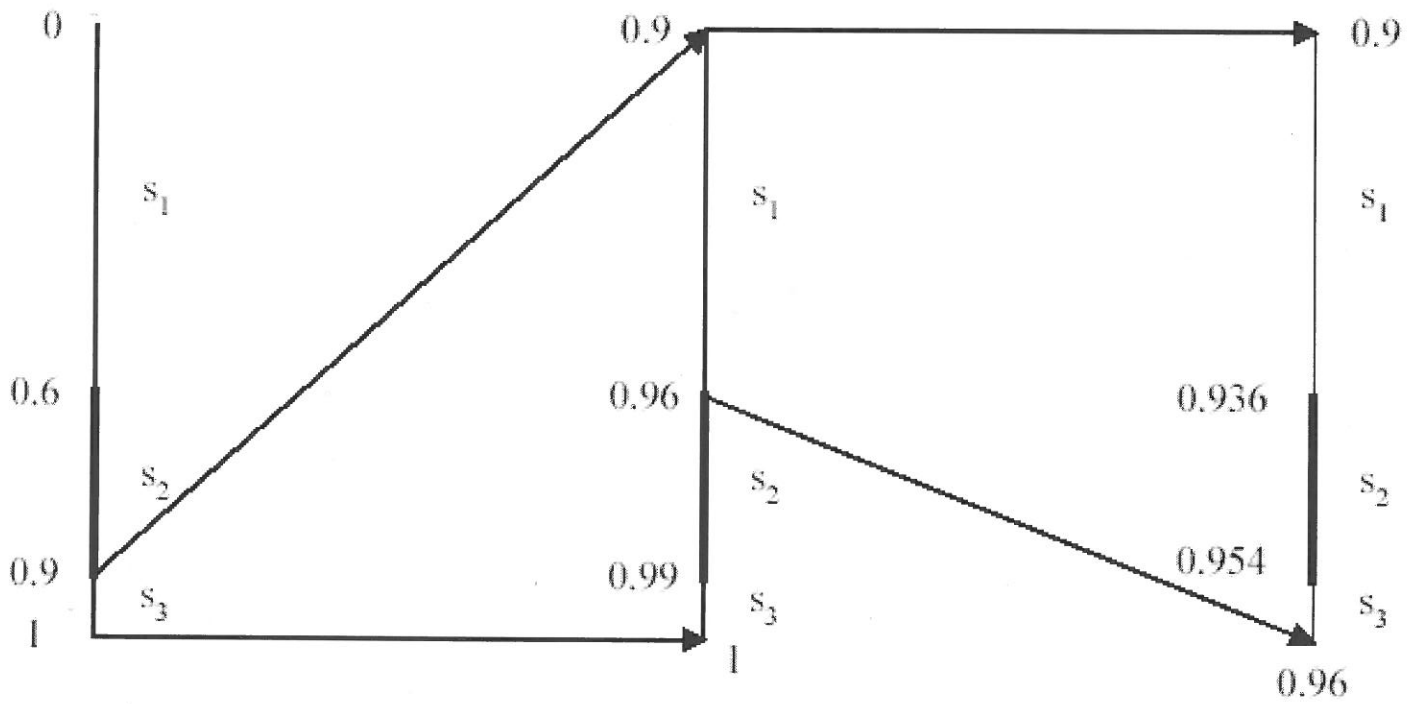


Fig. 7.8.0 Formation of tag in coding the sequence $s_3\, s_1\, s_2$.

ALGORITHM 7.5 Arithmetic Coding Encoder

```
BEGIN
    low = 0.0;    high = 1.0;    range = 1.0;

    while (symbol != terminator)
        {
          get (symbol);
          low =  low + range * Range_low(symbol);
          high = low + range * Range_high(symbol);
          range = high - low;
        }

    output a code so that low <= code < high;
END
```

Example : $S_3\ S_1\ S_2$

[Range_low, Range_hi)

S_1: [0, 0.6)

S_2: [0.6, 0.9)

