JHU Computer Organization Module 6 Hint

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March 2020

1 Introduction

In this assignment we're examining the odds of winning a basic lottery. Mathematically, we're sampling without replacement (when we draw a number, it does not go back into the pool) and the order doesn't matter (1 2 3 4 is the same as 3 1 4 2). To model this we use the following formula: $\binom{n}{k}$, which gives us the number of ways to choose k items out of a total of n items where $n >= k$. This can be re-written as: $\binom{n}{k} = \frac{n!}{k!(n-k)!}$.

So, for the case where we want to draw $k = 3$ balls from $n = 6$ total balls, we can plug-in for n and k: $\binom{n}{k} = \frac{6!}{3!(6-3)!} = \frac{6!}{3! \cdot 3!} = \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3! \cdot 3 \cdot 2 \cdot 1}$. As we can see, the 3's, 2's, and 1's will cancel out leaving us with: $\frac{6 \cdot 5 \cdot 4}{3 \cdot 2 \cdot 1} = 20$.

So, hopefully you can see the algebraic shortcut that will help your factorial values fit into 32-bit memory locations. That is, at a certain point, all terms will begin to cancel each other out and your value for $\binom{n}{k}$ will simply be the product of the leading terms in the denominator divided by $k!$.

If we wanted to think of this in terms of some high-level code, the numerator would simplify to a loop: $val = 1$; while $n > (n - k)$, val = val * n; $n = n - 1$. The denominator will just be $k!$.

I hope this helped!