

# Re: Error rate probability

---

*Source:* <http://sci.tech-archive.net/Archive/sci.math/2005-06/msg05249.html>

---

- *From:* Jeroen Boschma <[jeroen.boschma@xxxxxx](mailto:jeroen.boschma@xxxxxx)>
  - *Date:* Wed, 29 Jun 2005 09:11:29 +0200
- 

"Keith A. Lewis" wrote:

>  
> "jan hauben" <[jan.hauben@xxxxxxxxxxx](mailto:jan.hauben@xxxxxxxxxxx)> writes in article  
> <[dviwe.132562\\$ej.7213120@xxxxxxxxxxxxxxxxxxxxxxxx](mailto:dviwe.132562$ej.7213120@xxxxxxxxxxxxxxxxxxxxxxxx)> dated Tue, 28 Jun 2005 20:34:17 GMT:  
> >in general :  
> >one extra bit can detect one fault (like parity-bit)  
>  
> True for any size frame.  
>  
> >two extra bits can correct one fault bit  
>  
> Certainly for a single bit. But for 2 data bits + 2 check bits, you can  
> have 4 different single-bit errors, or no error at all (a 5th case). So you  
> would need more than 2 bits to correct them all.  
>  
> Let  
> N = data bits  
> C = check bits  
> E = maximum expected errors in (n+c) frame  
>  
> You need  
>  $\sum(\text{choose}(N+C,i), i=1..E) \leq 2^C$   
>  
> See "Hamming Codes" for more info.  
>  
> >if a little mistake is acceptable, one can use gray-code  
>  
> Gray code is useful in circuits where you want only 1 bit to change at a  
> time, for whatever reason. I don't understand what use that would be in  
> error detection.

Gray coding prevents excessive biterrors in a bitstream. As an example, with QAM (Quadrature Amplitude Modulation) the data is send in packages of N bits which are called symbols. All  $2^N$  possible symbols can be represented as a 2-D grid (the symbol constellation), such that each symbol has neighbour symbols. Due to an error vector in the communcations channel, it is possible that the receiver decides that one of the neighbouring symbols was sent instead of the truly sent symbol itself. If the symbol constellation is Gray-coded such that neighbouring symbols only differ by one

Re: Error rate probability

bit, it is likely that if an error occurs only a single bit error occurs. If the symbol constellation is not Gray-coded, then you'll get multiple bit-errors in the described case.

Jeroen

>

> --Keith Lewis klewis {at} mitre.org

> The above may not (yet) represent the opinions of my employer.

.

---

• **References:**

◆ **[Re: Error rate probability](#)**

◇ *From:* jan hauben

◆ **[Re: Error rate probability](#)**

◇ *From:* Keith A. Lewis

• Prev by Date: **[Re: Is this expression viewable on sci.math?](#)**

• Next by Date: **[Re: Tic-tac-toe probability](#)**

• Previous by thread: **[Re: Error rate probability](#)**

• Next by thread: **[Re: Error rate probability](#)**

• Index(es):

◆ **[Date](#)**

◆ **[Thread](#)**