ERROR DETECTION [1]

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Introduction

- While the transmission of data , it could so happen that the data transmitted could get corrupted , by means of noise , or many other factors ,and some thing must be done to know whether the recieved signal was erraneous.There fore , some of the techniques are imnplemented to be able to know if a signal has an error , ie. a bit(or more) is in error.

METHODS / TECHNIQUES OF ERROR DETECTION

- There are two main algorithms that are used to detect error in a transmitted signal . These are
- 1.Parity Check
- 2.Cyclic Redundancy Check

Parity Check

- A test that determines whether the number of ones or zeros in an array of binary digits is odd or even. Note: Odd parity is standard for synchronous transmission and even parity for asynchronous transmission. Synonym odd-even check.
- Take as an example that you want to transmit 1100110 and we choose even check , then the message should be transmitted as 11001100 , last zero bit is added so that the sum of the number of 1's in the signal remains even.
- If at the reciever , (say for even parity) we get a message with no. of 1's even , then either the

[1]Ref: Data and Computer Communications by William Stallings

message recieved is correct , or the number of errors in the message (i.e. , the no. of errorenous bits) in the recieved message is a multiple of 2.

- The probability that in a small message being transmitted , the no. of errorenous bits is a multiple of 2 is very very low. So we can assume without any loss of generality that the error in the message , if there , will be caught at the reciever parity check circuit.

Cyclic Redundancy Check

- The basic fundamental behind this approach is to detect the error even if the message sent is having a big size.
- In case of parity check , the main problems are :
  - If message size is too big , then there can be possibility (though small - but still resonable probability) that 2 bits will be in error . If that is the case, then the parity check will not be effective .
  - For the above reason , the message sent should be a small one. This is not what we always want.

Cyclic Redundancy Check - Method

- 1.Modulo 2 Arithemetic
- 2.Polynomial

Cyclic Redundancy Check - Arithemetic Modulo 2

- Say we want to send a message M = 1010001101 (10 bits) . There is something called a pattern which in our case is 110101 (6 bit). The purpose of pattern is that the final message sent should be dic=visible by the pattern P , and when the reciever recieves the message , then it should check if the message received is divisible by pattern P . If it is , then the message is received correct with a very high probability. If the message is not divisible by P , then the message is in error with a very high probability. Lets see the above stated with an example .
- Concept of FCS : The final message being sent is the original message appended with a fixed number of bits , such that the mesasge(final, bneing sent) becomes divisible by P. This is quite easy. Here's how this can be done. Take Message M to be 1010001101 (10 bits) , Pattern P to

be 110101(6 bits) and FCS R = 5 bits part yet to be calculated. Assume that the Message is appended with 5 0's and then divided with 110101 . Then check what the reminder is . In our case that turns out to be 01110 . So the FCS R = 01110 . Hence the final message to be sent is MR or 101000110101110. You can check it yourself that the final message will be divisible by P

- The probability that the message is recieved as correct but is actually in error is 1/pow(2,r) where r is no. of bits in final message . This is indeed very low , if r ¿10 .
- The concept of Polynomial method is exactcly similar to Arithemetic modulo 2 technique . Here , M becomes x9+ x7 + x3 + x2 + 1 , and P becomes 1 + x2 + x4 + x5. The remainder is x + x2 + x3 . Hence the final message to be transmitted is M + R . And the concept is therefore exactly similar.