

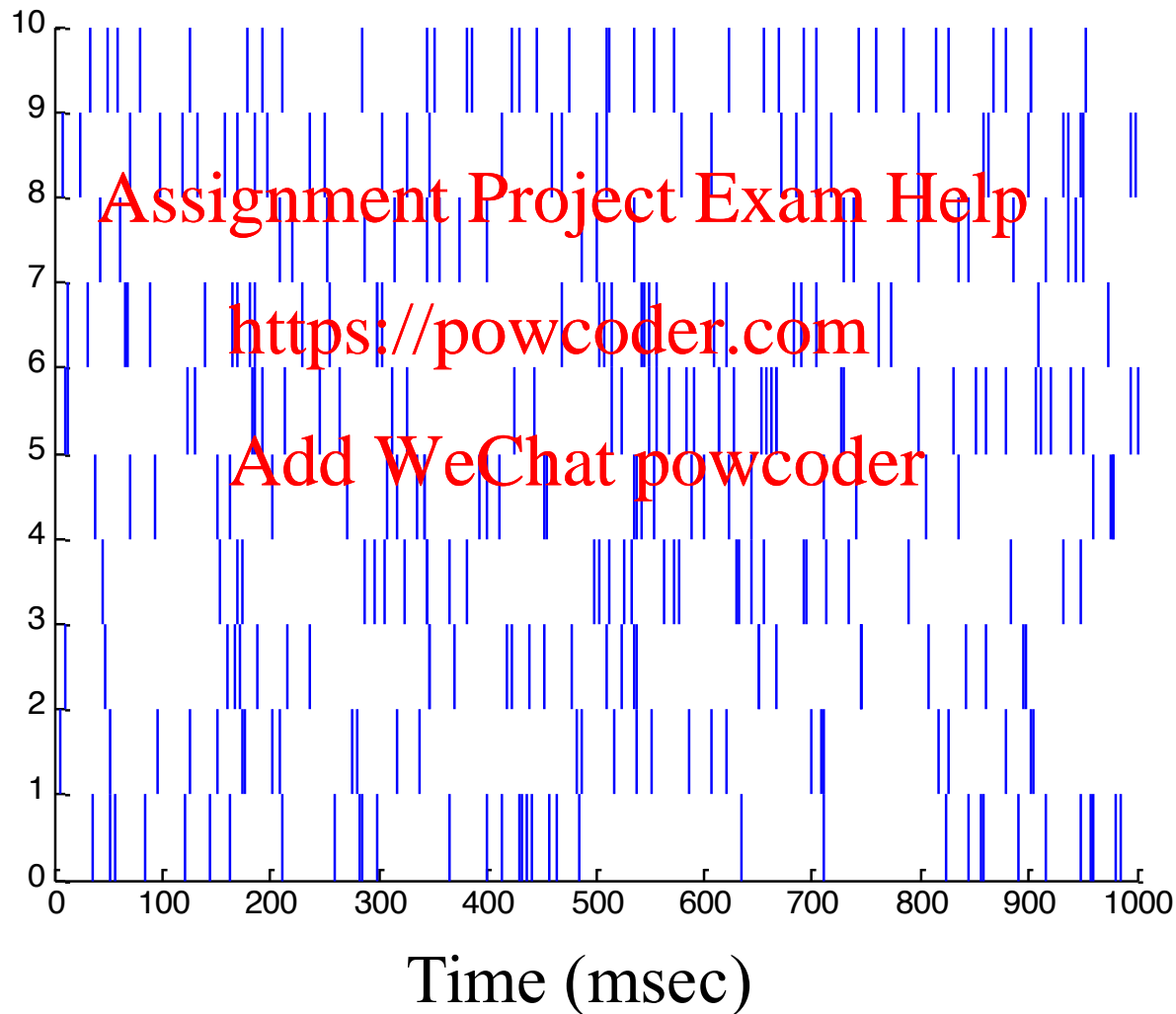
Point Process Spectral Analysis

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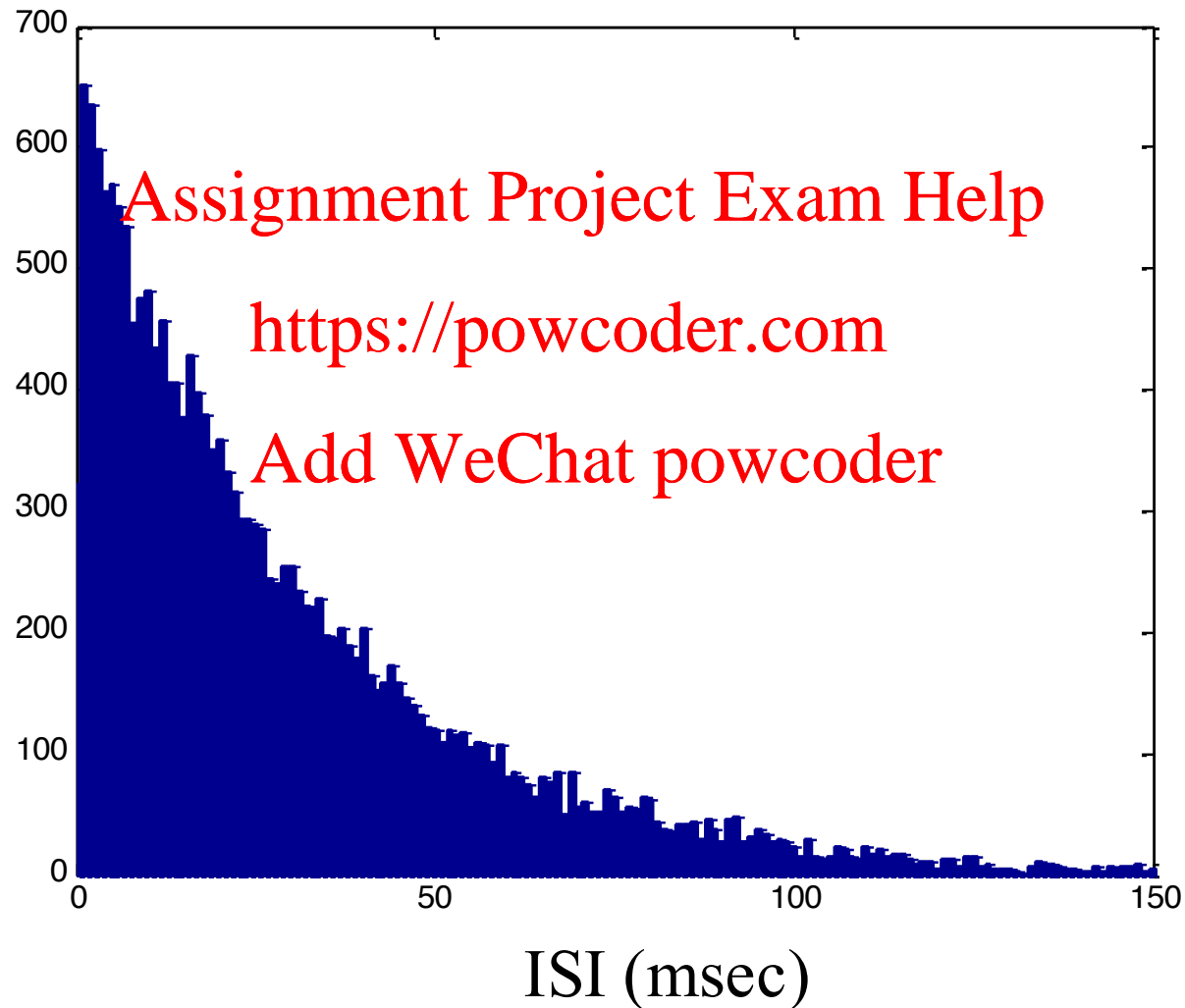
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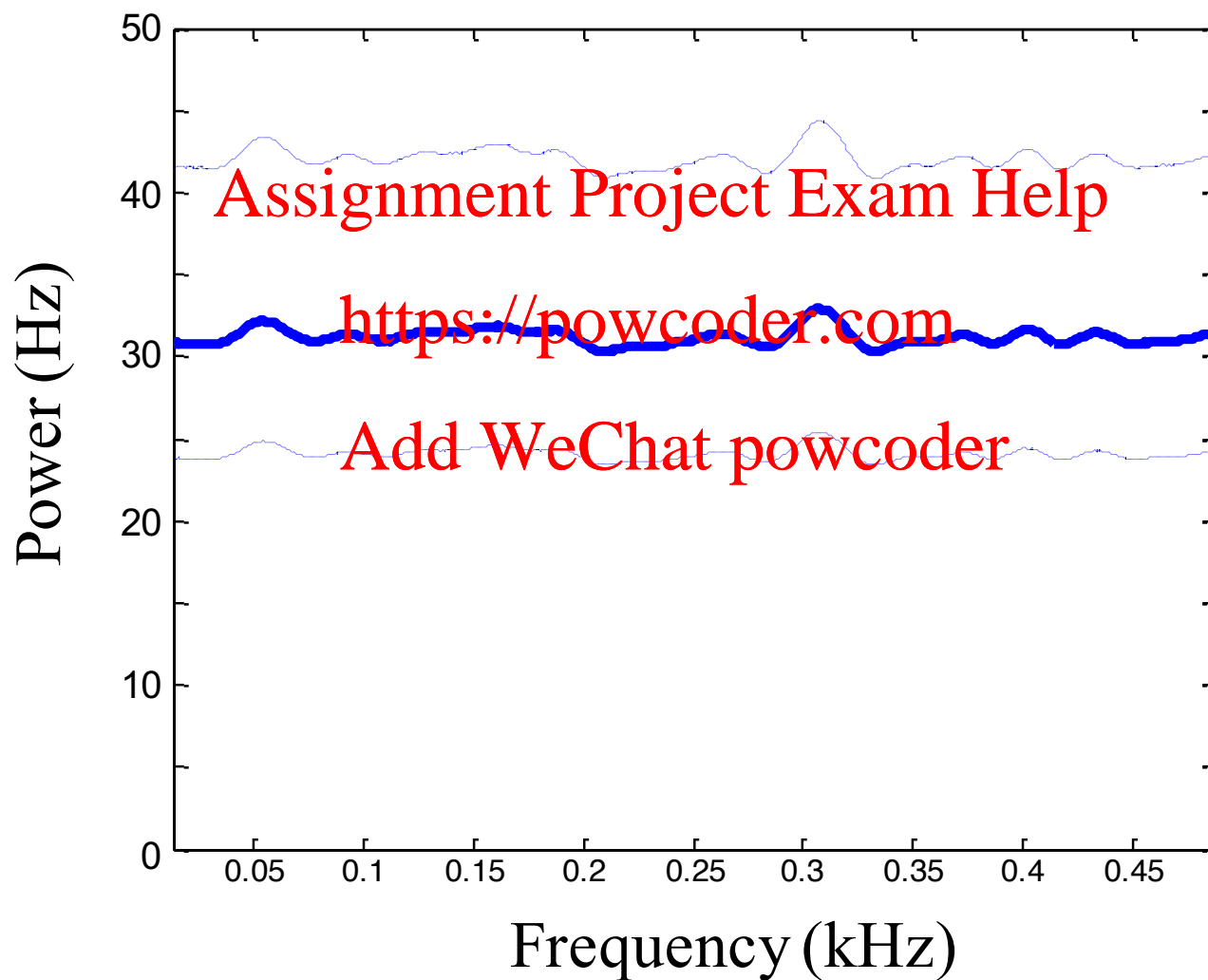
Example #1: Simple Poisson Process



