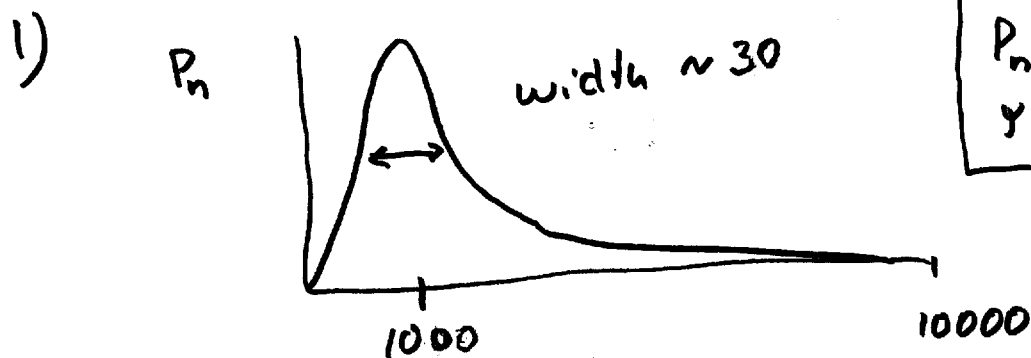


CRC



wikipedia:
Binomial distro *

$$P_n = \binom{N}{n} \cdot f^n \cdot (1-f)^{N-n}$$

$$\mu = Nf, \sigma = \sqrt{Nf(1-f)}$$

$$N = 10000$$

- 2) Disk has no errors if all bits are Ok

$$P_0 = (1-f)^{8 \cdot 10^9}$$

$$\approx 1 - 8 \cdot 10^9 f$$

1 or more errors

$$P_{1..} = 1 - P_0 = 8 \cdot 10^9 f = 0.001$$

$$\Rightarrow f = 1.25 \cdot 10^{-13}$$

- 3) without parity checking: error is always undetected error.

$$P_{\text{error}} = 1 - P_{\text{no error}} = 1 - (1-f)^{8000}$$

$$\approx 8000 f$$

with parity checking:

- a) what is probability of receiving 1 byte error? It is approximately probability of having two bit errors of the 9 bits

g bits

$$\begin{aligned}
 0 \text{ errors} &: (1-f)^g \\
 1 \text{ error} &: (1-f)^{g-1} \cdot f \cdot \binom{g}{1} \leftarrow \text{detected} \\
 2 \text{ errors} &: (1-f)^{g-2} \cdot f^2 \cdot \binom{g}{2} \leftarrow \text{not detected} \\
 &\vdots \\
 g \text{ errors} &: f^g \leftarrow \text{detected}
 \end{aligned}$$

P of undetected error of byte $\approx g(1-f)^{g-1}f \equiv F$

b) P of undetected error of 1000 bytes?

$$1 - (1-F)^{1000} \approx 1000 F$$

4)

01110010001111100100	
<u>100101</u>	<u>111001</u>
0111000	<u>100101</u>
<u>100101</u>	0111000
0111010	<u>100101</u>
<u>100101</u>	0111010
0111110	<u>100101</u>
<u>100101</u>	0111110
0110111	<u>100101</u>
<u>100101</u>	0110111
0100101	<u>100101</u>
<u>100101</u>	0100101
0000000	

5 bit CRC

5) If a bit error occurred, of all 2^{m+n} combinations 2^m are correct. Error passing is then

$$P = \frac{2^m}{2^{m+n}} = 2^{-n} \quad (n = \text{CRC} - 1!)$$

In this case $n = 5$, so $p = 3\%$.

However, it does not include the probability of a bit error itself. It just says that if a bit error occurred, 3% of random combination result in valid bit streams.

This is not the answer to the question.

A question I will leave open

Note: parity check is CRC-2

Note: A error rate of 3% would be terrible!