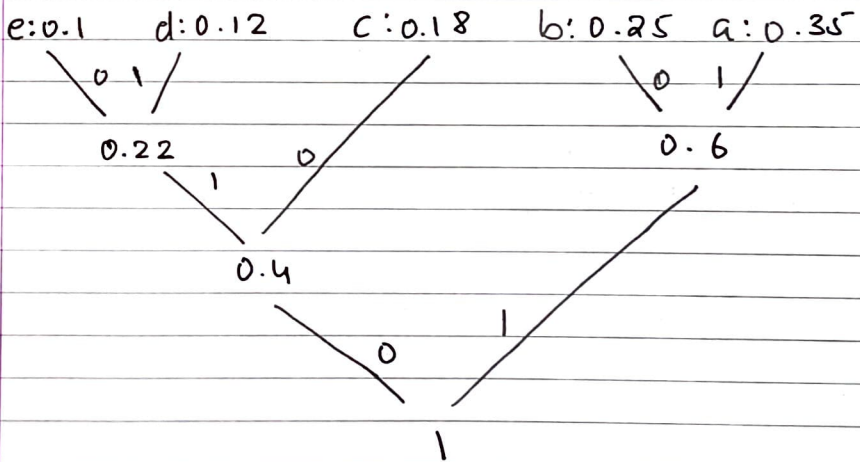


Introduction to Cryptography

Quiz 6

1. $S = \{a, b, c, d, e\}$
 $p[a] = 0.35$
 $p[b] = 0.25$
 $p[c] = 0.18$
 $p[d] = 0.12$
 $p[e] = 0.10$



2.

	a	b	c	d	e
code	11	10	00	011	010

$$3. \quad l(X) = 0.35 \times 2 + 0.25 \times 2 + 0.18 \times 2 \\ + 0.12 \times 3 + 0.1 \times 3 \\ = 2.22$$

$$4. \quad n_0 \approx \frac{\ln(|K|)}{R_L \ln(|P|)}$$

26 has 12 prime relatives.

\therefore no. of possible keys = 312

Plaintext possibilities = 26

$$n_0 = \frac{\ln 312}{R_L \ln 26}$$

$$R_L = 1 - \frac{H}{\log_2 |P|}$$

For the English language.

$$H = 1.25$$

$$|P| = 26$$

$$\therefore R_L = 0.75$$

$$\therefore n_0 = \frac{\ln 312}{0.75 (\ln 26)}$$

$$= 2.35$$

5. For $m = 5$

$$|K| = 26^5$$

$$|P| = 26^5$$

$$\eta_0 = \frac{\ln(26^5)}{0.75 \ln(26^5)} = \frac{1}{0.75} = \underline{1.33}$$

6. For $m = 6$

$$|K| = 26^{36}$$

$$|P| = 26^6$$

$$\eta_0 = \frac{\ln(26^{36})}{0.75 \ln(26^6)}$$

$$= \frac{36 \times 1}{6 \times 0.75} = 8$$

7. \therefore There are 312 possible keys in total in the Affine cipher and in this case, each key occurs with a probability of $\frac{1}{312}$, then the cryptosystem achieves perfect security.