S_3: [0.9, 1.0)

	low	high	range
	0.0	1.0	1.0
S_3	0.9	1.0	0.1
S_1	0.9+0.1×0 = 0.9	0.9+0.1×0.6 = 0.96	0.06
S_2	0.9+0.06×0.6 = 0.936	0.9+0.06×0.9 = 0.954	0.018

ALGORITHM 7.6 Arithmetic Coding Decoder

```
BEGIN
    get binary code and convert to
        decimal value = value(code);
    Do
        { find a symbol s so that
                Range_low(s) <= value < Range_high(s);
          output s;
          low = Rang_low(s);
          high = Range_high(s);
          range = high - low;
          value = [value - low] / range;
        }
    Until symbol s is a terminator
END
```

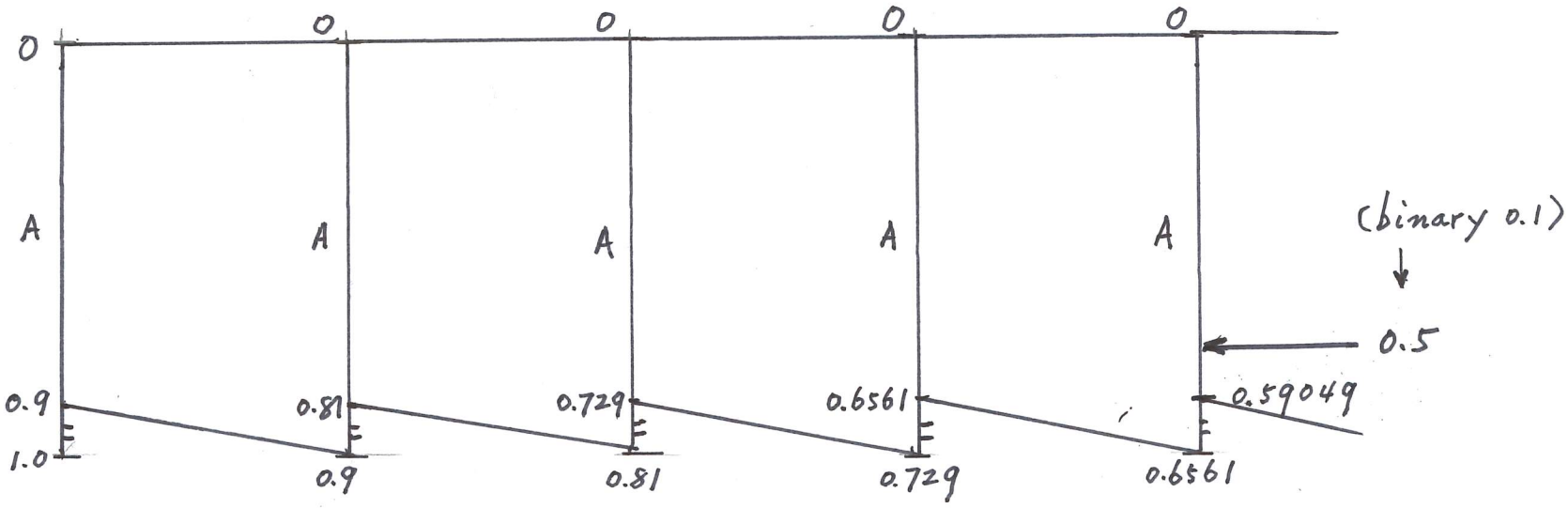
.1111

.9375

value	s symbol	low	high	range
0.9375	s_3	0.9	1.0	0.1
0.375	s_1	0	0.6	0.6
$\frac{0.375}{0.6} = 0.625$	s_2	0.6	0.9	0.3

— The shortest codeword in Arithmetic coding requires at most k bits to encode a sequence of symbols, and

$$k = \lceil \log_2 \frac{1}{\text{range}} \rceil = \lceil \log_2 \frac{1}{\pi_i p_i} \rceil$$



Example:

$P(A) = 0.9$, $P(B) = 0.04$, $P(C) = 0.02$, $P(D) = 0.04$

for a sequence of "AAAAA", $k = \lceil \log_2 \frac{1}{0.9^5} \rceil = 1$.