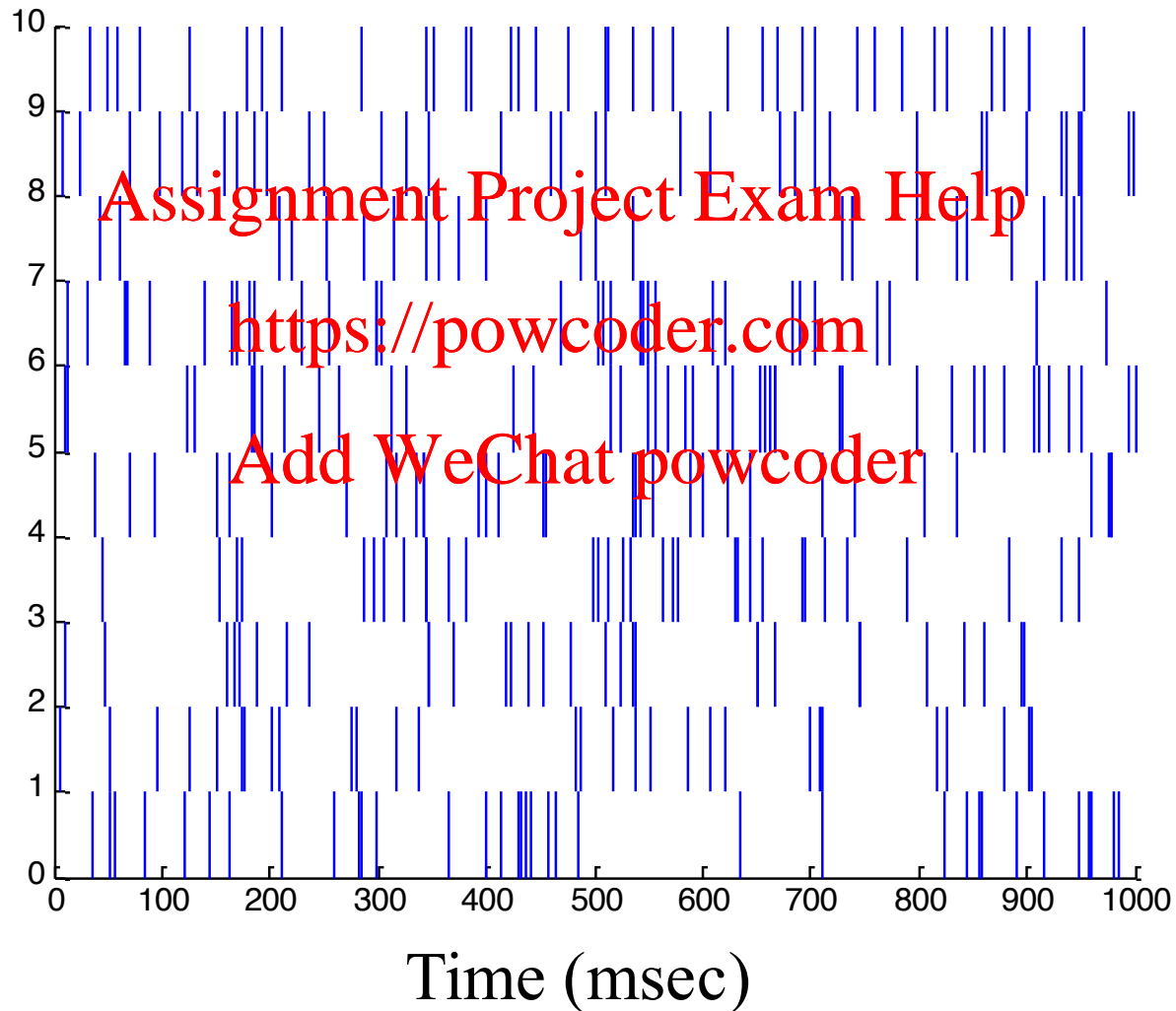
Poisson ISI Histogram



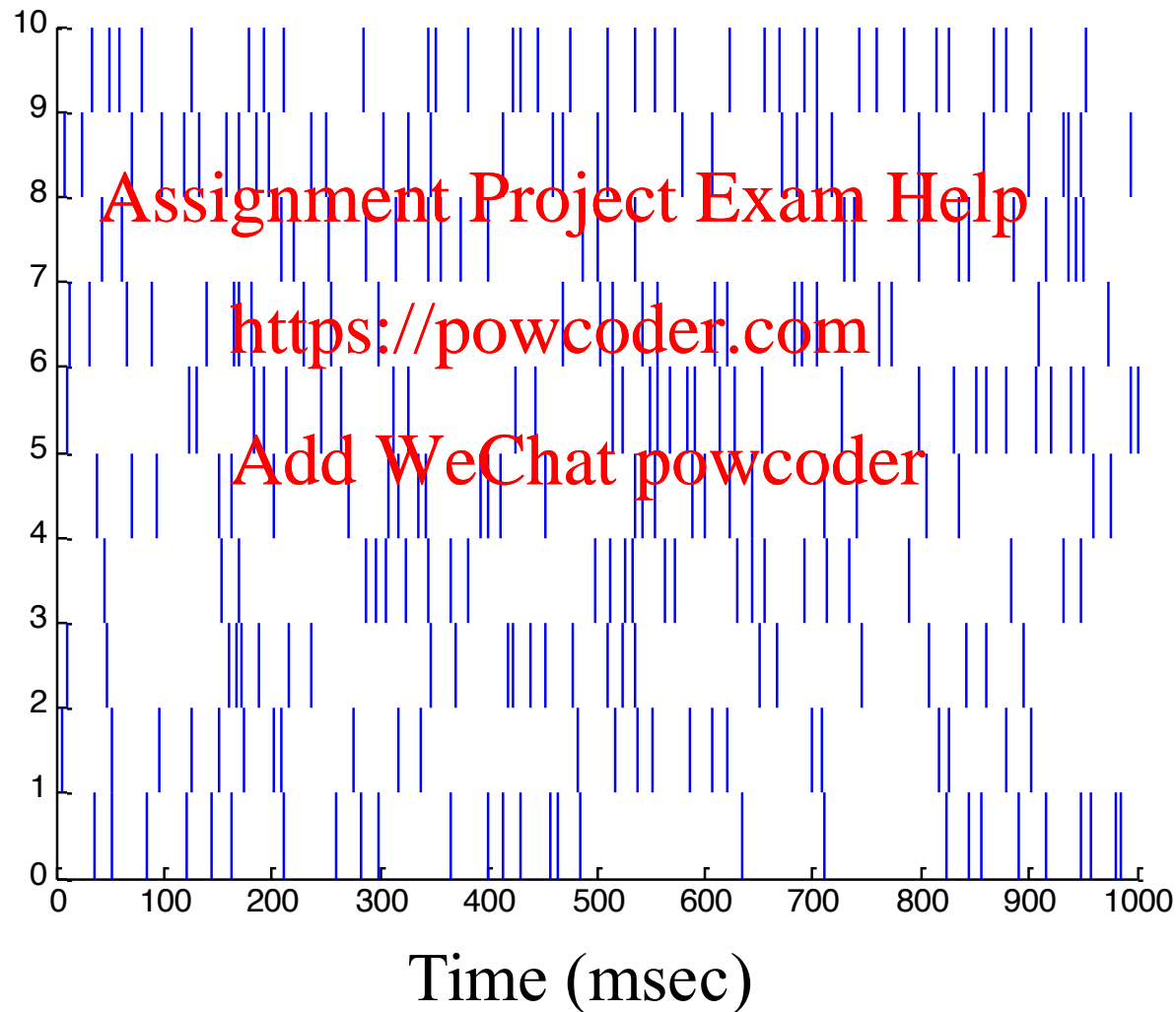
Sample Spectrum from Poisson Data



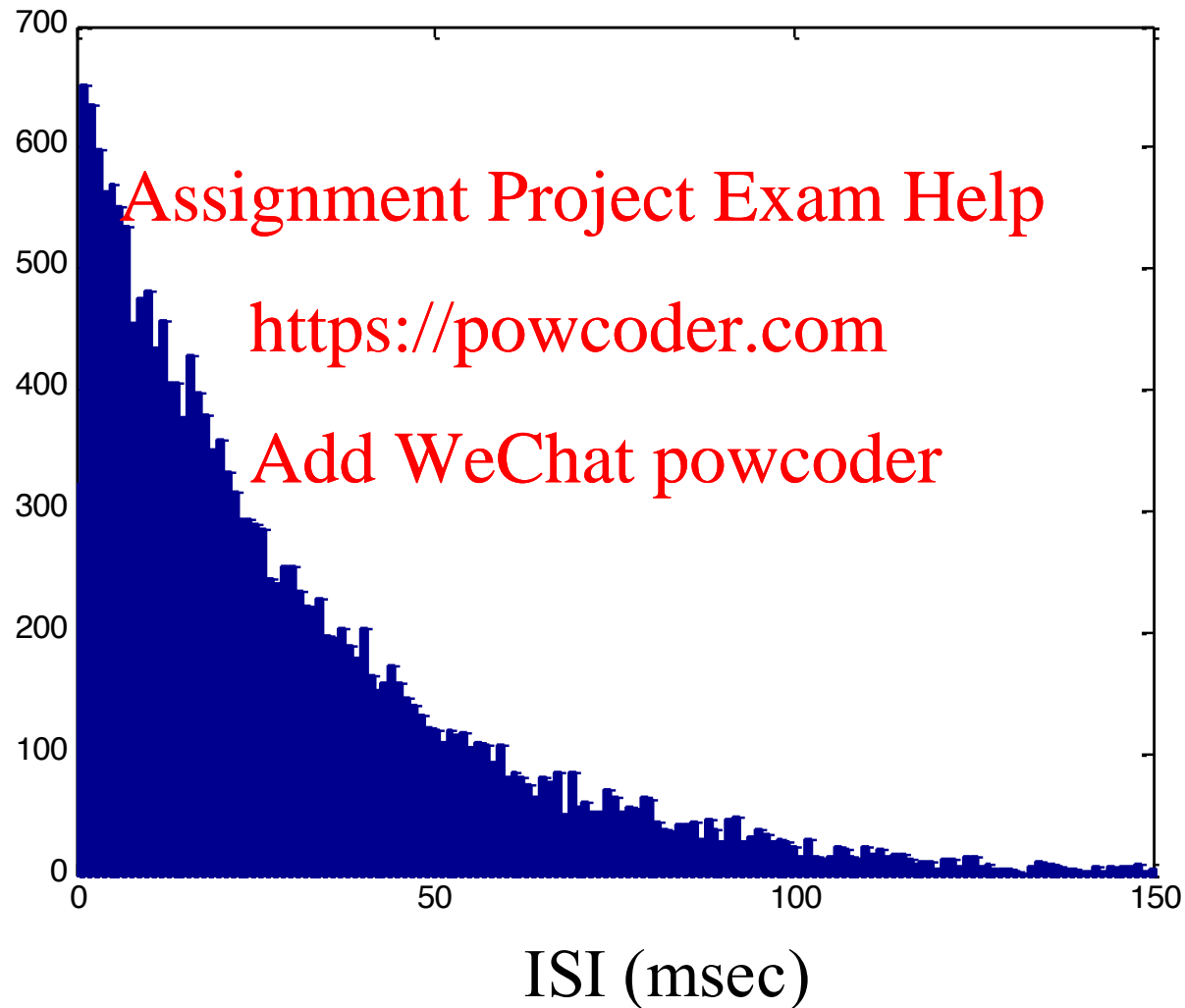
