Principles of communication systems EET3202, CUNY City Tech, Fall 2023 Homework #09 (Due on Dec 7)

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Problem 1 A. What type of line coding does the figure represent?

B. Which digital carrier modulatic signal? Why?

C. Compare ASK, PSK, and FSK digital modulation methods in terms of bandwidth.



B. Which digital carrier modulation method is more suitable for this

A source in a communication system generates 6 different messages with the following probabilities: m1 (0.11), m2 (0.33), m3 (0.08), m4(0.17), m5 (0.25), m6 (0.06).

- corresponding Huffman codes.
- B. What is the average code length for the Huffman code?
- C. What is the Shannon entropy of the source?
- D. What is the redundancy of the Huffman code?

A. Rank these messages according to their probabilities and find their

The table lists the English alphabet (plus sp character) along with their probability of oc an average English text.

A. Calculate the Shannon entropy correspond set of 27 messages.

B. What is the minimum integer number of represent all these messages?

	Letter	Probability
	Space	0.187
	E	0.1073
	Т	0.0856
Jace	Α	0.0668
	0	0.0654
currence in	Ν	0.0581
	R	0.0559
	Ι	0.0519
	S	0.0499
	Н	0.04305
onding to this	D	0.03100
	L	0.02775
	F	0.02395
	С	0.02260
	Μ	0.02075
	U	0.02010
	G	0.01633
DILS LO	Y	0.01623
	Р	0.01623
	W	0.01620
	В	0.01179
	v	0.00752
	Κ	0.00344
	Х	0.00136
	J	0.00108
	Q	0.00099
	Z	0.00063

 $-\log P$ 2.46 3.22 3.84 3.90 3.94 4.114.16 4.27 4.33 4.54 5.02 5.17 5.38 5.45 5.60 5.64 5.94 5.95 5.95 6.32 6.42 7.06 8.20 9.54 9.85 9.98 10.63

flips a 1 to 0. Let the probability of the single bit flip be p.

- A. In a 3-bit repetition code we encode a 0 to 000 and a 1 to 111. What is the probability that all three 0's flip into 1's after going through the channel?
- B. Calculate the probability that all three 0's stay 0 after transmission?

code?

Our task is to calculate the probability of error in a repetition code. Assume that we have a channel that occasionally flips a 0 to 1 and

C. What are the above probabilities if we choose an N-bit repetition



Problem 5 Consider a 3-bit repetition code.

the sequence 000?

the sequence 000?

A. What are the code words that have a Hamming distance of 1 from

B. What are the code words that have a Hamming distance of 2 from

We know that a 3-bit repetition code can be used to correct single bit flip errors and a 5-bit repetition code can correct at most two simultaneous bit flips. What is the maximum number of simultaneous bit flips that can be corrected in an N-bit repetition code?

Problem 7 For all 8 possible 3-bit data words, find the corresponding codewords of the given generator matrix G.

$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$