

## Problem Set: 2.23 2.24

---

Daniel Halmrast

February 25, 2017

### PROBLEM 2.23

### PROBLEM 2.24

#### PART A

Problem: Use Stirling's Approximation to estimate the height of the multiplicity function.

Solution: This will occur at  $N_d = N_u = \frac{N}{2}$ . The multiplicity is

$$\Omega(N, N_d) = \frac{N!}{(\frac{N}{2}!)^2}$$

Which simplifies to

$$\begin{aligned}\Omega(N, N_d) &\approx \frac{N^N e^{-N} \sqrt{2\pi N}}{((\frac{N}{2})^{\frac{N}{2}} e^{-\frac{N}{2}} \sqrt{\pi N})^2} \\ &\approx \frac{N^N e^{-N} \sqrt{2\pi N}}{(\frac{N}{2})^N e^{-N} \pi N} \\ &\approx \frac{2^{N+\frac{1}{2}}}{\sqrt{\pi N}}\end{aligned}\tag{0.1}$$

Which, for large  $N$ , goes to  $\frac{2^N}{\sqrt{N}}$ .

#### PART B