Guidelines

When constructing codes for exotic channels like the ones below, it's often impossible to find a uniquely best solution. Of course, there's always some known code (e.g. Hamming code or a code that repeats the entire message several times) that will achieve at least some results. You will need to apply various heuristic, ad hoc methods to adapt the code to the given channel.

Note: In the examples below, the message length being sent is $n + k$ (n represents only the bits of some original message to which k protection bits are added).

Tasks

1st Channel

Distribution of X	Uniform over all distortions that change at most t bits of the message and the changed bits can be split into fewer than p **consecutive** substrings of the message
$dist$	Difference of binary values
Channel	simple
n (number of message bits)	table below
k (number of protection bits)	table below

This channel should be solved for the cases:

n	k	t	p
100	20	10	1
200	50	30	5

Each is worth 100 points.

2nd Channel

Distribution of X	Uniform over all distortions that change at most x bits of the message and apply at most y adjacent bit swaps (one after another)
$dist$	Hamming distance
Channel	complex
n (number of message bits)	table below
k (number of protection bits)	table below

This channel should be solved for the cases:

n	k	x	y
12	5	3	3
200	50	30	30

Each is worth 100 points.

3rd Channel

Distribution of X	Uniform over all distortions that change at most x bits
$dist$	Let $[p_1, p_2, ..., p_g]$ be the positions of bits where the original and received message differ ($p_1 < p_2 < ... < p_g$). Then $dist = \sum_{i=1}^{g-1} \frac{1}{p_{i+1} - p_i}$
Channel	simple
n (number of message bits)	table below
k (number of protection bits)	table below

This channel should be solved for the cases:

n	k	x
12	5	3
200	100	50

Each is worth 100 points.

4th Channel

Distribution of X	Uniform over all distortions that change bits at positions $[a, a+b, a+2\times b, a+3\times b..., a+r\times b]$ such that a and b are integers for which: $a < b < n+k$ $(a+(r\times b)+b) > n+k$
Channel	simple
n (number of message bits)	table below
k (number of protection bits)	table below

This channel should be solved for the cases:

n	k
12	5
512	20

Each is worth 100 points.