Example #1: Simple Poisson Process



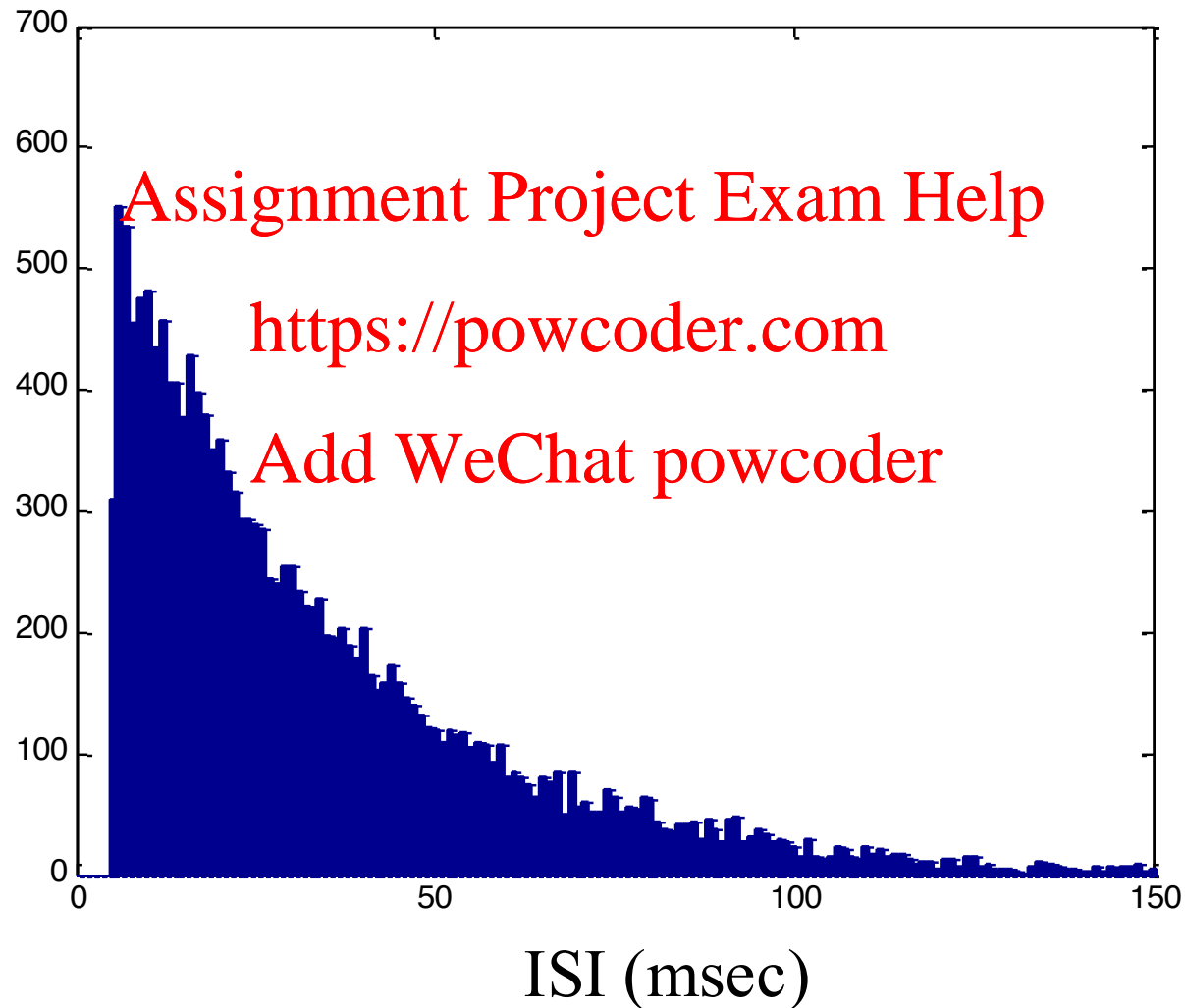
Example #2: Hard Refractory Period



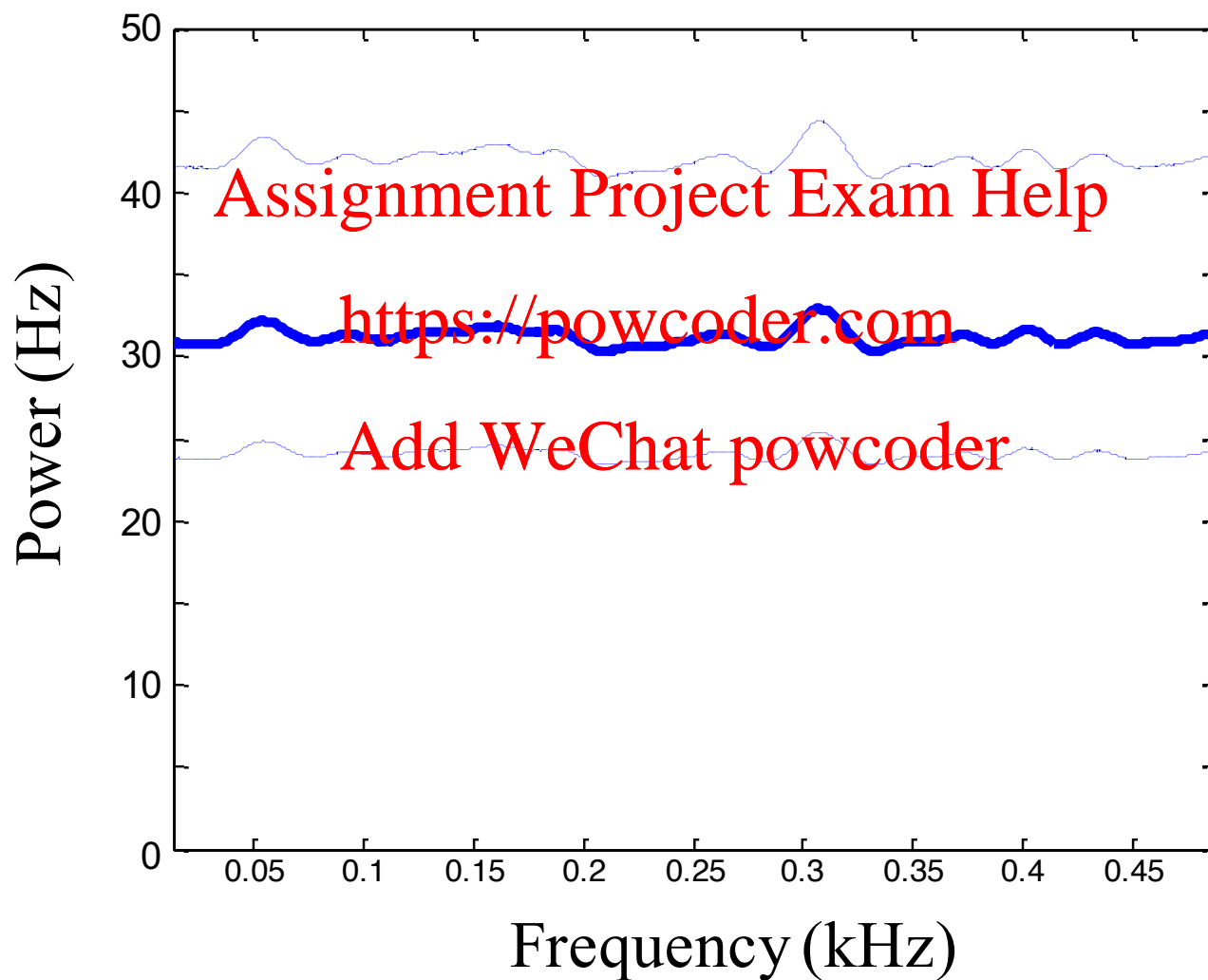
Poisson ISI Histogram



