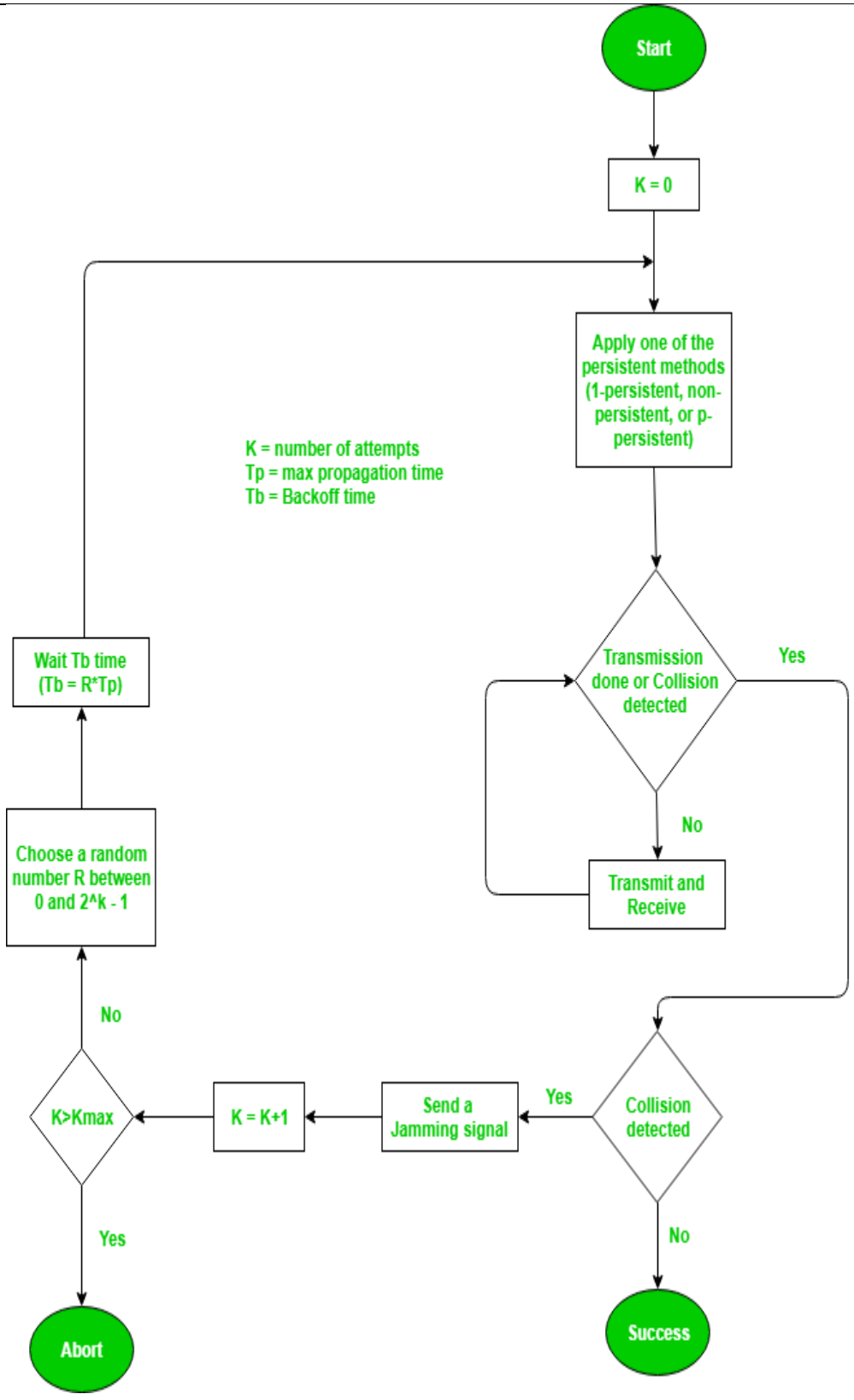
Advantage and Disadvantage of CSMA CA

Advantage of CSMA CA

1. When the size of data packets is large, the chances of collision in CSMA CA is less.
2. It controls the data packets and sends the data when the receiver wants to send them.
3. It is used to prevent collision rather than collision detection on the shared channel.
4. CSMA CA avoids wasted transmission of data over the channel.
5. It is best suited for wireless transmission in a network.
6. It avoids unnecessary data traffic on the network with the help of the RTS/ CTS extension.

