19CS2109 - Computer Networks & Security

Set No: 2 - Key + scheme

1. Applications of Computer Networks:

   (i) Business Applications 1.5M

   a. Resource sharing

   b. Providing Communication medium

   c. Doing business electronically

   (ii) Home Network Applications 1.5M

   a. access to remote information

   b. Person-to-person Communication

   c. Interactive entertainment

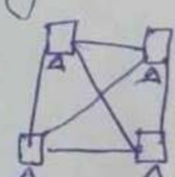
   d. Electronic commerce

   (iii) Mobile Network Users 1.5M

   - Combination of wireless Networks and mobile Computing

Number of cables required for connecting a set of nodes when the nodes follow the below topologies:

a. Mesh - $N(N-1)/2$ → (a) Eg $n=4$



∴ for 4 nodes 6 cables are required

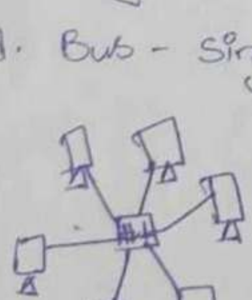
$$\frac{n(n-1)}{2} = \frac{4(4-1)}{2} \Rightarrow \frac{4\times3}{2} = 6$$

b. Star - single hub

c. Ring - Two nodes connecting cable

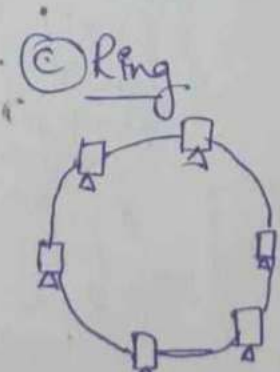
d. Bus - single cable

(b)



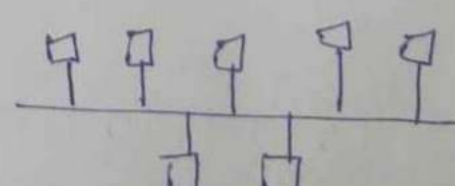
Hub fails leads to entire n/w failure.

(c) Ring



A link fails makes a node isolated

(d) Bus



Back bone failure leads to entire n/w failure.

(3.) CRC

Given Data = 101011110011 , k = 12

Generator polynomial is x^4+1

First convert given polynomial into bits

$x^4+0.x^3+0.x^2+0.x^1+1$ = 10001 → 2M

So $n-k+1=5$

$n-12+1=5$

$n=16$

So, $n-k = 16-12 = 4$ zero's are to be appended

```
              101001010110
       ___________________
10001 ) 1010111100110000
        10001
        Ø01001
         00000
         Ø10011
          10001
          Ø00101
           00000
           Ø01010
            00000
            Ø10100
             10001
             Ø01011
              00000
              Ø10111
               10001
               Ø01100
                00000
                Ø11000
                 10001
                 Ø10010
                  10001
                  Ø00110
                   00000
                   (0110)
```

$\boxed{1010111100110110}$

Problem - 6M

Given Data = 1111, So $m = 4$

(4)

$2^r \geq m + r + 1 \implies r = 3$

Explanation + problem 6M

$m + r = 4 + 3 = 7$

Error bit location - 2M

7	6	5	r_4	3	r_2	r_1
1	1	1		1		

$r_1 = 3, 5, 7 = 1 \oplus 1 \oplus 1 = 1$

$r_2 = 3, 6, 7 = 1 \oplus 1 \oplus 1 = 1$

$r_4 = 5, 6, 7 = 1 \oplus 1 \oplus 1 = 1$

$\therefore$ Data to be send is 1111111

Error bit Identification:

Given Data is 1011101

7	6	5	4	3	2	1
1	0	1	1	1	0	1

$d_1 = 1, 3, 5, 7 = 1 \oplus 1 \oplus 1 \oplus 1 = 0$

$d_2 = 2, 3, 6, 7 = 0 \oplus 1 \oplus 0 \oplus 1 = 0$

$d_4 = 4, 5, 6, 7 = 1 \oplus 1 \oplus 0 \oplus 1 = 1$

So, error has occurred in 4^{th} position

Hence the data must be 1010101

5A. Two dimensional parity check : 4M

- Parity check bits are calculated for each row, which equivalent to a simple parity check bit
- Parity bits are also calculated for all columns, then both are sent along with the data
- At the receiving end these are compared with the parity bits calculated on the received data.

