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ASTR5465

Use the results in the previous slide to show that $\log N$ vs mag. should have a slope of 0.6.

$$\frac{dN}{dm} = \rho\frac{4}{5}\pi \ln[10]\, 10^{0.6(m-M+5)}$$

$$dN = \rho\frac{4}{5}\pi \ln[10]\, 10^{0.6(m-M+5)} dm$$

$$\int dN = \int \rho\frac{4}{5}\pi \ln[10]\, 10^{0.6(m-M+5)} dm$$

$$N = \rho\frac{4}{5}\pi \ln[10]\, \frac{5}{3\ln[10]} 10^{0.6(m-M+5)}$$

$$N = \frac{4}{3}\rho\pi 10^{0.6(m-M+5)}$$

$$\log[N] = \log\left[\frac{4}{3}\rho\pi 10^{0.6(m-M+5)}\right]$$

$$\log[N] = \log\left[10^{0.6(m-M+5)}\right] + \log\left[\frac{4}{3}\rho\pi\right]$$

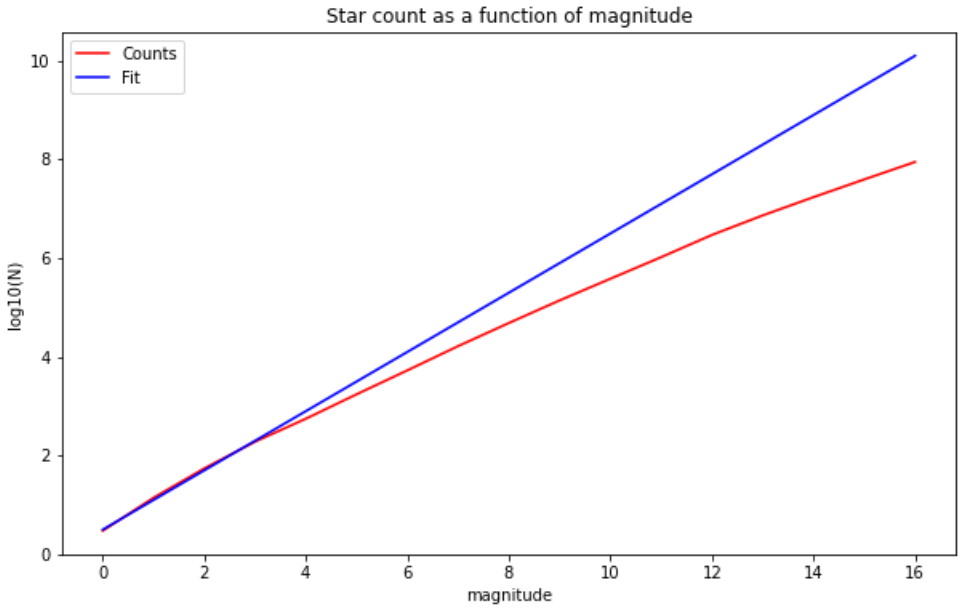
$$\log[N] = 0.6\,(m - M + 5) + \log\left[\frac{4}{3}\rho\pi\right]$$

$$\frac{d\log[N]}{dm} = 0.6$$

$$\boxed{\frac{d\log[N]}{dm} = 0.6}$$

As shown above, the slope of the log of N plotted against m should be a constant value of 0.6. Thus, when the log of N is plotted against magnitude, we would expect a linear fit with a constant positive slope of 0.6. In other words, N and m exhibit a power law relation with an exponent value of approximately 0.6.

Use Python to construct a plot of log N vs. magnitude from the Tycho catalog. Overplot a fiducial line with slope of 0.6 and discuss what do you find.



Shown above is a plot of log N versus magnitude from the Tycho catalog as well as a fitted line with the expected slope of 0.6. As we can see, the Number of binned stars for magnitudes larger then 4 drops off below what is expected. I believe this may be a result of extinction due to interstellar dust. Higher magnitude stars will be harder to discern due to the extinction caused by interstellar dust. This would decrease the count value for dimmer stars resulting in the deficit shown above.