Hamming code of

Che capterects make to

CRC can detect most of the largest burkt ernor with higher probability.

For CRC-12 detects 99.97% of even with a lingth 12 or more.

- H. CRC K baad hum next tichnique joh use Kare Hahai.
 hai woh hou hamming code.
- Hamming Lode: >
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 Hamming code is based on the concept of hamming
 distance.
 - · Hum data send karte hai, ABC jaise hamane send. Kiya,
 - · Joh ABC K flace for hum Kya send karte hai uski ascii value.
- · Aun Hamming in assi rabue Ki blace par kya use Karta hai code words.
 - Hamming mein hum basically data nahi send kanti, hai hum code word send kanti hai. Joh bluejoh Send ho raha hai it is woh kya hai code words hai of fixed lingth.
- Now suppose yet hamane do code words hai

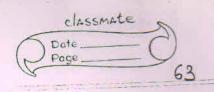
1101

Aafse fucha gaya ûnke bish ka hamming distance Kîtana haî.

- · Joh in code words k bich mein hamming distance kaise find karegry.
- · Joh hamming distance find kanne k lige buform.

 XOR on this hamming code words.

- Now un code ka hamane code word xor purform kiya toh kya mila hamne 0 L00.
 - New in result mein Kitari One's hai took
 - Joh humber of one's in rusulaing xor is the hamming distance between the code words.
- · Joh in hamming code-words Ki bich Ka distance Kitana hai too- one.
- Aacha apko sets of code words dige hur hai, fahala diga hua hai-
 - 1001, LOLO, thisa 1100 now aafsi bucha inke bich ka hamming distance Kitana.
- · Joh kya hum thing to ek santh Yor karugey



Nahi, XOR toh kangly but at a time do ko kang-

 $\min L_{2,2,2} = 2$

Overall hamming distance Kirana Kahalayega Joh.

fo hamming distance between the code word is size.

yeh hamming distance Ka concept important kyo haus is hamming distance se hum kya conclusion nikal Sakte ho si

Suppose hum communication mein jouise ascei character.

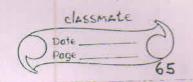
Kitane bûts k hote hai 8 bûts k.

8 bit K Kêtane Combination bangakte hai 28 ie 256 8 bit mein 256 different Character bon gakte hai.

Likin aaf sab words use hahê karte ho, hur kya use karte hai a-Z, A-Z, i'e 65-90, a > 97, 2 > 122, bich k joh asii value hai hum usually use hah karte hai.

Joh hamming yet assume Karta hai, ki agar afke code word 8 lingth K hai, Joh 8 lingth K. Sabhi code word valid nahi hai.

- · Kuch selicted valid har aux Kuch invalid har-
- · Valid Kisko kaha rahai hai joh hum sund tarrahai hai , aure kon învalid hai joh hum sund nahî karrahai hai.
- * Cafital A se cafital 2 tak Send Kannahan han, 8 bit ka woh code word. jiski value 65 aanahan han woh valid han.
- Par 8 bit ka woh code word Jiski value Kitani aarahai 64 woh kya hojayega invalid.
- · Joh hamming yet assume kanta hai ki jitana bhi bada naf code word send kan rahai ho wake sabhi combination valid nahi hai.
- · Some au valid & some au invalid.
- · Agan Kahi în ralid code word rucierin end fan bachu gaya, toh definitely newern ko fota Chal Jayoda Ki thur is some ennon
 - Euron kab detect pahi ho fayegi jab ek valid code dusur valid code mein convent hojayegi.
- · Jouse, chalo dekte hai, hum assume kan rahai hai ki hum four bit k code word sind kan rahai aux surf do hi send kannahai fai



- . Konse do ek toh loll aux dusna 1101.
 - Agan yeh do code word hat toh Hicker assume kanga ki yer valid code aaya hat, other than this two agan kohi aaya hat, toh Hicker difinitly assume kanga ki there is some veron.
- · Aab suffose is code word mein Ek bit ke evror
- · Aacha in dono code word K bich ka hamming distance Kitana 2.
- Mond kons: bhi ex bit ki evren aagayi, ek code work mein:

1001 OOLL

- Now hamane bheja tha LOIL four Muserun Ne Ki fass Kya fachucha OOLL, toh yeh code word Yalid hai ki invalid hai.
- word volled hai ek to LOLL aux dustre LLOL.
- · Joh Mucker K fass joh fachucha har usme kuch www.
- Agan ek bût kê Konsê bhê evron hai, result Kêgra luds to învalid code.
- · Joh I bit ki han ennon ko nucleum detect kon

liga.

