Series of real numbers- series with random terms

Exercise 1: Study both the absolute convergence and the convergence of the following series of real numbers:

a)
$$\sum_{n\geq 1}(-1)^n\frac{(n+1)^{n+1}}{n^{n+2}}.$$

b)
$$\sum_{n\geq 1}(-1)^n\frac{2n+1}{3^n},$$

c)
$$\sum_{n\geq 1}(-1)^n\frac{1}{\ln n}$$

d)
$$\sum_{n\geq 1}(-1)^n\frac{1}{\sqrt{n(n+1)}}$$

e)
$$\sum_{n\geq 1}(-1)^n\frac{(2n-1)!!}{(2n)!!}$$

where !! means double factorial, i.e. either all the even number multiplied, or the odd ones (for example $8!! = 2\cdot 4\cdot 6\cdot 8$)

f)
$$\sum_{n\geq 1}(-1)^{\frac{n(n+1)}{2}}\frac{n^1 00}{2^n};$$

g)
$$\sum_{n\geq 1}(-1)^{\frac{n(n+1)}{2}}\sin\frac{\pi}{n\sqrt{n+1}}.$$

Exercise 2: Consider $a, b > 0$. Study the convergence or divergence of the following series of real numbers:

a)
$$\sum_{n\geq 1}\frac{a(2a+1)(3a+1)\cdot\ldots\cdot(na+1)}{b(2b+1)(3b+1)\cdot\ldots\cdot(nb+1)};$$

b)

$$\sum_{n\geq 1} \frac{a(a+1)...(a+n)}{n!} \cdot \frac{1}{n^b};$$

c)

$$\sum_{n\geq 1} \frac{2^n}{a^n + b^n}$$

d)

$$\sum_{n\geq 1} \frac{a^n b^n}{a^n + b^n}.$$