Problem Guide for *Fifty Challenging Problems in Probability with Solutions* by Mosteller

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About

> *"A man must love a thing very much if he not only practices it without any hope of fame or money, but even practices it without any hope of doing it well."* - G.K. Chesterton (Maybe)

Almost certainly my most useless set of notes, as the title of this book says *with Solutions*.

1 The Sock Drawer

Let the number of socks in the drawer be n, and let the number of red socks be k. Then we are given that $\binom{k}{2}/\binom{n}{2}$ is $\frac{1}{2}$. Thus, we can constrain our possibilities as follows

$$\begin{aligned}\binom{k}{2} + \binom{k}{1}\binom{n-k}{1} + \binom{n-k}{2} &= \binom{n}{2} \\ \binom{k}{1}\binom{n-k}{1} + \binom{n-k}{2} &= \frac{1}{2}\binom{n}{2} \\ n(n-1) &= 2k(k-1)\end{aligned}$$

From the last equation, we have that $n = 4, k = 3$ is one solution. Additionally, we can note that $21 * 20 = 3 * 7 * 5 * 2^2 = 2 * 15 * 14$ to get a solution with an even number of black socks. Beyond that, I'll have to get back to you; I haven't started reading number theory books yet.