2.24 Problem 2.24. For a single large two-state paramagnet, the multiplicity function is very sharply peaked about $N_\uparrow = N/2$. (a) Use Stirling's approximation to estimate the height of the peak in the multiplicity function. (b) Use the methods of this section to derive a formula for the multiplicity function in the vicinity of the peak, in terms of $x \equiv N_\uparrow|(N/2)$. Check that your formula agrees with your answer to part (a) when x = 0. (c) How wide is the peak in the multiplicity function? (d) Suppose you flip 1,000,000 coins. Would you be surprised to obtain 501,000 heads and 499,000 tails? Would you be surprised to obtain 510,000 heads and 490,000 tails? Explain.