Information Rate

If the time rate at which source X emits symbols is r (symbols/second), the information rate R of the source is given by

$$R = rH(X) \text{ (b/second)}$$

Information Rate : Example

- A high-resolution TV picture consists of about 2×10^6 picture elements (symbols) and 16 different brightness levels.
- Pictures are repeated at a rate of 32 per second.
- All picture elements are assumed to be independent, and all levels have equal likelihood of occurrence.
- Calculate the average rate of information conveyed by this TV picture source.

Information Rate : Example

- $H(X) = -\sum_{i=1}^{16} \frac{1}{16}\log_2 \frac{1}{16}$
- i.e. $H(X) = [-\frac{1}{16}\log_2 \frac{1}{16}] + [-\frac{1}{16}\log_2 \frac{1}{16}] \ldots [-\frac{1}{16}\log_2 \frac{1}{16})]$
- Sixteen identical terms. Compute one and multiply by 16.

$$H(X) = 16 \times [-\frac{1}{16}\log_2 \frac{1}{16}] = -\log_2 \frac{1}{16} = -(-4) = 4$$

- $H(X) = 4$ b
- $r = 2(10^6)(32) = 64(10^6)$ elements/sec
- $R = rH(X) = 64(10^6)(4) = 256(l0^6)$ b/sec $= 256$ Mb/sec