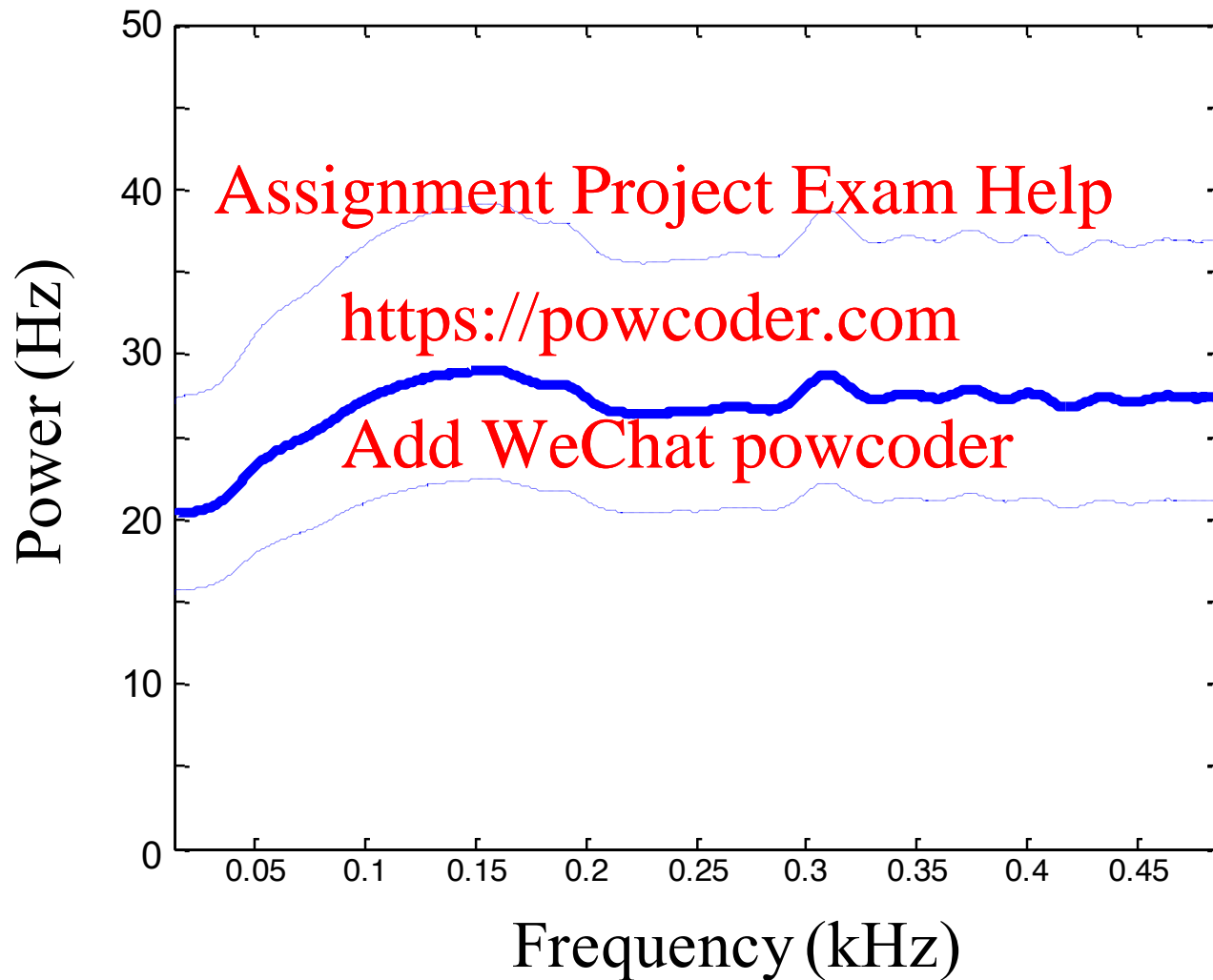
Refractory Process ISI Histogram



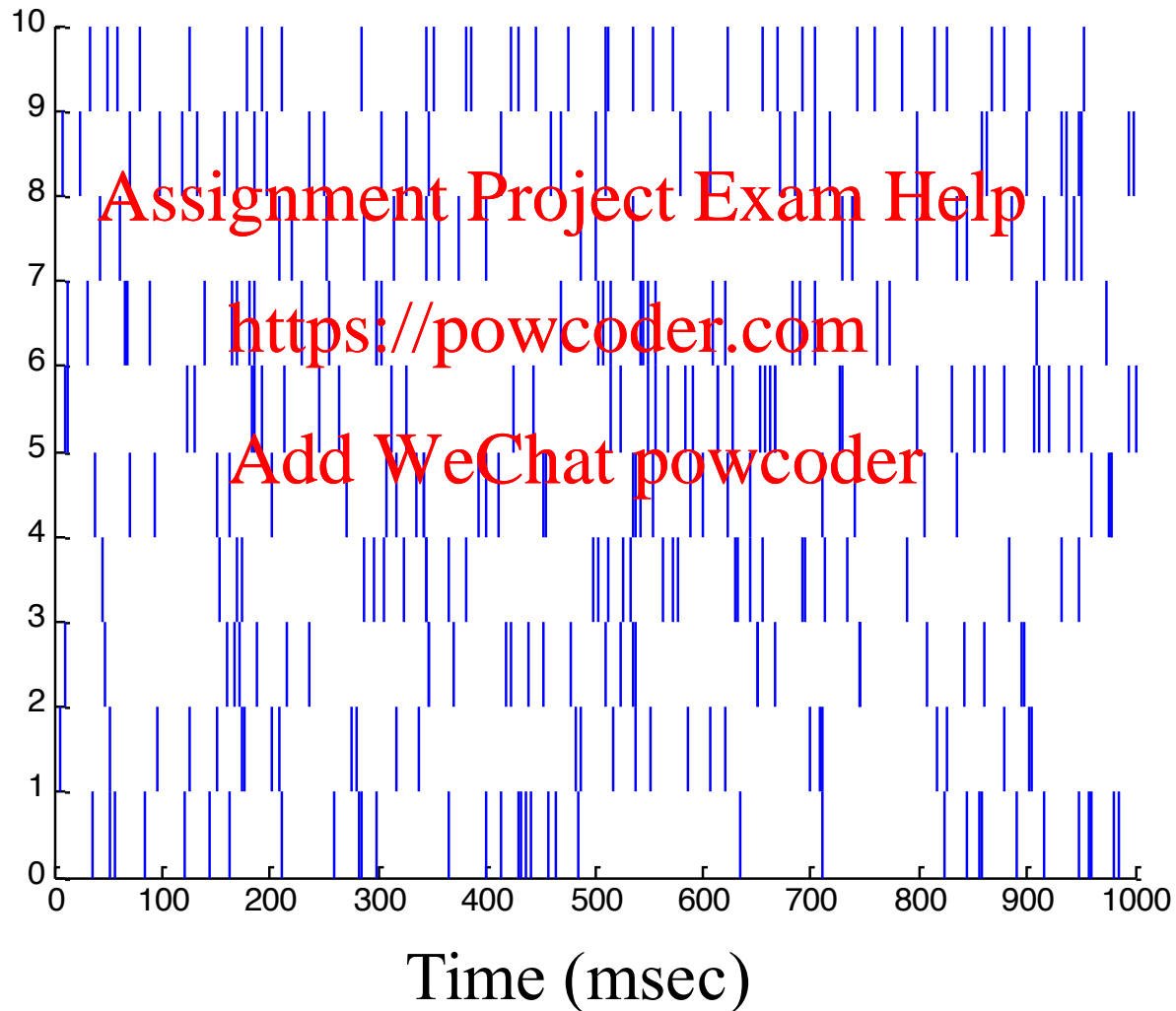
Sample Spectrum from Poisson Data



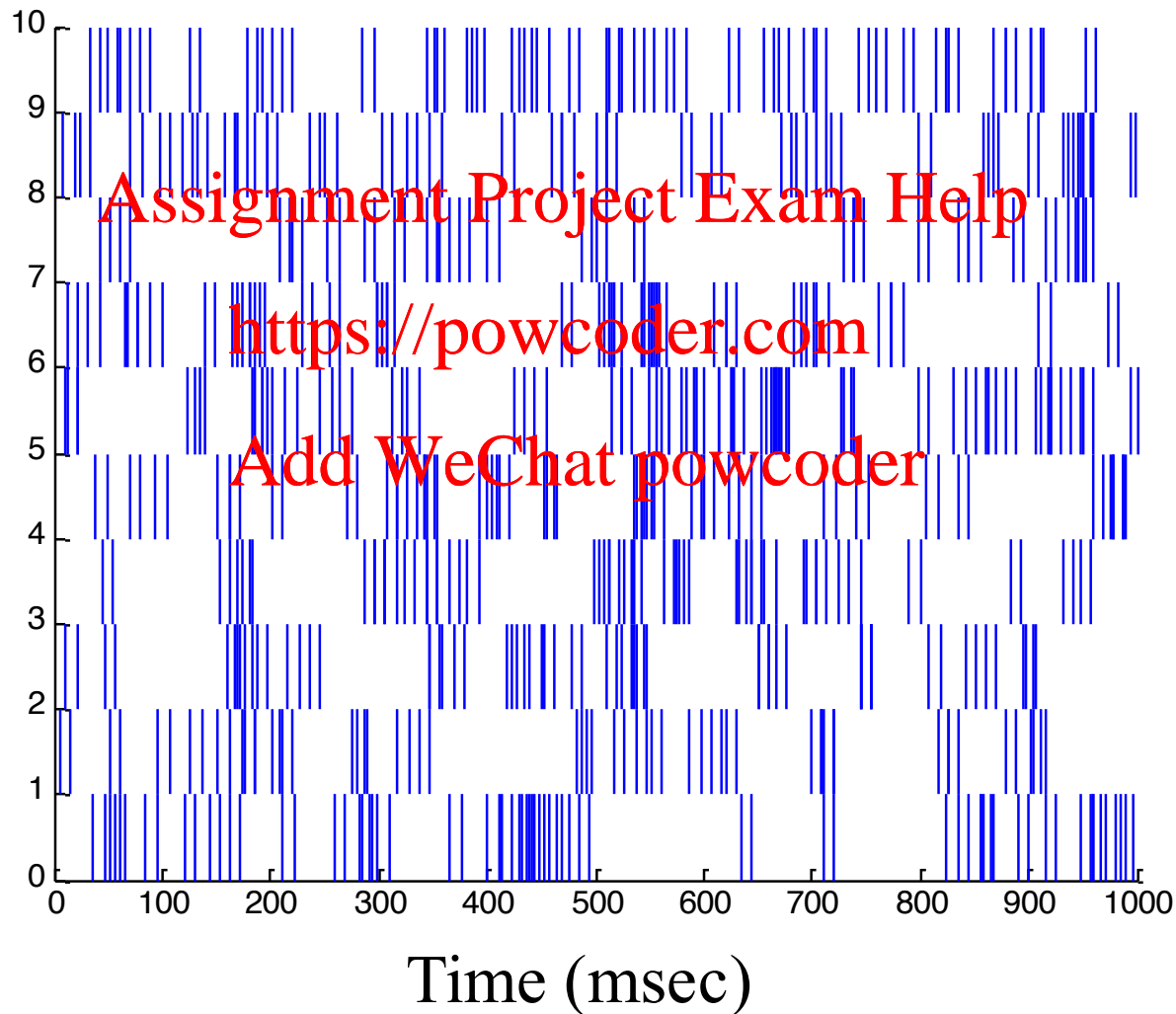