The disadvantage of CSMA CA

1. Sometime CSMA/CA takes much waiting time as usual to transmit the data packet.
2. It consumes more bandwidth by each station.
3. Its efficiency is less than a CSMA CD.



Difference between CSMA CA and CSMA CD

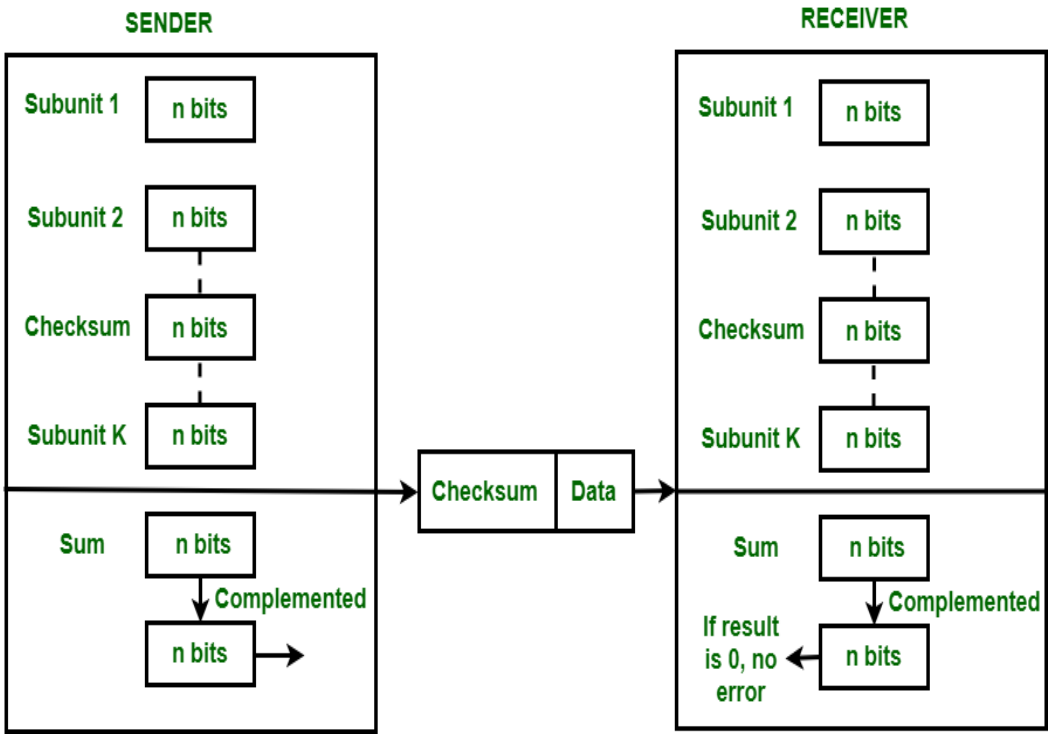
S. No	CSMA CD	CSMA CA

	1.	It is the type of CSMA to detect the collision on a shared channel.	It is the type of CSMA to avoid collision on a shared channel.			
	2.	It is the collision detection protocol.	It is the collision avoidance protocol.			
	3.	It is used in 802.3 Ethernet network cable.	It is used in the 802.11 Ethernet network.			
	4.	It works in wired networks.	It works in wireless networks.			
	5.	It is effective after collision detection on a network.	It is effective before collision detection on a network.			
	6.	Whenever a data packet conflicts in a shared channel, it resends the data frame.	Whereas the CSMA CA waits until the channel is busy and does not recover after a collision.			
	7.	It minimizes the recovery time.	It minimizes the risk of collision.			
	8.	The efficiency of CSMA CD is high as compared to CSMA.	The efficiency of CSMA CA is similar to CSMA.			
	9.	It is more popular than the CSMA CA protocol.	It is less popular than CSMA CD.			
5 (b)	**A Pure ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. What is the throughput if the system (all stations together) produces a. 1000 frames per second b. 500 frames per seconds c. 250 frames per second.** Throughput of pure aloha, $S=G \times e^{-2G}$. Where G is the average no. Of frames generated by system during one frame transmission time. Transmission time $=h=200/200=1$ ms. If system create 1000 frames per second means 1 frame per millisecond ,so G=1 $S= G \times e^{-2G} =0.135$ that means throughput is 1000×.135=135 frames. Only 135 frames out of 1000 will survive.			[5]	CO2	L3

