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Exercise 4.38

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Use Stirling's Approximation:

$$(3N)!\ /\ (N!)^3 = \sqrt{6\pi N}(\tfrac{3N}{e})^{3N} / [\sqrt{2\pi N}(\tfrac{N}{e})^N]^3$$

What about the (1+O(1/N)) terms?

This expression here is sufficient if error term is included

$$= \frac{\sqrt{6\pi N}(\frac{3N}{3})^{3N}}{2\pi N\sqrt{2\pi N}(\frac{N}{e})^{3N}} = \frac{\sqrt{3}}{2\pi N}(3)^{3N}$$

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$$= \frac{\sqrt{3}}{2\pi N}(1 + N log(27) + \tfrac{1}{2}N^2 log^2(27) + \tfrac{1}{6}N^3 log^3(27) + O(N^4))$$

I don't follow this equality. How are you applying the Taylor series expansion? If it's using e^3N you dropped the multiplicative (3/e)^3N term

$$= N^{-1}\frac{\sqrt{3}}{2\pi} + \frac{\sqrt{3}}{2\pi}log(27) + N\frac{\sqrt{3}}{4\pi}log^2(27) + N^2\frac{\sqrt{3}}{12\pi}log^3(27) + O(N^3)$$

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