Refractory Process Sample Spectrum



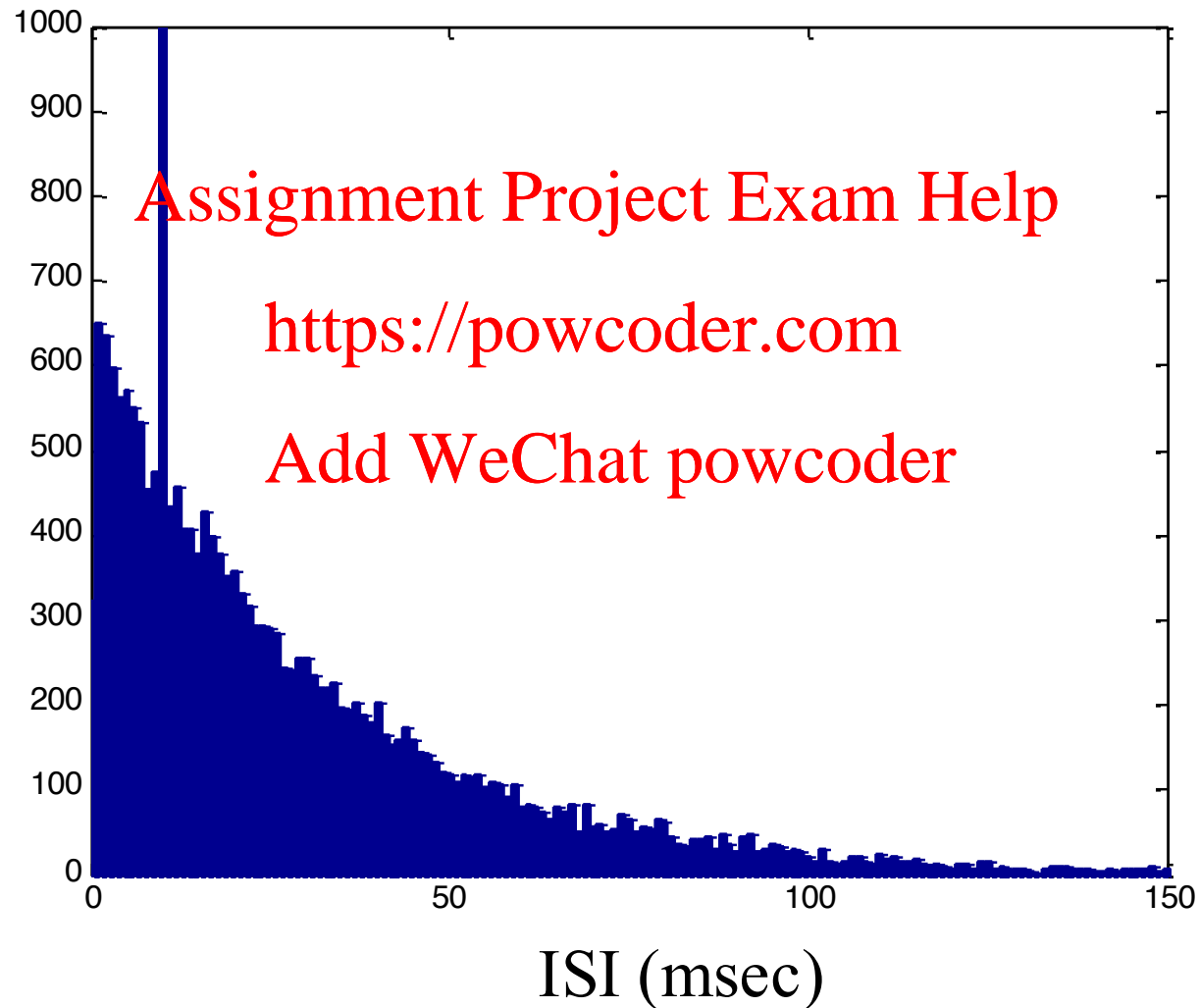
Example #1: Simple Poisson Process



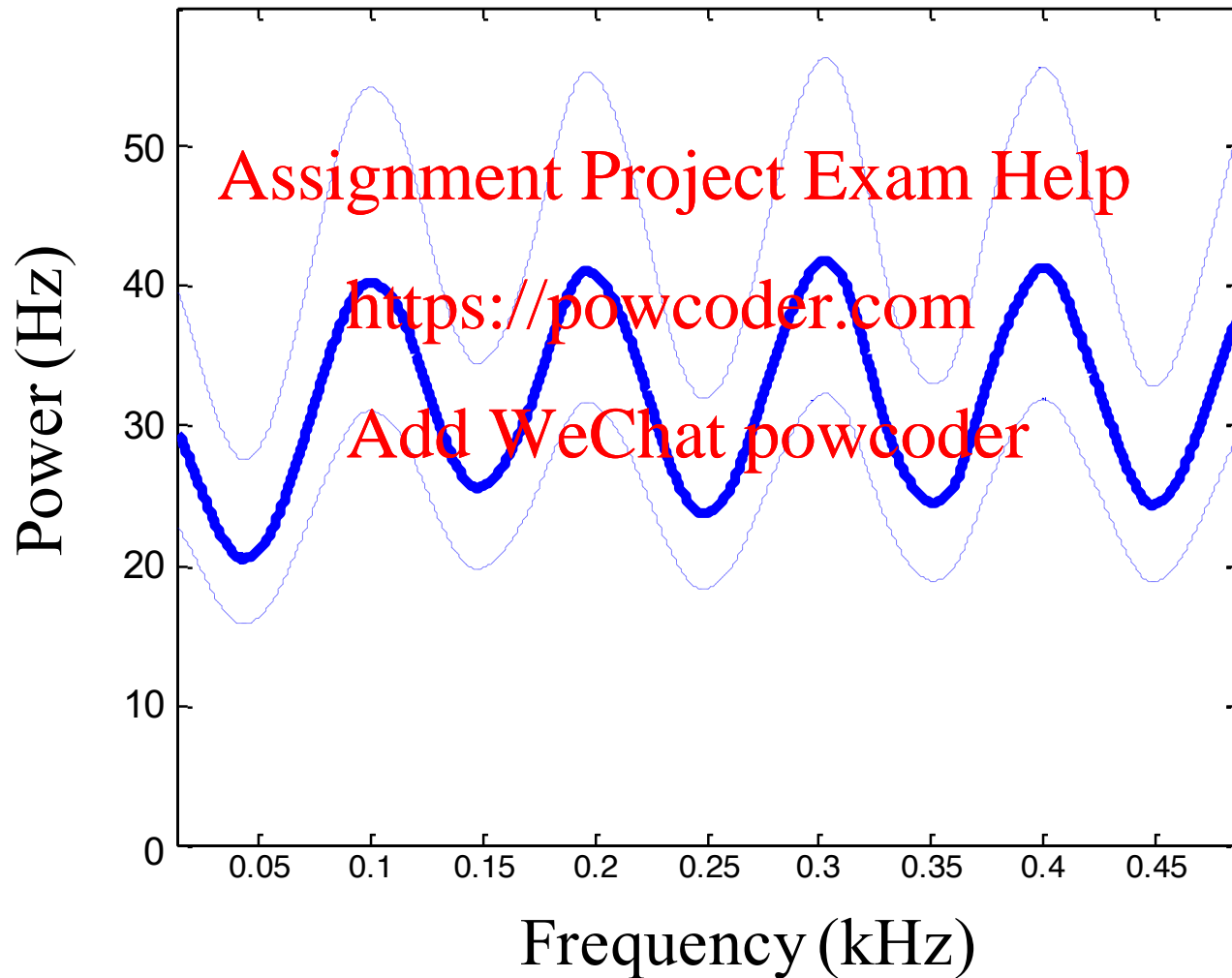
Example #3: Duplicate each spike at 10 ms lag



