$$S_n = \frac{1}{1!} - \frac{1}{2!} + \cdots \frac{(-1)^{n+1}}{n!}$$

$$\boxed{S_n = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n!}}$$

① let $a_n = \frac{1}{n!}$

$$\lim_{n\to\infty} a_n = \lim_{n\to\infty} \frac{1}{n!} = \boxed{0}$$

② $(n+1)! > n! \quad \forall n \in N$

$$\Rightarrow \frac{1}{(n+1)!} < \frac{1}{n!}$$

$$\Rightarrow \boxed{a_{n+1} < a_n} \quad \forall n \in N$$

$\Rightarrow$ a_n is monotonically decreasing

Thus by leibnitz test for alternating series above series is convergent.

$\Rightarrow$ S_n is convergent

$\Rightarrow$ S_n is cauchy (convergent sequence is cauchy sequence)