信号与系统实验（二）

实验报告要求：

1. **报告内容：实验题目、实验摘要、实验内容(实验思路、实现过程、代码、实验结果截图)、实验结果分析、实验小结。报告以pdf格式提交。**
2. **6月3日20:00前，压缩包（一份实验报告，一份代码）发送至wyou@xidian.edu.cn；邮件主题："信号与系统实验二报告"+姓名；附件命名格式：学号+姓名+TP2。**
3. **实验报告模版中高亮内容根据情况删掉或修改；字体行间距等格式请按此模板，字数不限，表格可扩展。**

题目：

1. 写出由程序

```
t=-2*pi:0.001:2*pi;
y=sawtooth(0.5*t,1);
plot(t,y)
```

形成的信号经周期延拓得到的周期信号的时域表达式；编程计算其指数形式的傅里叶系数(计算至11次谐波)；用MATLAB画出前11次谐波叠加的波形，并指明吉布斯现象出现于何处。

2. Write a function called **square_wave** that computes the sum

$$\sum_{k=1}^{n}\frac{\sin\left[(2k-1)t\right]}{2k-1}$$

for each of 1001 values of t uniformly spaced from 0 to 4π inclusive. The input argument is a scalar non-negative integer n, and the output argument is a row vector of 1001 such sums—one sum for each value of t. You can test your function by calling it with n = 20 or greater and plotting the result and you will see why the function is called "square_wave".

完成英文部分的实验，读出 n = 200 时 square_wave 函数生成的波形的参数(如幅度、周期等)，利用该参数和 MATLAB 函数 square()画出一致的标准波形。

3. 用MATLAB进行以下实验，回答问题并粘贴实验过程中产生的结果图。

1. What function $f(t)$ has the Fourier series

$$\sum_{n=1}^{\infty} \frac{\sin nt}{n}$$

You can evaluate the sum analytically or numerically. Either way, guess a closed form for $f(t)$ and then sketch it.

2. Confirm your conjecture for $f(t)$ by finding the Fourier series coefficients f_n for $f(t)$. Compare your result to the expression in the previous part. What happens to the cosine terms?

3. Define the partial sum

$$f_N(t) = \sum_{n=1}^{N} \frac{\sin nt}{n}$$

Plot some $f_N(t)$'s. By what fraction does $f_N(t)$ overshoot $f(t)$ at worst? Does that fraction tend to zero or to a finite value as $N \to \infty$? If it is a finite value, estimate it. (hint: Gibbs phenomenon)

4. Now define the average of the partial sums:

$$F_N(t) = \frac{f_1(t) + f_2(t) + f_3(t) + \cdots + f_N(t)}{N}$$

Plot some $F_N(t)$'s. Compare your plots with those of $f_N(t)$ that you made in the previous part, and **qualitatively** explain any differences.