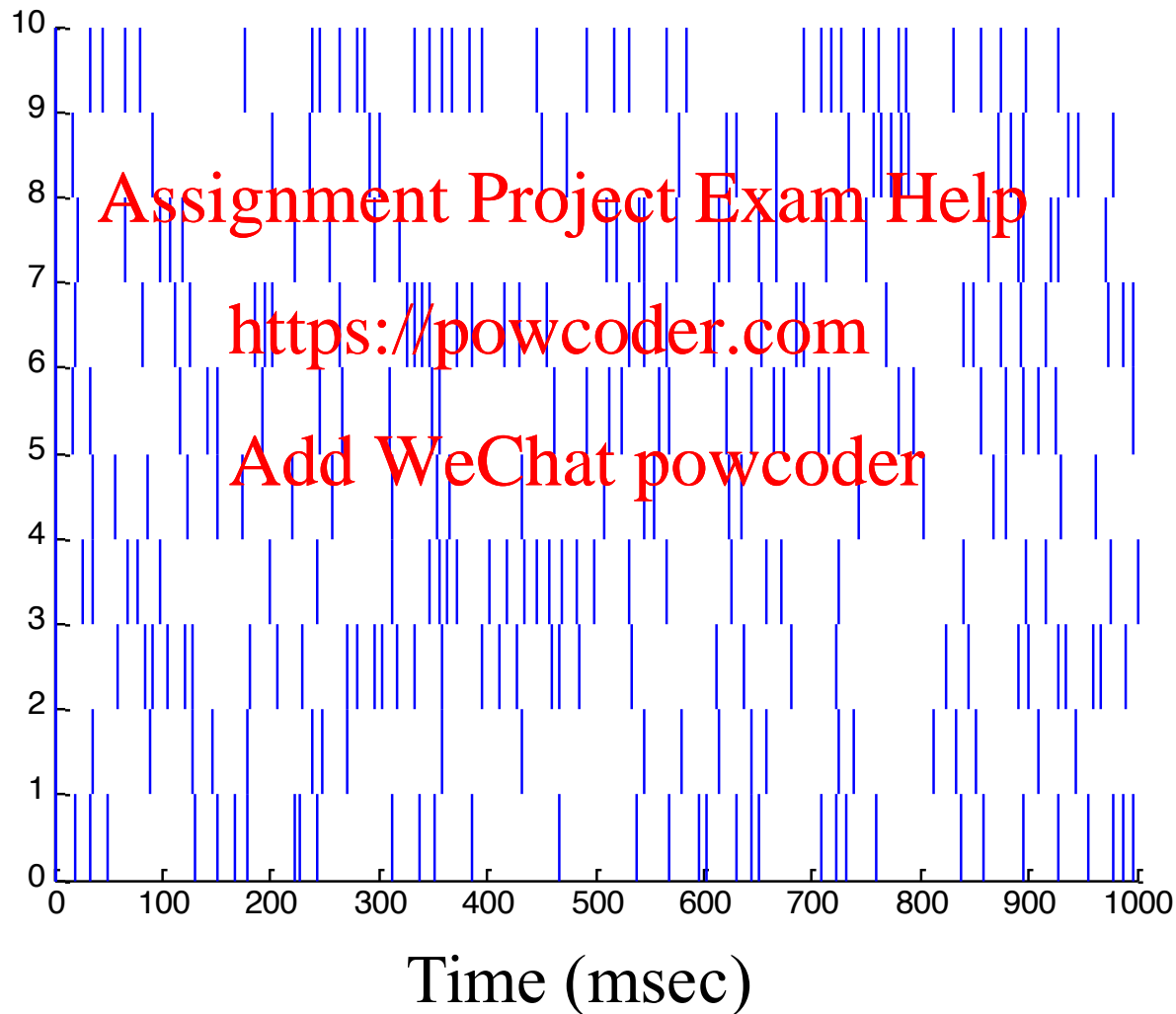
10 ms Repetition ISI Histogram



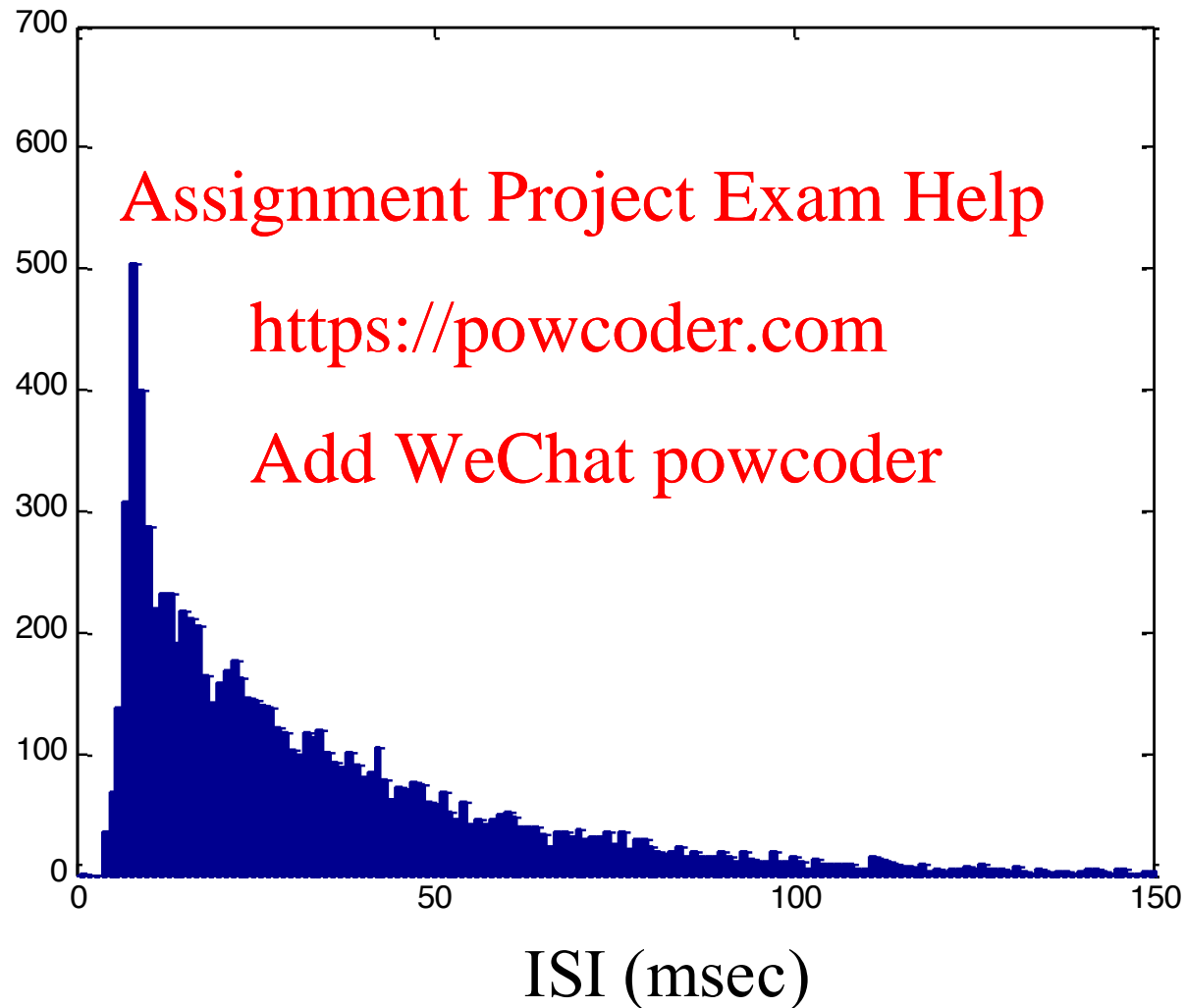
Repeated Spike Sample Spectrum



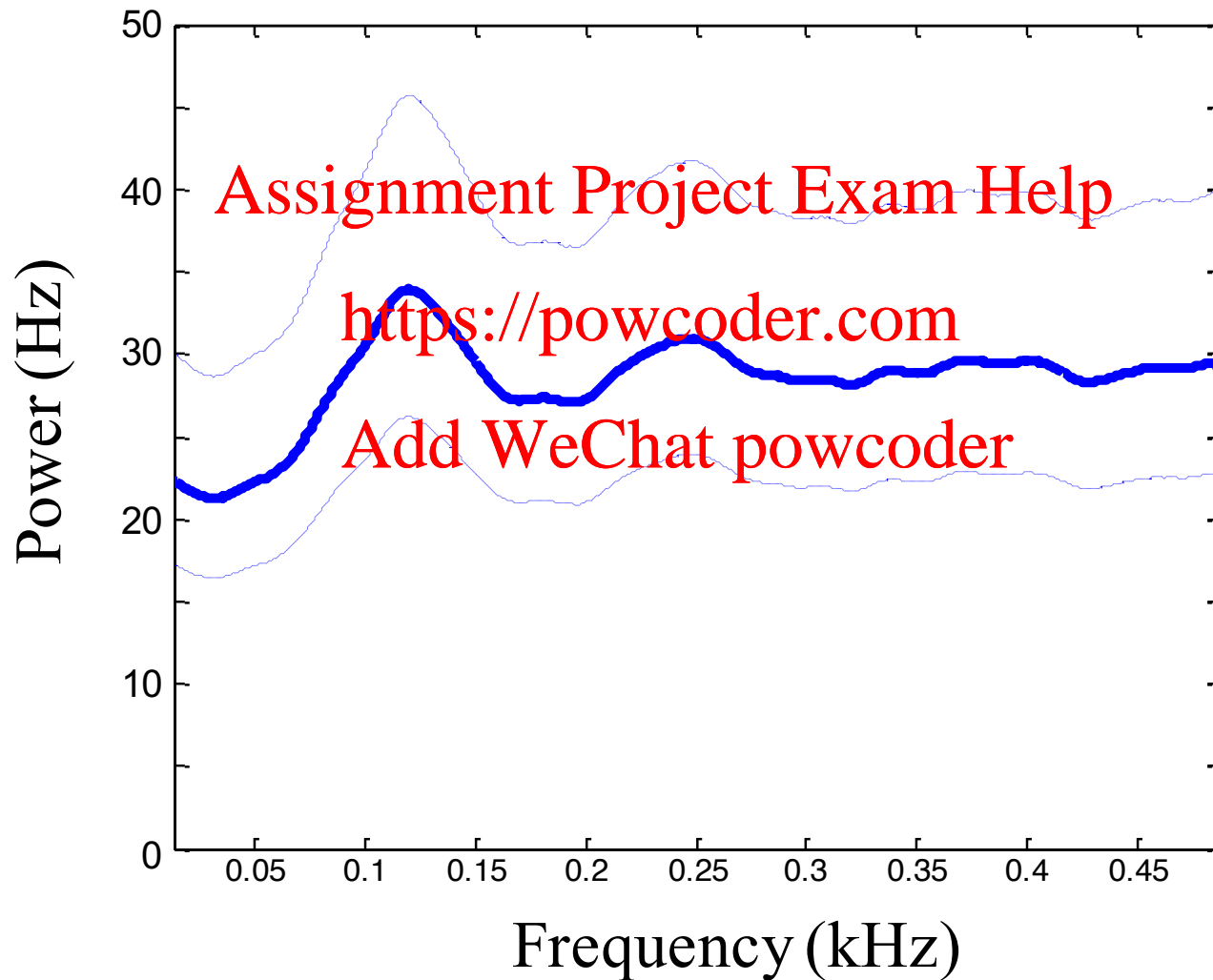
Example #4: Realistic Baseline Spiking Data



