Source task and conventions

Find the five-point DFT of $g[n] = h[(n-2)_5]$ from the given spectrum.

Conventional solution and proof

Put $m = (n-2)_5$. Periodicity of the exponential gives

$$G[k] = \sum_n h[(n-2)_5] e^{-2\pi i k n/5} = e^{-4\pi i k/5} H[k].$$