March-Problem 2014

At a wedding reception the friends of the groom decide to play a trick on him by putting pepper into his piece of the wedding cake. Before the meal begins the groom still gives a speech and praises his wife's beauty. The best man, being also the best friend of the groom, tries to warn the speaker by giving secret sign-symbols during the speech. He tries to transmit: "The cooks give u bad food".

However, even though the recipient of the message understands that he is being warned about something, he misses some symbols and has to guess about them himself. For every word except one, this happens with one letter, and for the remaining word it happens twice. What the groom understands makes him not only be the victim of the trick, but also to point out in his speech how little understanding his friend, the best man, has of real beauty.

What message did the groom think he had been sent?

1st) Problem: Define a code, which circumvents accidents like this for this particular message if each encoded word is potentially changed at two letters. See how Latin Squares can help with that:


2nd) Problem: Define a code, which circumvents accidents like this for this particular message if every unencoded word is changed at most at one letter (instead of two like in the riddle above), and the error rate should be allowed to remain as high as 6 errors per 20 symbols, but it can be assumed not to increase per word (e.g. only if the codeword is twice the length of the word with initially 1 error should allow 2 errors int the codeword).

Solution: The solution to the first problem is literally given in the document of the link: a ternary, two-bit detecting error detecting code of length 16 (note: 15 symbols in the message!) will do: When the groom doesn’t understand, he gives sign to have the word transmitted again.

A solution to the second works like this: each equivalence class of words which contain words that differ in only one bit is less than 26. Append to each word two letters which reflect (by addition of their places in the alphabet – A≡1, ..., Z≡26) the position of the correct word in the alphabetical sorted list of members of each class. If one of these last two digits is perturbed by the transmission, then they are not equal, which is therefore detected. Again, in this case the word should be retransmitted. (This is similar to the Hamming codes, which work with part of the words being so called checksums. See: http://en.wikipedia.org/wiki/Hamming_code)

(Note: By adding two digits to each word of at least three symbols, the new wordlength is not yet doubled, therefore keeping the restricions of the assumptions. The equivalence class of words with only one letter has to members: 'a', and 'u'. In this case, the empty word is transmitted (for 'a'), or only one letter (for 'u').