**Assignment for Friday, October 10**:

*To Hand In*:

Remember: Reasoning and clarity of explanation are important!

1. Suppose that A and B are independent events.
   a. Prove that A and B$^c$ are also independent events. [Hint: A = (A∩B)∪(A∩B$^c$), and the events A∩B and A∩B$^c$ are mutually exclusive.]
   b. Prove that A$^c$ and B are independent.
   c. Prove that A$^c$ and B$^c$ are independent.
   d. Prove that P(A∪B) = 1 - (1-P(A))(1-P(B)).
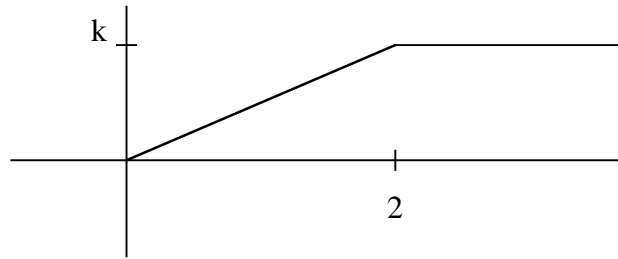
2. Define the random variable X to be the number of heads in four flips of a fair coin.
   a. What values does X take on?
   b. For each value of X, list the outcomes that give that value.
   c. Find the probability mass function (pmf) f(x) of X.
   d. Plot the probability mass function f(x) of X.
   e. Find the cumulative distribution function (cdf) F(x) of X.
   f. Graph the cumulative distribution function F(x) of X.

3. (Be careful with notation -- You may need to review the handout on writing and grading guidelines before writing up this problem.!)
X is a continuous random variable with probability density function (pdf)

$$f(x) = \begin{cases} \dfrac{C}{x^3} & \text{if } x > 1 \\ \\ 0 & \text{if } x \leq 1 \end{cases}$$

   a. Find C.
   b. Carefully graph f(x).
   c. Find P(1 < x < 2).
   d. Find the cumulative distribution function (cdf) F(x) of X. State your final answer carefully.
   e. Carefully graph the cdf F(x) of X.

4. The graph of the cumulative distribution function (cdf) F(X) of the continuous random variable X is shown here:



a. What is k? How do you know?
b. Find a formula for the cdf F(X). (You will need more than one part to the formula. Be sure you define the function for all real values x.)
c. Find the probability that X is between 0 and 1.
d. Find a formula for the probability distribution function (pdf) f(x) of X. (Heed the cautions in part (b).)
e. Graph the pdf f(x).
f. What kind of random variable is X? How do you know?