

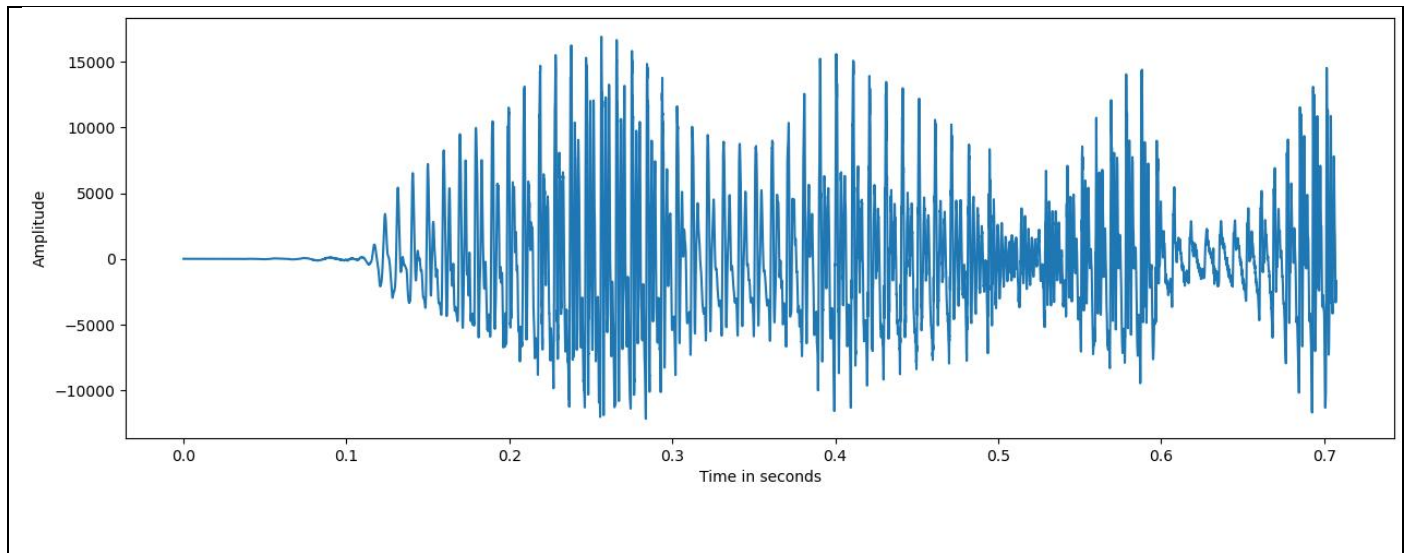
Task 7.1P Answer sheet

Fill in the required results (images).

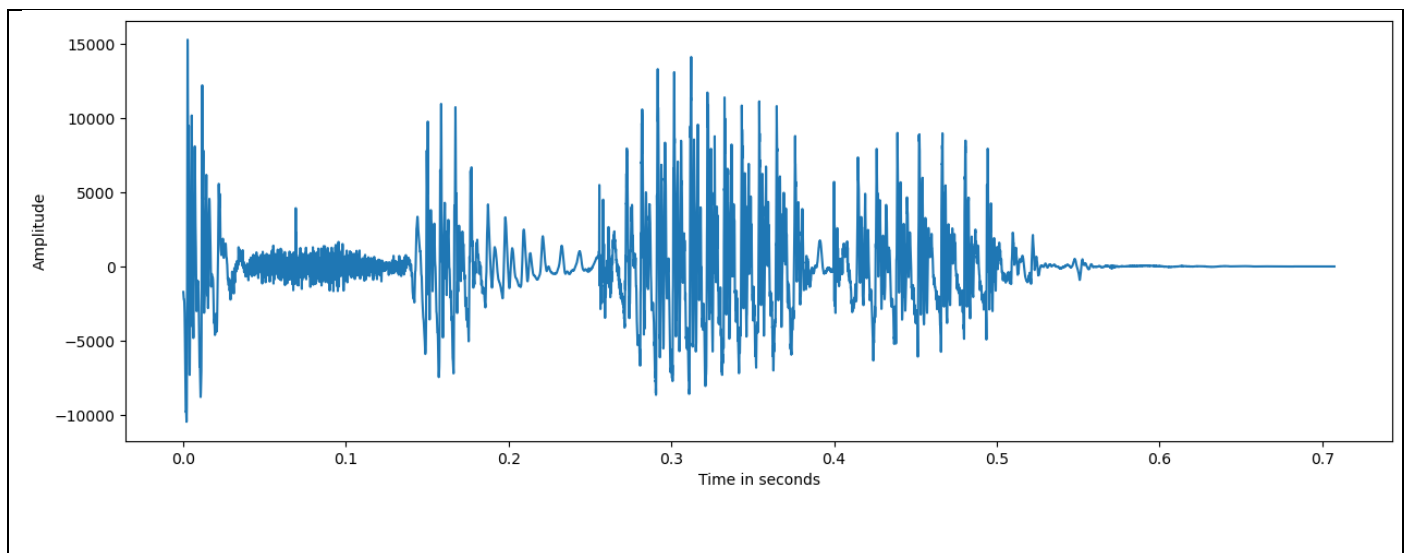
Notes:

- Examples (if any) need to be replaced by your results.
- Missing any required results will result in a re-submission.