Baseline Spiking ISI



Sample Spectrum for Baseline Spiking



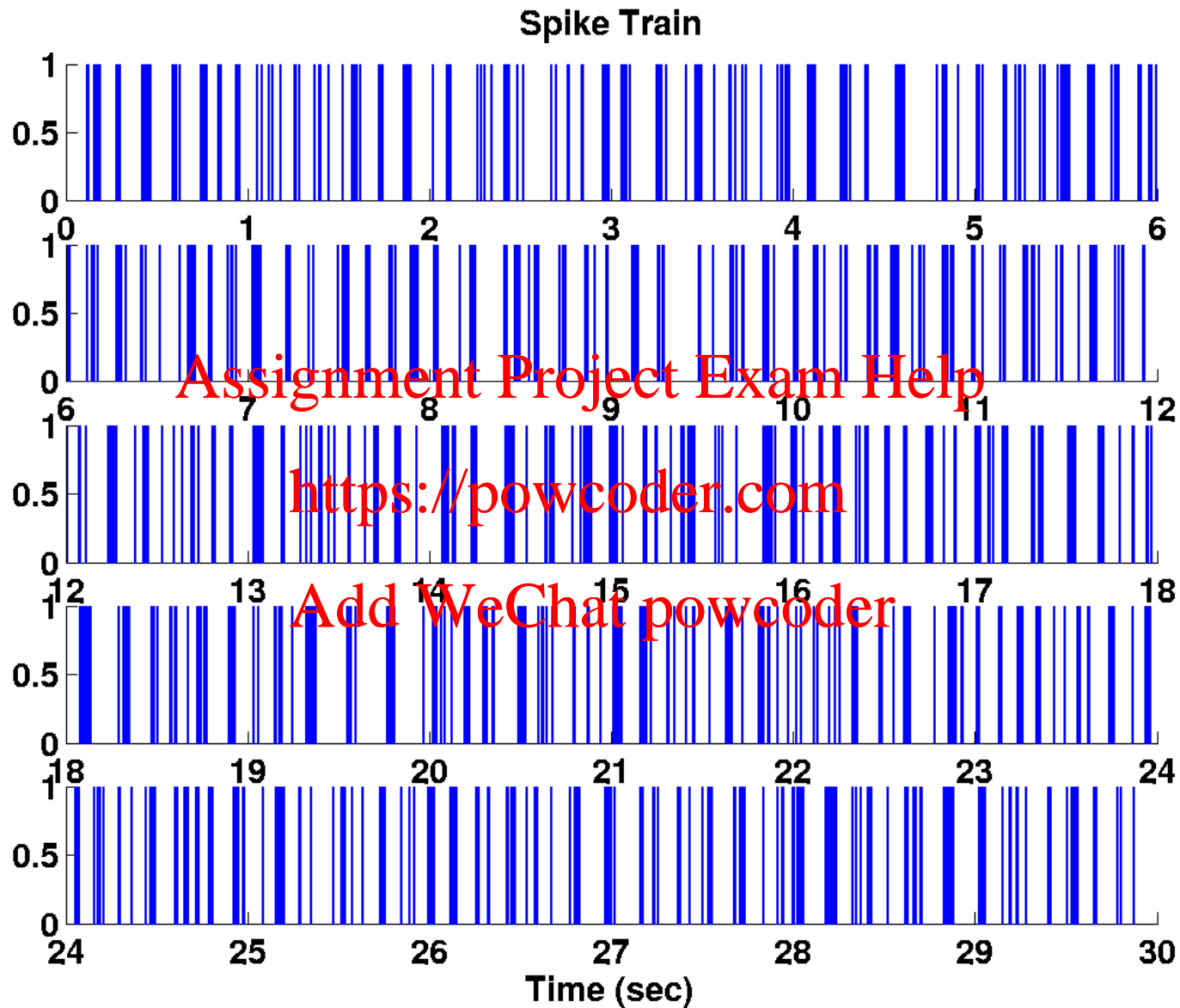
Case 1: An Analysis of the Spiking Activity of Retinal Neurons in Culture (Iyengar and Liu, 1997)

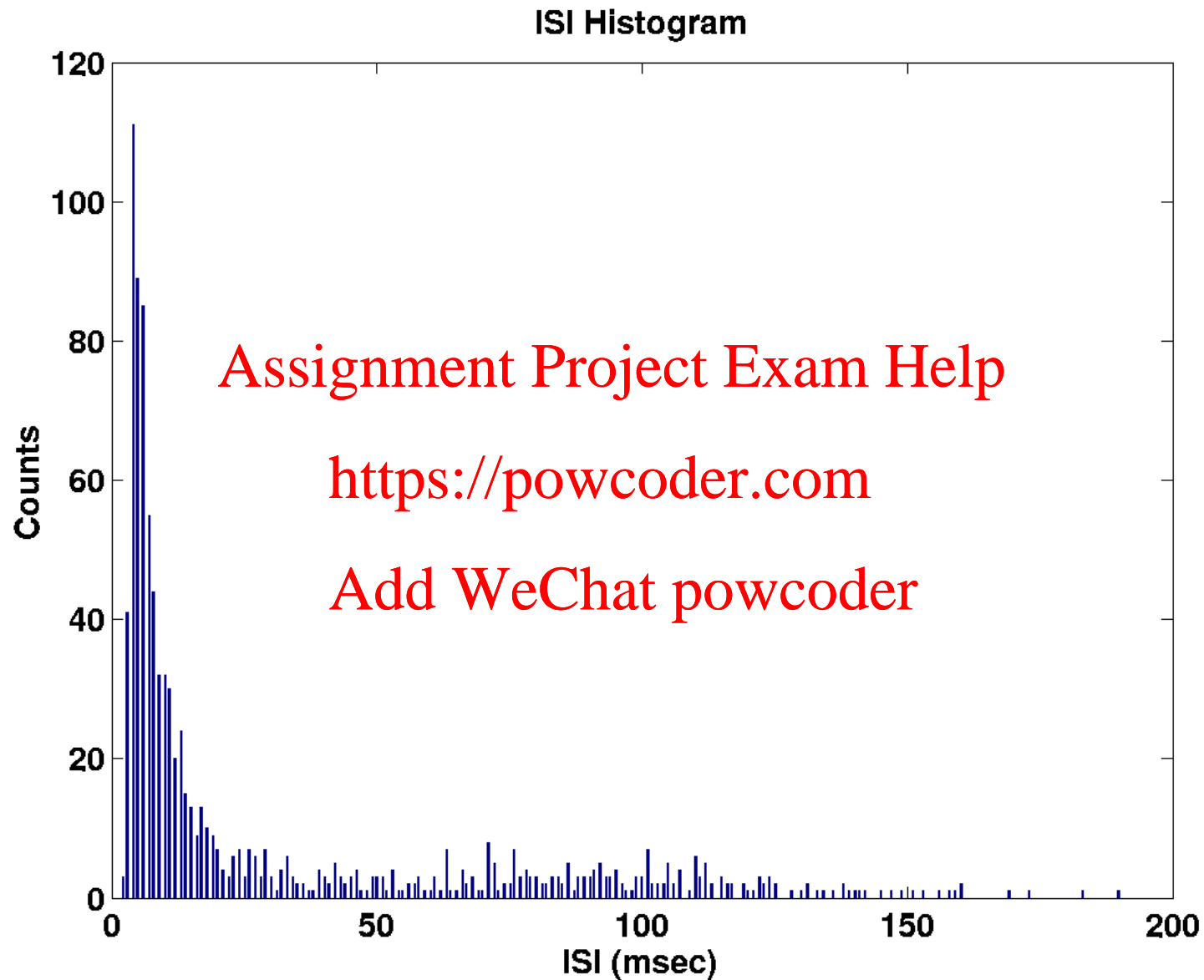
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Retinal neurons are grown in culture under constant light and environmental conditions. The spontaneous spiking activity of these neurons is recorded. The objective is to develop a statistical model which accurately describes the stochastic structure of this activity.

