SOFT ???

$$p(E) \le Q\left(\sqrt{\frac{2E_b}{N_0} \cdot R \cdot d^*}\right)$$

$$= Q\left(\sqrt{\frac{2E_b}{N_0} \cdot \frac{16}{31} \cdot 7}\right)$$

d_{min}

$R = \boxed{16/31}$

2.2

HARD ???

$$t = \left\lfloor \frac{d_{min} - 1}{2} \right\rfloor = \boxed{3}$$

$$p(E) \le 155 \cdot Q\left(\sqrt{\frac{2E_b}{N_0} \cdot R \cdot 7}\right) + 456 \cdot Q\left(\sqrt{\frac{2E_b}{N_0} \cdot R \cdot 8}\right) + 5208 \cdot Q\left(\sqrt{\frac{2E_b}{N_0} \cdot R \cdot 11}\right)$$

$R = \boxed{16/31}$

If we add a final parity check bit (even number of "1")

(155 + 465) words $\Rightarrow$ 8 errors

620

5208 words $\Rightarrow$ 12 errors

1 words $\Rightarrow$ 0 errors

$N = 32$

$K = 16$ $\rightarrow$ $N = 32$ $\rightarrow$ $\boxed{R = 1/2}$