Given

	D_4	D_3	D_2	D_1	D_0	Paritybit
R_0	1	1	0	0	1	0
R_1	1	0	1	1	1	1
R_2	1	1	1	0	0	0
R_3	0	0	1	0	0	0
R_4	0	1	1	1	0	0
	0	0	1	1	1	0

So Final Senders data is,

110010 101111 111000 001000 011100 001110

Error Detection : changing $R_0 D_4$ and $R_2 D_1$

Contradiction - 2.5M

	D_4	D_3	D_2	D_1	D_0		Parity again calculating
R_0	0	1	0	0	1	0	1
R_1	1	0	1	1	1	1	0
R_2	1	1	1	1	0	0	1
R_3	0	0	1	0	0	0	0
R_4	0	1	1	1	0	0	0
	0	0	1	1	1	0	0

the receiver counts the 1s in each so we are not getting all 0s. So error is detected.

P-3

B. Explanation - 2M

Given frame1 : 1011101 1

frame 2 : 1110111 0

frame 3 : 1010101 0

frame 4 : 1111011 0

frame 5 : 1100001 1

11001010 - 4M

(i) Given code word is 221

Convert to binary 0010 0010 0001

After stuffing 01111110 0010 00100001 01111110

* student can convert each character into 3 bits / 8 bits instead of 4 bits as above

* Student can convert 221 ~~into~~ (Two hundred and twenty one) into binary and then perform bit stuffing (4M)

(ii) Flag = 01111110

Data = 0110111111101111111110000

Stuffed data

01111110 01101111101101111101111100000 01111110 (4M)

(iii) Flag = "DLE", Data = "IDLE"

Stuffed data DLE IDLE DLE DLE

Disadv : wastage of Bandwidth by unnecessary stuffed data transmission (4.5M)

7. Given 4 bits for representing sequence number 1.5

Possible no of sequence numbers are $2^4 = 16$

Possible sequence numbers are

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Need of Sequence number Explanation - 3M

8. In pipelined transmission - 4.5M

frames will be transmitted one by one

- Before receiving the acknowledgement of previous frame next frame can be transmitted
- Go-Back-N & Selective Repeat protocol Overview

9. General Assumptions are 4M

1. Station ~~channel~~ Model
2. Single channel
3. Slotted time
4. Continuous time
5. Carrier Sense
6. No Carrier sense
7. Collision assumption

a) CSMA - 1-persistant - station model, (4M)
Single channel
Collision Assumption
Carrier Sense
Continuous time

1-5

CSMA - Non-Persistent - station model,

By

Single channel

Collision Assumption

Carrier Sense

~~continuous~~ slotted but slots based on Backoff (partially slotted)

CSMA - P-Persistant - Station model

Single Channel

Collision Assumption.

Carrier Sense

Slotted time

slotted Aloha - Station model 4M.

Single channel

Collision Assumption

No Carrier Sense

Slotted time

(10) State whether the below statements are true or false

(i) (a) Logical address is also called Ip address and it helps to identify every node in the network uniquely.

→ True ⇒ As Ip address is the only address with which a node can be identified uniquely in Internet 2M

(b) Multicasting is a type of Broadcasting.

→ True ⇒ Broadcasting sends msg to all · Multicasting sends to a group. 2M

(ii) Broadcast LANS - Uses a single channel by all nods

Explain process of how data is transmitted - 2M.

Channel Access mechanism - 2M.

(11) Node A : 01110   Explanation – 3M

Node B : 10011   given Example problem – 3.5M. Total –

Node C : 11111

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Node A dropped   Node B dropped

∴ winning station is node c.

∴ channel is conquered by 'c'.

Disadvantage of Bit map over binary count down. – 6M.

- Floats contention slots and asks all the stations to reserve the slots, allocated the channel as per the reservations.
- Eg:- If a station received data from its n/w layer after completing the contention slots. That station has to wait untill all the reserved station transmits and floats contention slots again.

∴ waiting time may be more for few stations sometimes

In Binary count down a station waits only until any one other station completes its transmission. Waiting time may be decreased.

