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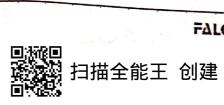
Subject: Information Theory

Assignment: Homework Six

Date: October 10th

Prof: Marco Tomamichel

Exercise 6.1
Proof: know, Pr (x) = \(\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\fir}\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\
And for the definition of total variation distance, we can show that
Studier, Qr) = = = 11Por- Qr11 = = = = = = = = = = = = = = = = = =
With the definition of data processing inequality in KL $D(P_{x} Q_{x}) \ge D(P_{x} Q_{x})$
And then
Finally, it is desired.
Exercise 6.2
Proof: As for the definition of empirical set, we know the empirical distribution: $f_{X^n}(X) := \frac{1}{n} \{ i \in \{1, \dots, n\} : X_i = X \} $
And use the repression of total variation distance, we can rewrite empirical inject see like that
And then , we know x1, x2 Xn are a sequence of 7.7.xl. source.
In this case $u = n \cdot P(x)$.
FALCON



Exercise 6.3.

a). Symmetric error probabilities:
$$(P, 9, S) = -\min_{0 \le \lambda i \le 1} \log_{10} \frac{\lambda_i}{2} \log_{10} \frac$$

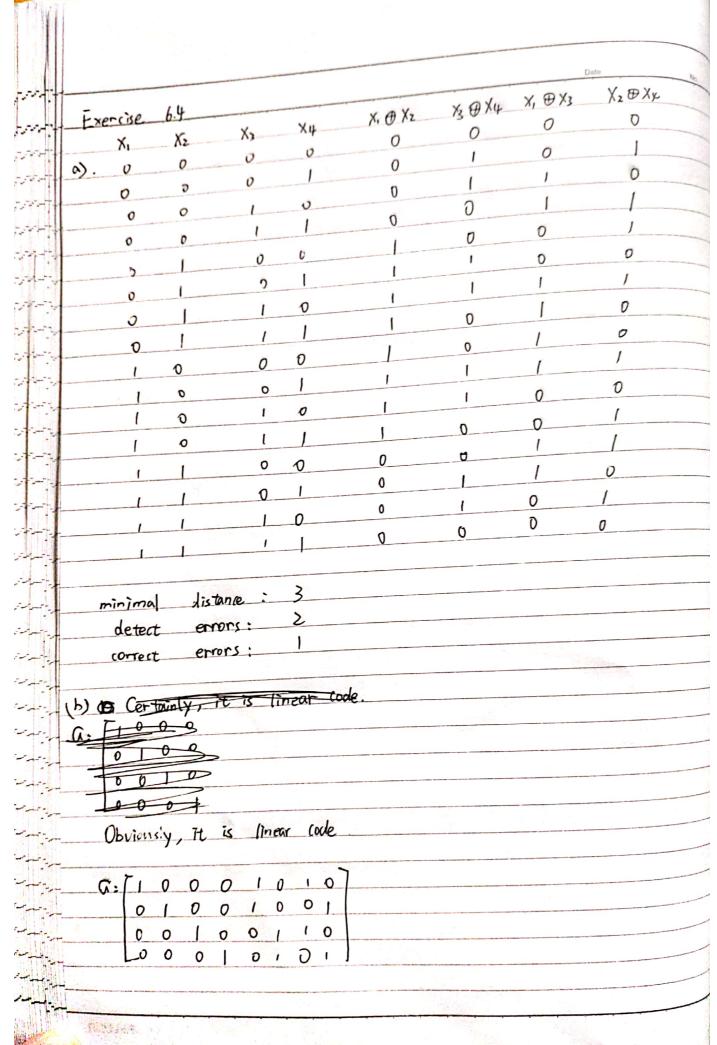
especially when
$$\lambda_1 = \lambda_2 = \frac{1}{3}$$
, we can get minimum value.
 $C(P, q, s) = -\frac{1}{3}$

$$\frac{3}{\xi^* q_{m,1} = 2^{-n} \cdot c(R_1 q, s)} = \frac{n}{2^{-\frac{1}{3}} = \frac{1}{8}}$$

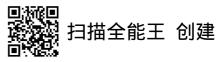
(h). In ternary hypothesis testing problem, especially when
$$0:=12=\frac{3}{3}$$
, all three have equal priors.

That is $9(\frac{1}{3},\frac{1}{3},\frac{1}{3})$

Therefore, the minimal error probability:



(c) Using the hamming bound,	
it is not perfert because it can make one more reduncy, which means the most perfert code should be 7 bits	
(1) Dual code	
	foot foot
	- San
	esa esa esa
	FΔLCO



F8