

# 11.3 Source Extension

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11:24 AM

## 11.3 Source Extension (Extension Coding)

In general (not always), one can do better by encoding blocks of several source symbols rather than individual source symbols.

First-order extension ← the same thing that we did in 11.2

Ex.

$x$	$P_x(x)$	$c(x)$	$l(x)$
Y(1)	0.9	0	1
N(0)	0.1	1	1

$$E[l(x)] = 1$$

0 1 1 0 0 0 1 0 0 1 1 1  
Y N N Y Y Y N Y Y N N N ...  
 10 110 0 110 10 111

Second order extension

$$H = P_{x_1}(x_1) P_{x_2}(x_2)$$

$x_1, x_2$	$P_{x_1, x_2}(x_1, x_2)$	$c(x_1, x_2)$	$l(x_1, x_2)$
YY	0.81	0	1
YN	0.09	10	2
NY	0.09	110	3
NN	0.01	111	3

$$E[l(x_1, x_2)] = 1.29 \text{ bits per } 2 \text{ source symbols}$$

$$= 0.645 \text{ bits per source symbol.}$$

Third-order extension

$x_1, x_2, x_3$	$P_{x_1, x_2, x_3}(x_1, x_2, x_3)$
Y Y Y	0.729
Y Y N	0.081
Y N Y	0.081

⋮

$$\begin{aligned} \mathbb{E}[\ell(x_1, x_2, x_3)] &= 1.5980 \text{ bits per 3 source symbols} \\ &= 0.5327 \text{ bits per source symbol} \end{aligned}$$