Mini Quiz: Professor Marks

November 17, 2011

A random variable, X, is uniformly distributed on the interval $(8, 8 + \frac{1}{4})$. The units of X are liquid quarts.

1. How many bits is required to express X to 4 bits of accuracy on average?
2. How many bits is required to express X to 4 bits of accuracy on average if X is expressed in gallons?

Solutions

$\Delta = 2^{-n}$ and $n = 4$.

1. $h(X)$ is independent of shift, so $h(X) = \log_2 \frac{1}{4} = -2$. Thus, $b = n - 2 = 2$ bits are required.
2. $Y = X/4$ is uniform on $(2, 2 + \frac{1}{16})$, so $h(Y) = \log_2 \frac{1}{16} = -4$ and $b = n - 4 = 0$ bit is required. (It's always two gallons $= (10.00)_2$, to four bits of accuracy!)