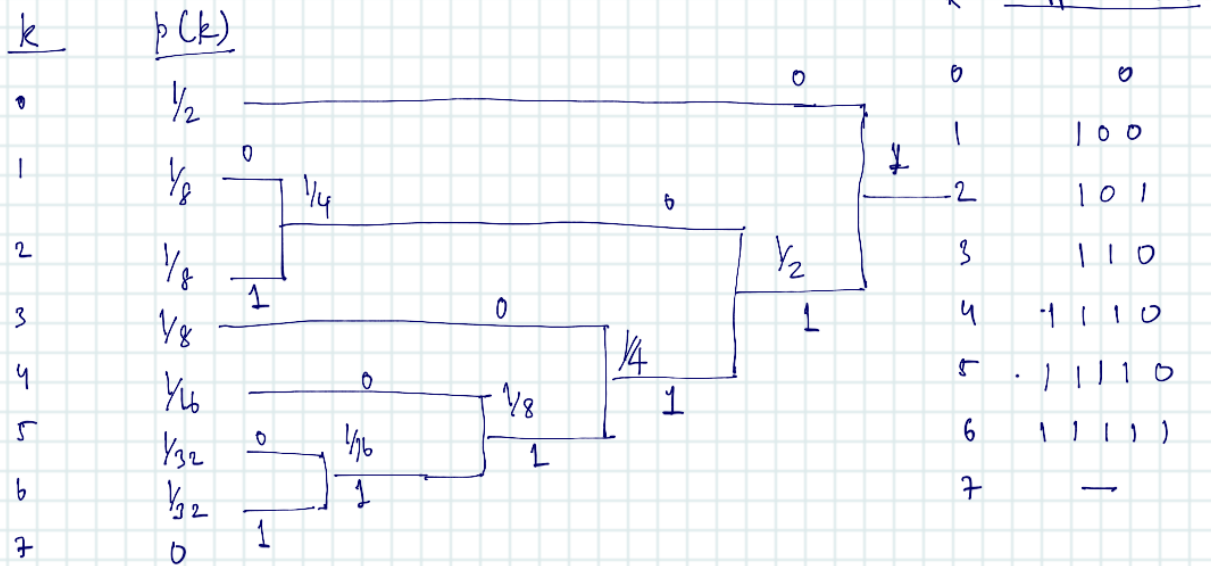○ Examples of Variable length coding

- Huffman Coding; $K = 8$ (0 to 7); $p(0) = 0.5$ $p(1) = p(2) = p(3) = 0.125$, $p(4) = 0.0625$, $p(5) = p(6) = 0.03125$; $p(7) = 0$

- Arithmetic coding! 5 symbols − a, e, i, o, u
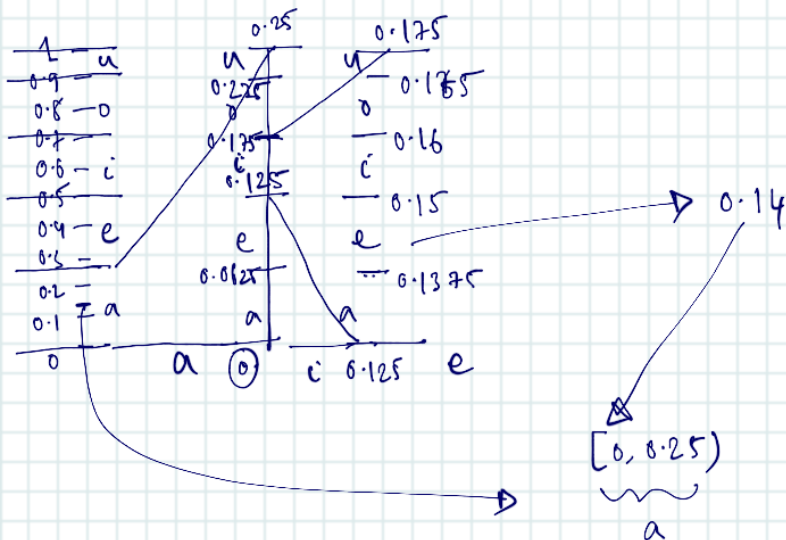$p(a) = p(e) = 0.25$; $p(i) = p(o) = 0.2$; $p(u) = 0.1$

k	$p(k)$
0	$\frac{1}{2}$
1	$\frac{1}{8}$
2	$\frac{1}{8}$
3	$\frac{1}{8}$
4	$\frac{1}{16}$
5	$\frac{1}{32}$
6	$\frac{1}{32}$
7	0

k	Huffman Code
0	0
1	1 0 0
2	1 0 1
3	1 1 0
4	1 1 1 0
5	1 1 1 1 0
6	1 1 1 1 1
7	—

Decode:

1 1 0   0 1 1 1 1   0 1   0 0
   3   0   5   1

○ Arithmetic coding: $p(a) = p(e) = 0.25$; $p(i) = p(o) = 0.2$; $p(u) = 0.1$

Encode: a i e

(interval)

① Check where our codeword falls in the original partition of $[0,1)$

② Simply read off the symbol assigned to that interval

③ $r = $ Code word − lower limit of current symbol

$$= \frac{\text{upper limit of} - \text{lower limit}}{\text{current symbol} \quad \text{of current symbol}}$$

$$= \frac{\text{Code word} - \text{Ll of current symbol}}{p(\text{current symbol})}$$

$[0, 0.25)$
    a

$0.14 \rightarrow a$; $r = \dfrac{0.14 - 0.}{p(a)} = \dfrac{0.14 - 0}{0.25} = 0.56$ ④

$0.56 \rightarrow i$; $r = \dfrac{0.56 - 0.5}{p(i)} = \dfrac{0.06}{0.2} = 0.3$ ⑤

$0.3 \rightarrow e$