MITx 6.004.1x
Computation Structures 1: Digital Circuits

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LE1.8

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🗊 Calculator

LE1.8.1: Error Correction

4/4 points (ungraded)

Let's choose an encoding for our four symbols ("heart", "diamond", "club", and "spade") in a way that will allow us to correct single-bit errors and detect double-bit errors. In this problem we'll assume that either only 0, 1, or 2 bit errors have occurred.

We'll use four code words with a minimum Hamming distance of 4; call these the "legal" code words. Now use the following scheme to process the received code word R. Let HD(A,B) be the Hamming distance between A and B.

- If HD(R,C) is 0 or 1 for some legal code word C, then the received symbol is the one whose encoding is C. Note that our encoding, with it's minimum Hamming distance of of 4, guarantees that there is at most one such C!

- If HD(R,C) is 2 for any of the four possible legal code words C, then a double-bit error has been detected. Note that with a minimum Hamming distance of 4 between legal code words, the set of code words which are Hamming distance two from some legal code word can't be any closer than Hamming distance 2 from any legal code word.

Here's a 7-bit encoding with a minimium Hamming distance of 4

```
heart: 0000000   diamond: 1010101   club: 1101010   spade: 0111111
```

For each of the following received code words, indicate the received symbol or "double-bit error".

1010101

- ( ) heart
- (●) diamond
- ( ) club
- ( ) spade
- ( ) double-bit error

✔

1111111

- ( ) heart
- ( ) diamond
- ( ) club
- (●) spade
- ( ) double-bit error

✔

1000001

- ( ) heart
- ( ) diamond
- ( ) club
- ( ) spade
- (●) double-bit error

✔

[Calculator]

1101110

○ heart

○ diamond

◉ club

○ spade

○ double-bit error

✔

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💬 **Direct & Articulate Questions**
I really do not appreciate all the unnecessary narrative before the actual question. What is being asked is rather elementary, it does not requ… **10**

❓ **Two different hamming distance for two legal code words**
Is it possible that the hamming distance between the received code and a legal code word could be 1 and with another legal code word 2? If… **4**

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