**Self-Diagnostic: Math**

These questions check your level of mathematical preparedness for this course. Most students will be able to answer all of these questions.

**Probabilistic inference:** Your box of cereal may be a contest winner! It's rattling, which 100% of winning boxes do. Of course 1% of all boxes rattle and only one box in a million is a winner. What is the probability that your box is a winner?

**Events:** You are playing a solitaire game in which you are dealt three cards without replacement from a simplified deck of 10 (marked 1 through 10). You win if all your cards are odd or if one of them is a 10. How many winning hands are there if different orders are different hands? What is your chance of winning?

**Expectations:** Someone rolls a fair six-sided die and you win points equal to the number shown. What is the expected number of points after one roll? After 2 rolls? After 100 rolls?

**Conditional Probabilities**: Which of the following statements are true for all joint distributions over X and Y :

(a) P(x, y) = P(x)P(y),

(b) P(x, y) = P(x|y)P(y),

(c) P(x, y) P = P(x|y)P(y|x),

(d) P(x) =∑y P(x|y),

(e) P(x) =∑y P(x| y)?

**Linear Equations:** You know that x = (1/2)y + (1/2)(x + 1) and y = (1/3)y + (1/3)(x + 2). What are x and y?

**Hashing:** What critical operation is generally faster in a hashtable than in a linked list, and how fast is it typically in each? When will a hashtable degrade to the speed of a list?

**Induction:** Prove by induction that the sum of the first n odd integers is n2.