

EE 605: Error Correcting Codes  
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Quiz 1 : **15 points**

**Duration:** 60 minutes

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Each of the following questions is worth 5 points. Every nontrivial step in a proof should be accompanied by justification.

1. Find the smallest binary linear block code which contains the following codewords  $\{100101, 110010, 010111, 001011\}$ . Find a systematic generator matrix for this code. What is the minimum distance of this code?
2. Let  $C_1$  and  $C_2$  be two linear block codes of same length  $n$ .
  - (a) Show that  $C_1 \cap C_2$  is a linear code.
  - (b) Show that  $C_1 \cup C_2$  is a linear code if and only if either  $C_1 \subseteq C_2$  or  $C_2 \subseteq C_1$ .
3. Show that in every binary linear block code either all the codewords have even Hamming weight or exactly half of the codewords have even Hamming weight. *Hint:*  $\sum_{i=1}^n v_i = 0$  for a codeword  $\mathbf{v}$  of even weight or equivalently  $\mathbf{v} \cdot \mathbf{1}^T = 0$  where  $\mathbf{1}$  is the  $1 \times n$  vector containing all ones.