Introduction to Matroids
Second guest lecture in COMP150-Graph Theory
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Slides available at: www.cs.tufts.edu/~ablumer/Matroids2.pdf

References (see the slides for further references):

- West, Introduction to Graph Theory, 2nd edition
  chapter 8.2, pp. 349-78

- Cormen, Leiserson, Rivest, and Stein, Introduction to Algorithms,
  3rd edition, chapter 16.4, pp. 437-50

- Papadimitriou and Steiglitz, Combinatorial Optimization, Dover (1998),
  chapter 12, pp. 271-306

- Neel and Neudauer, Matroids You Have Known, Mathematics Magazine,
  vol. 82, no. 1, February 2009. maa.org

- Wikipedia, Wolfram MathWorld, encyclopediaofmath.org

Optional homework problems:

1) What is the diameter of the Rado graph? Prove your answer correct.
   (Hint: the diameter is not very large)

2) A code C is defined by the following:

   To transmit three bits (a, b, c) add three parity check bits to form
   a six-bit codeword (a, b, c, a⊕b⊕c, b⊕c, a⊕b), where ⊕ is XOR.

a) List all the codewords of C = $\{w_1, w_2, \ldots w_n\}$
b) If the received word is (1,0,1,0,1,0) how should it be decoded? What if
   (1,0,1,1,1,1) was received? (Assume the probabilities of bit errors are small)
c) Draw the simple graph with vertices $\{w_1, w_2, \ldots w_n\}$ and edges connecting
   each w_i to its nearest neighbors in Hamming distance
d) Identify this graph by finding its degree sequence and answering the
   following questions: Is it regular? Is it bipartite?