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)
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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)
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And then	use the part of (	Theorem 6-8 -	n lecture	notes/	
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