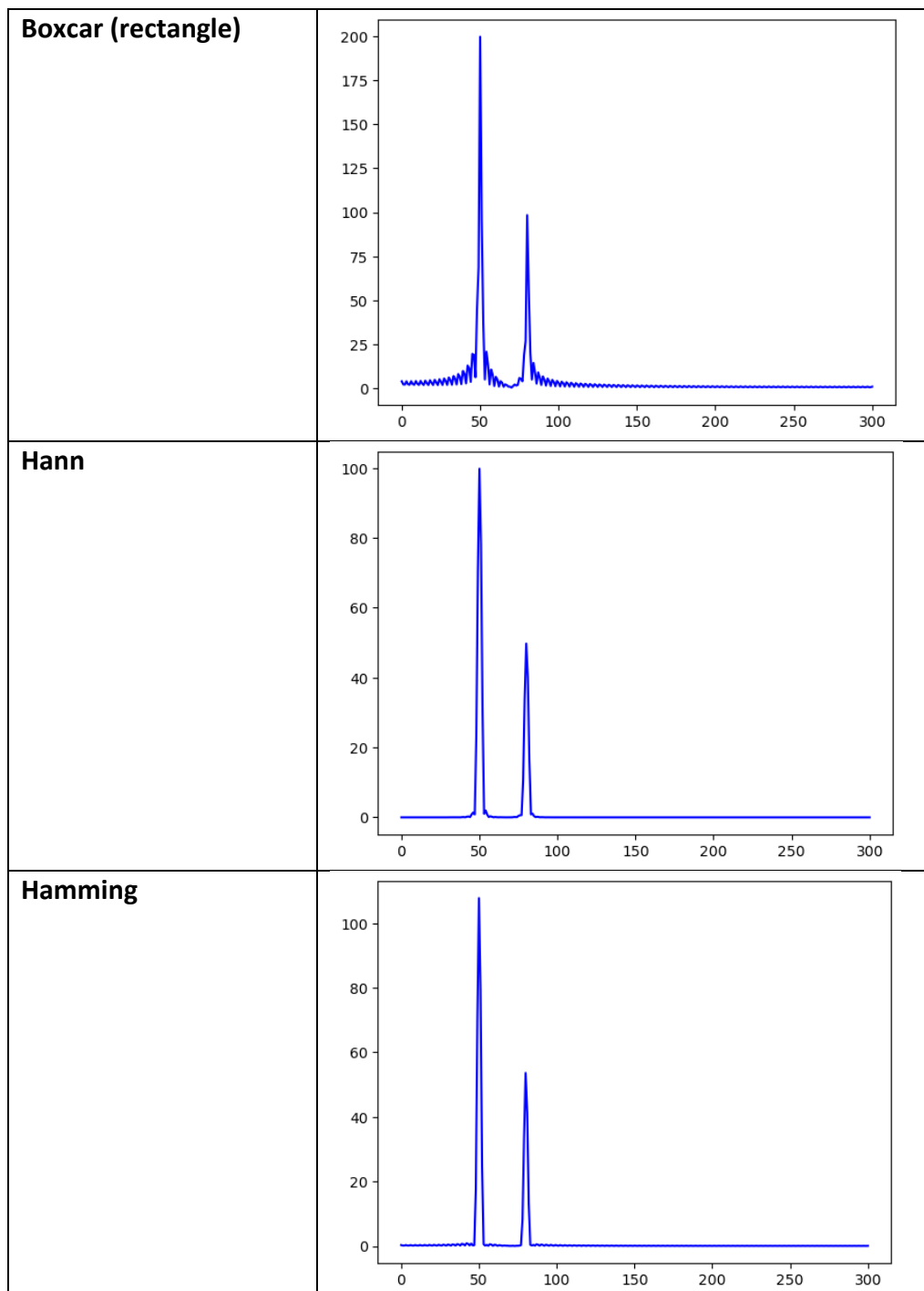
1. Visualisation of x1 in time domain



2. Visualisation of x2 in time domain



3. Fourier transform S 1 using different windowing techniques



Observations

Using `librosa.stft` to apply various windowing strategies in the Short-Time Fourier Transform (STFT) has an important impact on the spectrum that is produced, particularly at the edges of each frame. Because every sample is given the same weight in the boxcar (rectangular) window, the frame boundaries have sharp edges and discontinuities. This results in noticeable distortions and significant spectral leakage, which makes it more difficult to identify the actual frequency components. By gradually tapering the frame borders to zero, the hann window, in contrast, reduces border effects and discontinuities. A cleaner spectrum with less leakage is the outcome, enabling more precise frequency analysis. The hamming window is similar to the hann window but retains slightly more energy at the edges, offering a compromise between the boxcar and hann windows. It reduces leakage and border effects, but not as effectively as

the hann window. In summary, the boxcar window causes strong border effects and spectral leakage, the hann window minimizes these effects, and the hamming window provides intermediate performance. For most STFT analyses, windows like hann and hamming are preferred because they produce more reliable and interpretable results, especially for signals with non-periodic boundaries.