(12) Explain with a flow diagram pure Aloha and slotted Aloha. It is stated that the maximum throughput of slotted Aloha is 0.368 and pure Aloha is 0.184. Justify

→ Pure Aloha & slotted Aloha explanation with diagram – 4M

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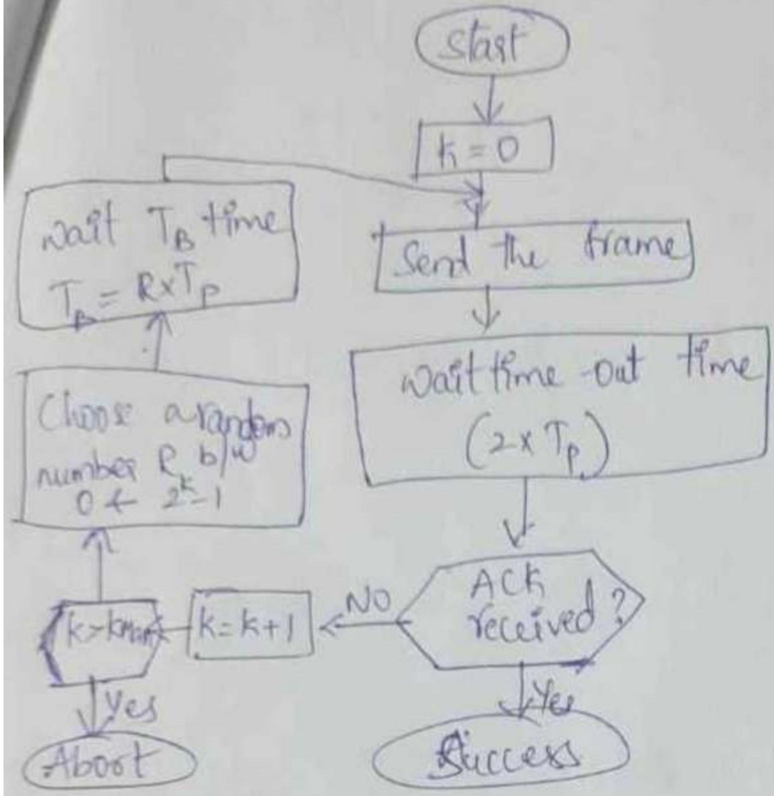
Pure Aloha



Slotted Aloha

→ Explanation based on Vulnerable time.

→ Every new frame starts at a specific time slot starting time.

Derivation

Pure Aloha : α - Stations number

N - New frames generation meantime

$0 < N < 1$

If $N > 1 \Rightarrow$ Overloading the channel.

Then $G \Rightarrow$ Mean for frames (new) + Retransmission frames

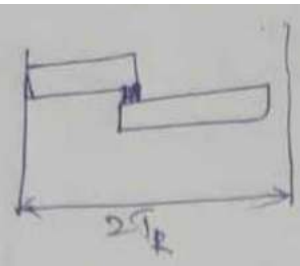
$N = 0$ then $G \simeq N$. S - Throughput

$N > 1$ then $G > N$.

$S = G * P_0 \rightarrow P_0$ is the probability of frames transmitted without collision.

$$P_r[k] = \frac{G^k \cdot e^{-G}}{k!} \Rightarrow P_0 = \frac{G^0 e^{-G}}{0!} \Rightarrow P_0 = \frac{1 \times e^{-G}}{1}$$

$P_0 = e^{-G} \rightarrow$ Substitute in $S = GP^0 \Rightarrow S = G \cdot e^{-G}$.

Vulnerable time $\Rightarrow$ 

As Vulnerable time is twice G becomes $\underline{\underline{2G}}$.

$\underline{S = G \cdot e^{-2G}}$ $\boxed{G = 0.5}$ for pure aloha
↳ frame transmission

$S = 1/2 * e^{-2 \times \frac{1}{2}}$

$\Rightarrow S = 1/2 * e^{-1} = \frac{1}{2e}$ $\underline{S = 0.183 \Rightarrow S = 18\%}$

Slotted Aloha

Vulnerable time is only T_R

* collision occurs then waits a random amount of time then retransmit

$\because S = G \cdot e^{-G}$

G=1 for slotted Aloha.

$S = 1 * e^{-1}$

$S = \frac{1}{e} \Rightarrow \underline{0.378} = 38\%$

$\therefore$ Slotted Aloha gives more throughput than pure Aloha.

——— * END * ———