Exercise 7 Proof: As we know, Pr (Y) = EI T (YIX) PLX), Qr (Y) = ZI T (YIX) O(X) And for the definition of total variation distance, we can show that $Stralpx, Qx) = \frac{1}{2}||Px - Qx|| = \frac{1}{2}||Px| - Qx||$ Stud (Pr. Qr) = = 11Por- Qr11 = = FEN P(+) -Q(+) = = ZENTEN [POS-OW]-TCHN With the definition of data processing inequality in KL D(Px IQx) > D(Pr IIQx) And then Stul (Px,Qx) - Stul(Pr,Qr) = = = = = [P(x)-Q(x)][1- Zi.T(x)x)] (1>Zi,T(x)x) >0. Finally, it is desired. Exercise 6027.2 Proof: As for the definition of empirical set, we know the empirical distribution: fxn(X):= 1/{i = {1, --- n}: xi=x} And use the repression of total variation distance, we an rewrite empirical typical see like that Stud (fxn, PX) < E = = 11 fx - P(x) | = E And then, we know X1, x2... In are a sequence of i.i.d. source. 1 [ie],...n): xi=x} -> u for n-> 00 In this case $u = n \cdot p(x)$. FALCON



And we use the tange law of large number po, which shows that Profilm 1 2 x; = u = 1 (almost sure convergence) In a word, the empirical distribution of a sequence should be close to the prior probability distribution Prp [xne A in) Pox)] =1 Exercise 7.3 a). Symmetric error probabilities: $C(p,q,s) = -\min_{0 \in \lambda_1 \in I} \log \overline{Z}(p(x)) \frac{\lambda_1}{q(x)} \frac{1-\lambda_1-\lambda_2}{s(x)}$ especially when $\lambda_1 = \lambda_2 = \frac{1}{3}$, we an get minimum you he $C(p, 9, s) = -\frac{1}{3}$ $e^* q_{m,1} = \sum_{n=1}^{\infty} \frac{n}{2^{n}} = \frac{1}{2^{n}} = \frac{1}{2^{n}} = \frac{1}{2^{n}}$

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

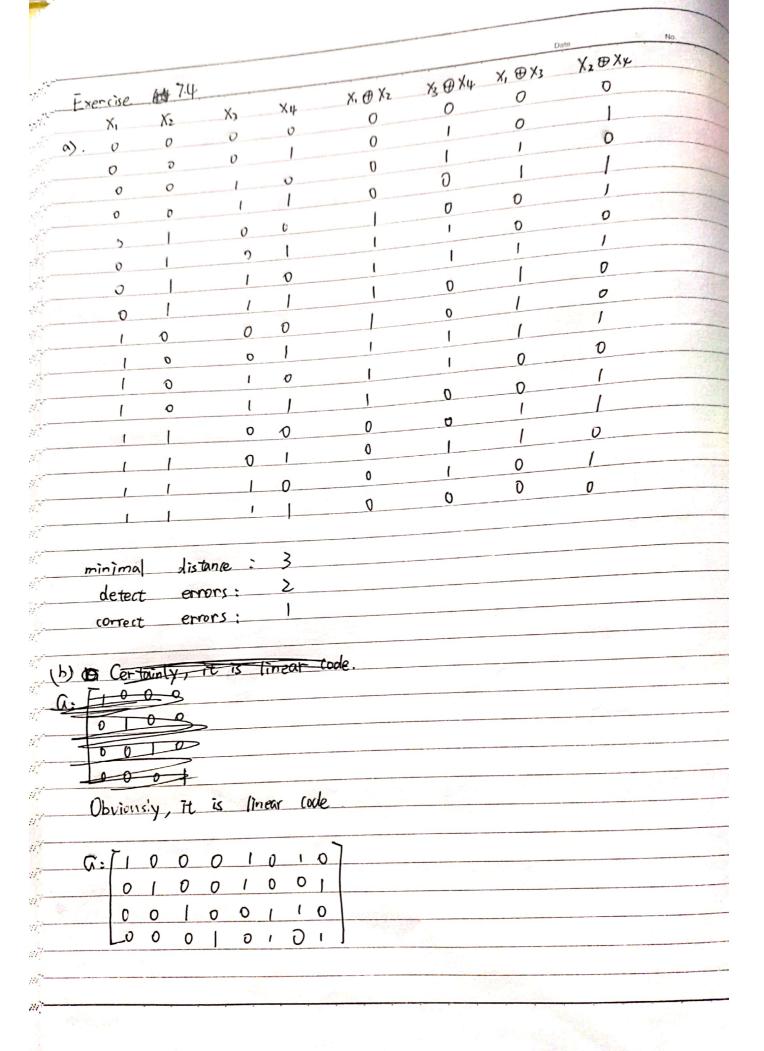
That $7 \le 9(\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$ Therefore, the minimal error probability: In a word, 9 is the optimal test.

$$D(P11s) = \sum_{i} s_{i} \log \frac{s_{i}}{p_{i}} = 1$$

191.

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(c) Using the hamming bound,	-
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