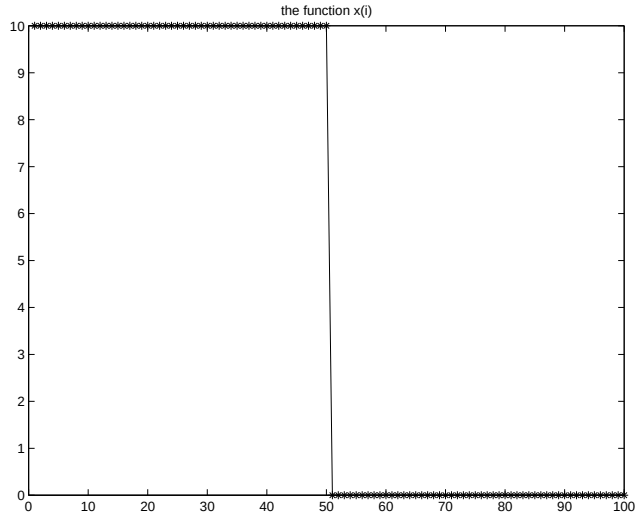
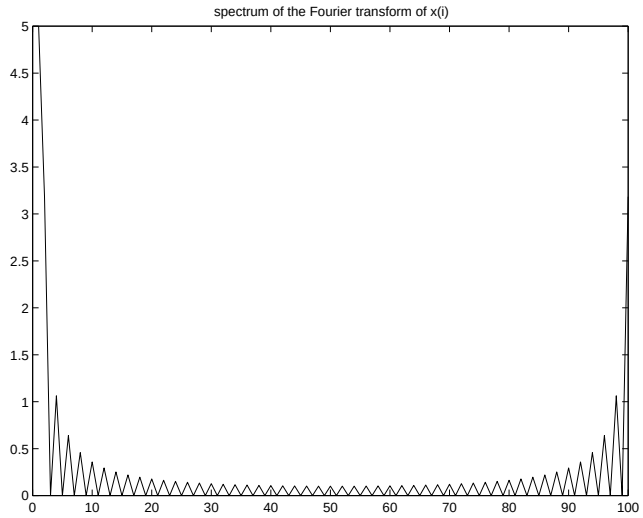
The effect of multiplying the function $f(x)$ by $(-1)^x$ in the visualization of the spectrum:

Consider $f(x) = 10$ for $x = 0, ..., 49$, and $f(x) = 0$ for $x = 50, ..., 99$, therefore $M = 100$. Note that in Matlab, we need to define $f(x)$ for $x = 1, ..., 100$.

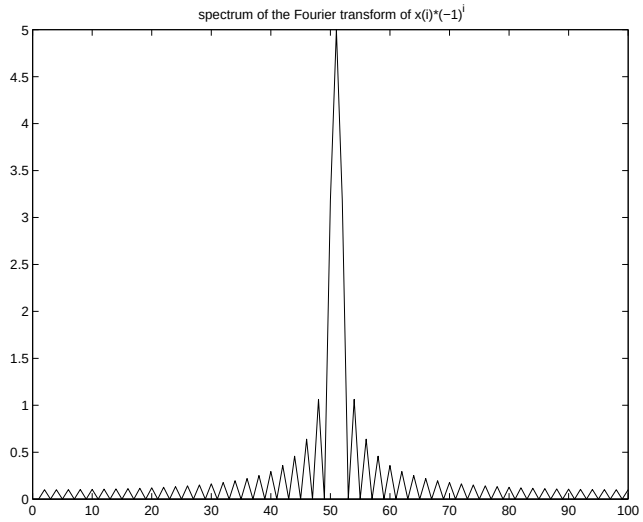
The graph of $f(x)$



The spectrum $|F(u)|$, where $F(u)$ is the discrete Fourier transform of f, calculated using the formula (4.2-5) from Gonzalez/Woods



The spectrum $|G(u)|$, where $G(u)$ is the discrete Fourier transform of $f(x)(-1)^x$, calculated using the same formula



Note how the center ($u = 0$) in the original transform is shifted to $u = M/2 = 50$.

The Matlab code to perform this implementation is attached. The same property holds in two dimensions.