

Name: LUO ZIJIAN

Matric. No: A0224725H

MUSNET: E0572844

Subject: Information Theory

Assignment: Homework NINE

Date: October 31st

Prof: Marco Tomamichel

Exercise 9.1 For z- channel, we can get p(YIX) with this following matrix 1 0 X X X E { 0 , 1 } And we suppose Pr (X=1) = P, H(Y1x) = Pr(X=0) · 0 + Pr (X=1) · 1 = P H(T) = H[A-(X=1)] = H[7] So, we can I(xir) = H(r) - H(rix) = H(1/2) - P In conclusion: this hannel mutual information +(1)-P Exercise 9.2 For empirical distribution, we know $f_{x}(x) := n^{-1} \cdot \sum_{i=1}^{n} \delta x_{i}, x$ And then x are n i.id. copies of X, Px = Px on $P_{X}^{(x)} = \prod_{i=1}^{n} P(x_i)$ $= Z_{i}^{(x)} = \log P(x_i)$ - 2 P(x) 1x") log P(x) -n [n log P(Xi)] (we use the fru)

definition) -n H [fxxx] + D(fxxx) 11 P(x)] -1 (H(fx) + D(fx11Px)) It is desired, the probability that xn being any sequence depends only on its type and px

Exercise 9.5
Following the instructions from lecture notes and the paper of vincent Poor which (2nd, n) code, we let emoder -
instructions from lecture notes
for this 12th
which we let enoder
means P[M + M] < 8
for this (z^{nR}, n) code, we let encoder and decoder to use random mapping $P[M \pm \hat{M}] \leq \varepsilon$
and then use the Proposition of
M/ < max min Px & P(7) Qx & P(Y) Bx * (Pxx Px x Qx)
Px & P(x) Bx op(x)
BETCPXTIIPX XQT)
MILES LANIA = D IN IN
where $P_{XY}(X,y) = P_{X}(X) \cdot W_{Y X}(Y X)$ is the joint distribution of channel informal output and $\beta_{E}^{*}(P_{XY} P_{X} X X)$ is the minimal error of the second kind.
and pe ((x) 11 fx xQx) is the minimal error of the
sewid kind
we know the encoder passed
and the decoder generate an estimate $\hat{n}(y^n, w)$
Therefore, we construct these sets $A_n = \{y \in y : (x_1y) \notin A\}$ for all $n \in \mathbb{N}$
The less that I yey: (xiy) & A I for all 25
Given a fixed changel output
Given a fixed channel output y) its probability of (assigns M=m)
1 N = m 1 = V1 = = = 1 Y & Apimis
Zim' I {y & A e (m')} I {Y & A e (m')}
Then to analysis the error for this code
P(M = M M=m, E=e) = 1 - Z W(Y em)). P[M=m Y=y]
I EYE A a mis
= VZ/W(Yleim)) (- I{YE Aeim) + Ini+mI{YEAcim)}
769 - 11/6 Helm) + ZM+MI(Y 6Ae(M))
= Z Px(x)W(y1x) [fayt Ax]+(M1-1)]Px(x)If
= ×6x,76y (7/x) 17076 Hx) + (M/-1) 2/x(x 2)
And summarising this, we can get
And summarising this, we can get P(M \$ M] = & + M P = (Pxy 1 Px x Pr)
,
FALCO



			1	Date 1	No
And then	use the part of (Theorem 6-8 -	n lecture	notes/	
	In R] <e (<="" pe="" td="" ·=""><td>D = 11 D = 2 P = 2</td><td>)</td><td>The Control of the Co</td><td>-</td></e>	D = 11 D = 2 P = 2)	The Control of the Co	-
	Z = \(\begin{array}{cccccccccccccccccccccccccccccccccccc	1 x 1 x 1 X	1 in west	January 1	
-	take lagrithm, and	thorse Px as the	e maxinis	er in the	destrois
And	ormation I (X=T)	= T(w)			3,173.0
nutual in	ormation I (x=1)	1	(Par 11 Px	xPY) = I(x	T) = CIU
R	17m 1 log - B* Ux	711 Px " × Px")			
	7.64				
As	estral, we prove	that this rank	lomization	idoes not	hcrease
capacity	of the DMC		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	Marie Marie	
		a produce of	Carlot Fill	4/ 1/25 E	
	10000				
				1150 C	O. S. T.
A	THE TOTAL	- K - K ! = N-	J. J.	Jack Total	
	The second	र हिंदू स्वास्त्रकार	Y SUSTAIN		4 2 2
1				- (5-1	AR THE
	5 6 2 3 3 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	unitari - Leno			
	A STATE OF THE PARTY OF THE PAR		51		
				101	
	1000	The state of the s	1/42	7	
to the same beauty	The same water				
V ₂		- 4 3 1 1 1			
KE, I'	The same of the sa				
	***	The same of the same	A STATE OF		
The second secon	and the second of the second o			and the second s	
	The first remaind another through showing the figure 10 march 4 march 10 ma				
	7.4	To see			
and the second second second second				4.5 101	