Now aab two bit Ki evron detect ho bayegi Ki

Joh hamane bheja tha LOII aux mila kya OBIL, toh yeh invalid code hai yeh ruiever detect karliga.

Now suppose Lott the bhefa to do but would the hogay? To he kya milega I LOI

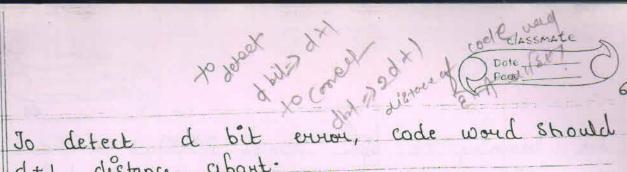
Now suppose hamane LOLL hi bhya but Milever Ko Kya mila hamane brow middle ki do bit count -t Kar di toh Museru Ko Kya mila LLOL. Jow yeh 1101 Kya hai , ek valid code woud.

Joh yen ernou rucierun dutich pahi karfajega

One bit Ki Sabhi evnou ko dituk karpayega fan two bit Ki Sabhi evnou ko dituk nahî Karpayega:

Aaisa Kys because unka hamming distance Kitana tha two.

Joh to detect d'bit evens, toh code word Kitana hamming distance Jarwie han dt L distance.



d+1 distance apart.

Agan two bit ka hamming distance hai toh One bit ki gabsi unon detect hojayegi.

386° tarike se hamming Kahata har to covert le d bits ever, code words min Kilana hamming distance hona chahiye 2d+L distance hona chahiye.

Ours X9f distance between code word is nine, to then how many bits of every can be consided 22

[Ld+1]= A Ld = 8 | 3MAY but correct of BIT

Ours: 95 distance between code word is 8, then how many bits of over can be covered 22 Ans

2d+L=82a = 7 d = 3.5[d] = [3.5] = 3

80/-

Ans. Three bêts can be corrected.

Now yet toh homane theory discuss ke, actual min hamming K code Kaise implement hote hai,

Joh Joh bractically implemented code how, it can cornect only single bit verous

Joh	hamming	ne	abre	Scheme	Sartri	duce Ki	the.
	suf ek						

- Joh aab hum dekte has woon fractically implement kaise hua has.
 - Joh VRC mein Kitane Reducdant bit one, CRC mein Kitane Reducdant bit equal to highest former of the Golynomial:
 - Joh hamming minn Kitani reductant bits, -9f d is the length of data bits -
 - Joh Number of Heducalent bits it is equal to minimum value of M.
- Joh ck equation hote hai -

d+ H+1. <= 2"

What is d > d is the length of data bit,
H is Heducdant bit.

Joh Minimum value of H, which is gatisfied by this equation should be the number of Heducant bits.

Now suppose afki data bit 4 hai, boh Kitani ruducdant bit hone chahije-

> 4+ H+1 <= 2^M 4+ H+1 <= 2^M 5+ H < 7.9^M

Minimum value of H = 3

- Joh agan data bit four hai top reductant bit kitane. hogi thru hogi.
 - If eight is the length of data bits, the how many reductant bits are there ??

Ansz

$$d = 8$$
 $d + M + 1 \le 2^{M}$
 $8 + M + 1 < = 2^{M}$
 $9 + M < = 2^{M}$
 $9 + 4 < = 2^{4}$

Minimum value of H = 4 which satisfy by this equation

> Number of reducdant bit = 4.

Now Suffose hamana data has eight bit ka, toh kitani ruducdant bit add kanne has fown. Joh 8+4, toh Kitane bit ka data hogaya hamana Le bits ka.

Now and reducedant bit kaha add karne har, beginning

Joh aab hum dekte hai, hamane kaha reducdant bit add karne hai.

