Chapter 4 Homework

1. Use one or more appropriate convergence tests to show if the series converges absolutely or conditionally or diverges:
   a) $\sum_{n=3}^{\infty} \frac{n^2+2n+3}{n^3+2n^2+3n+4}$
   b) $\sum_{n=0}^{\infty} \frac{(-1)^n}{\sqrt[3]{n+3}}$
   c) $\sum_{n=0}^{\infty} \frac{5^n+3n}{8^n-1}$
   d) $\sum_{n=0}^{\infty} \frac{\sin(n)}{4^n}$
   e) $\sum_{n=0}^{\infty} \frac{2^n}{(n+1)^2}$
   f) $\sum_{n=1}^{\infty} \frac{n^2 2^n}{n!}$
   g) $\sum_{n=1}^{\infty} (-1)^n \frac{n!}{n^n}$
   h) $\sum_{n=1}^{\infty} \frac{2^{n^n}}{(n!)^n}$
   i) $\sum_{n=1}^{\infty} \frac{3-\cos(n)}{n^{\frac{2}{3}}}$

2. For which values of p is $\sum_{n=2}^{\infty} (-1)^n \frac{(\ln(n))^{\mathrm{p}}}{n}$ convergent?

3. Give an example of series $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$, each of which converges, but such that $\sum_{n=1}^{\infty} a_n\, b_n$ diverges. *(Hint: try conditionally convergent series, not absolute convergent ones)*

4. Give an example of a divergent series whose partial sums are bounded.