6	**What is checksum? List the steps taken by sender and receiver for error detection with suitable example.**	[10]	CO2	L2

Checksum is the error detection method used by upper layer protocols and is considered to be more reliable than LRC, VRC and CRC. This method makes the use of **Checksum Generator** on Sender side and **Checksum Checker** on Receiver side.

At the Sender side, the data is divided into equal subunits of n bit length by the checksum generator. This bit is generally of 16-bit length. These subunits are then added together using one's complement method. This sum is of n bits. The resultant bit is then complemented. This complemented sum which is called checksum is appended to the end of original data unit and is then transmitted to Receiver.



The Receiver after receiving data + checksum passes it to checksum checker. Checksum checker divides this data unit into various subunits of equal length and adds all these subunits. These subunits also contain checksum as one of the subunits. The resultant bit is then complemented. If the complemented result is zero, it means the data is error-free. If the result is non-zero it means the data contains an error and Receiver rejects it.

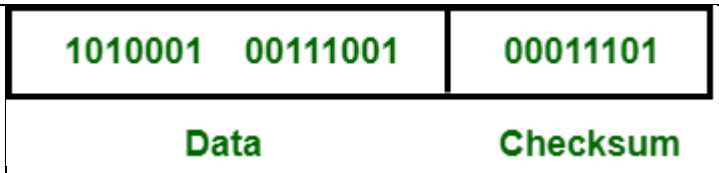
Example –

If the data unit to be transmitted is 10101001 00111001, the following procedure is used at Sender site and Receiver site.

Sender Site :

10101001	subunit 1
00111001	subunit 2
11100010	sum (using 1s complement)
00011101	checksum (complement of sum)

Data transmitted to Receiver is –



Receiver Site :

10101001	subunit 1
00111001	subunit 2
00011101	checksum
11111111	sum
00000000	sum's complement

Result is zero, it means no error.

Advantage :
The checksum detects all the errors involving an odd number of bits as well as the error involving an even number of bits.
Disadvantage :
The main problem is that the error goes undetected if one or more bits of a subunit is damaged and the corresponding bit or bits of a subunit are damaged and the corresponding bit or bits of opposite value in second subunit are also damaged. This is because the sum of those columns remains unchanged.

CO PO Mapping

CO-PO and CO-PSO Mapping

CO-PO and CO-PSO Mapping																				
Course Outcomes		**Blooms Level**	**Modules covered**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	Analyze and compare various networking protocols.	**L1**	**7,8, 9,10 ,11, 12**	2	-	-	-	-	-	-	1	1	-	-	2	-	2	-	-
CO2	Demonstrate the working of different concepts of networking	**L2**	**7,8, 9,10 ,11, 12**	2	3	3	-	-	-	-	1	1	-	-	2	-	2	-	-
CO3	Implement, analyze and evaluate networking protocols in NS2 / NS3 and JAVA programming language	**L3**	**1,2, 3,4, 5,6**	2	2	3	-	-	-	-	1	1	-	-	2	-	2	-	-

COGNITIVE LEVEL	REVISED BLOOMS TAXONOMY KEYWORDS

L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)				CORRELATION LEVELS	
PO1	Engineering knowledge	PO7	Environment and sustainability	0	No Correlation
PO2	Problem analysis	PO8	Ethics	1	Slight/Low
PO3	Design/development of solutions	PO9	Individual and team work	2	Moderate/ Medium
PO4	Conduct investigations of complex problems	PO10	Communication	3	Substantial/ High
PO5	Modern tool usage	PO11	Project management and finance		
PO6	The Engineer and society	PO12	Life-long learning		
PSO1	Develop applications using different stacks of web and programming technologies				
PSO2	Design and develop secure, parallel, distributed, networked, and digital systems				
PSO3	Apply software engineering methods to design, develop, test and manage software systems.				
PSO4	Develop intelligent applications for business and industry				