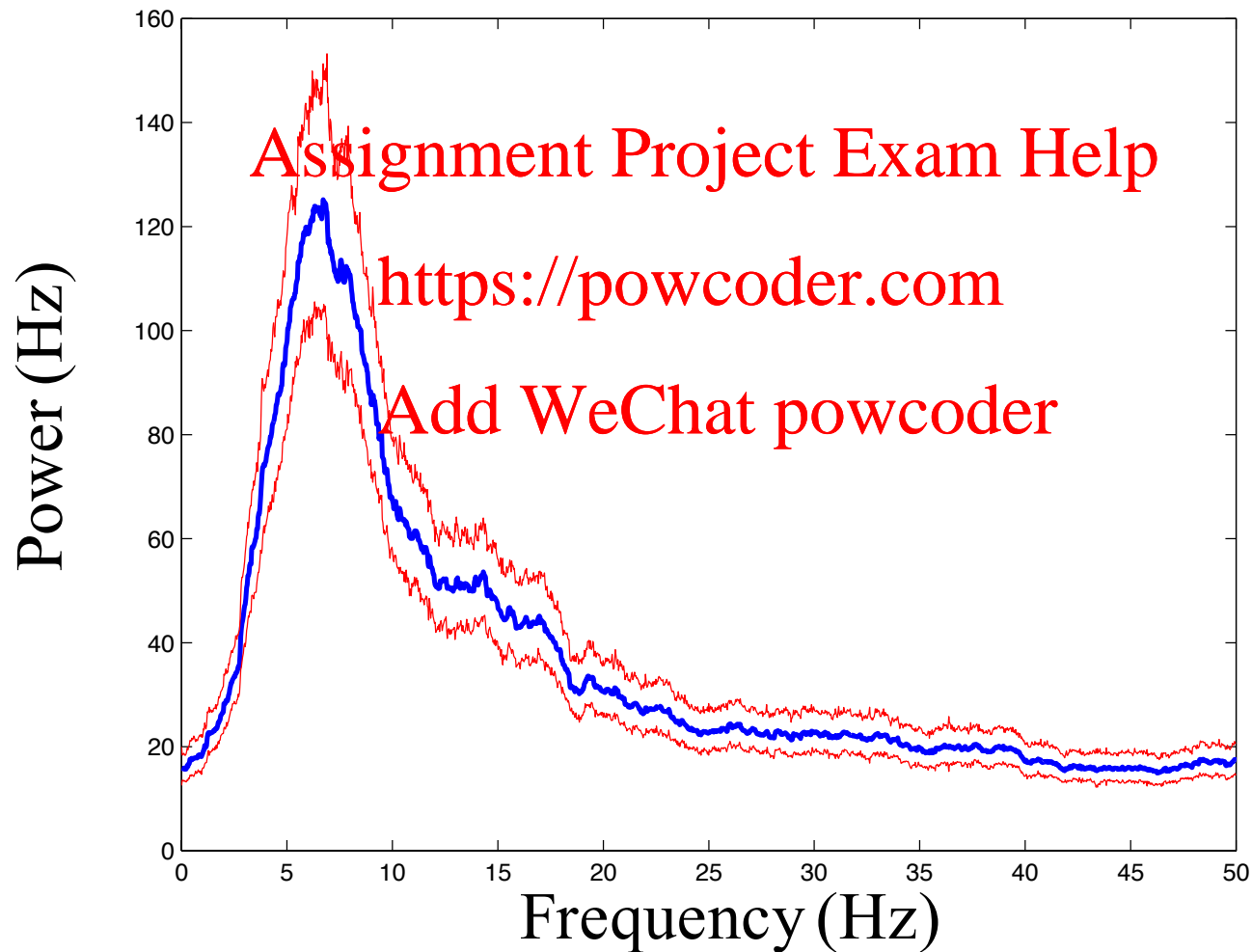
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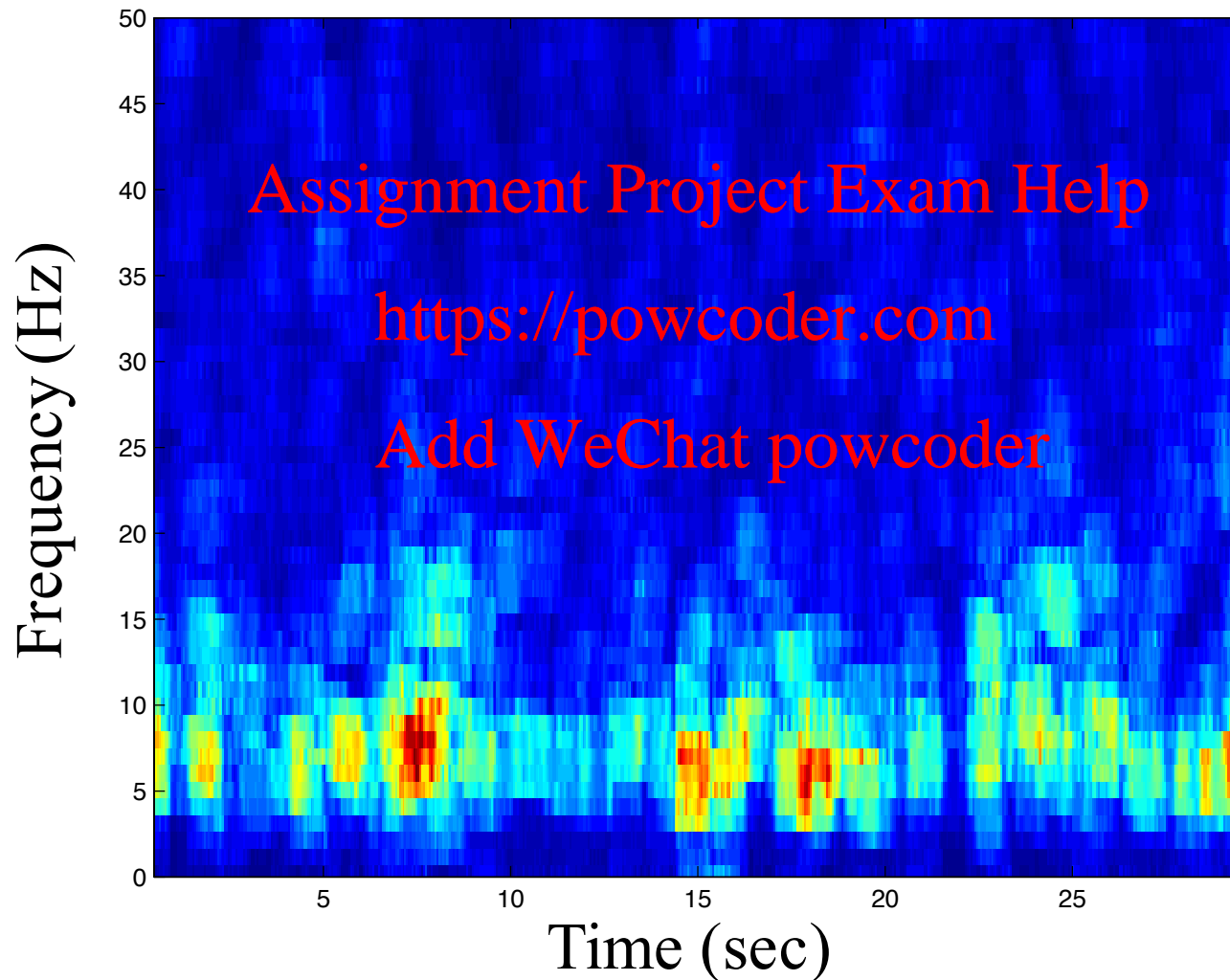




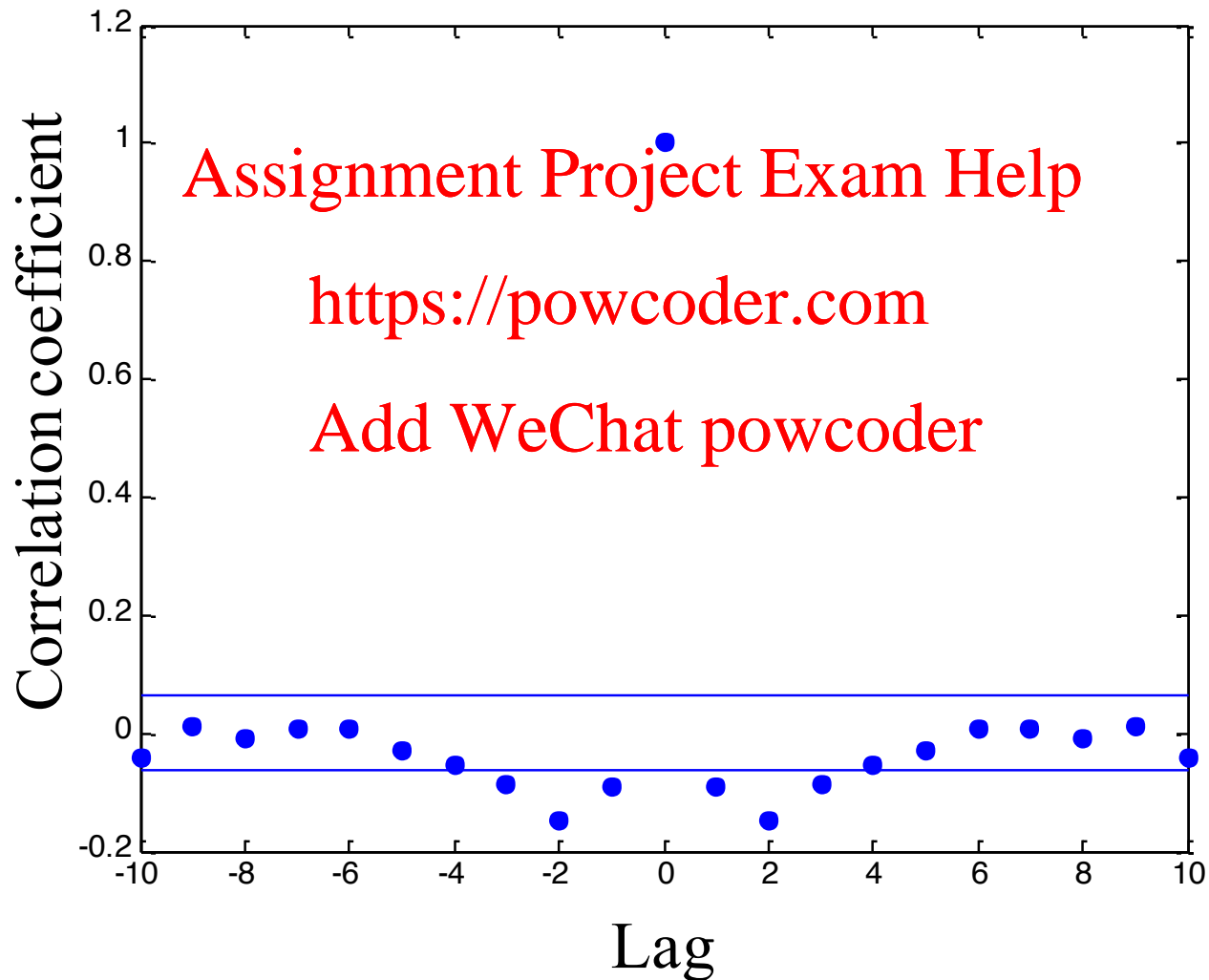
Retinal Baseline Data Spectrum



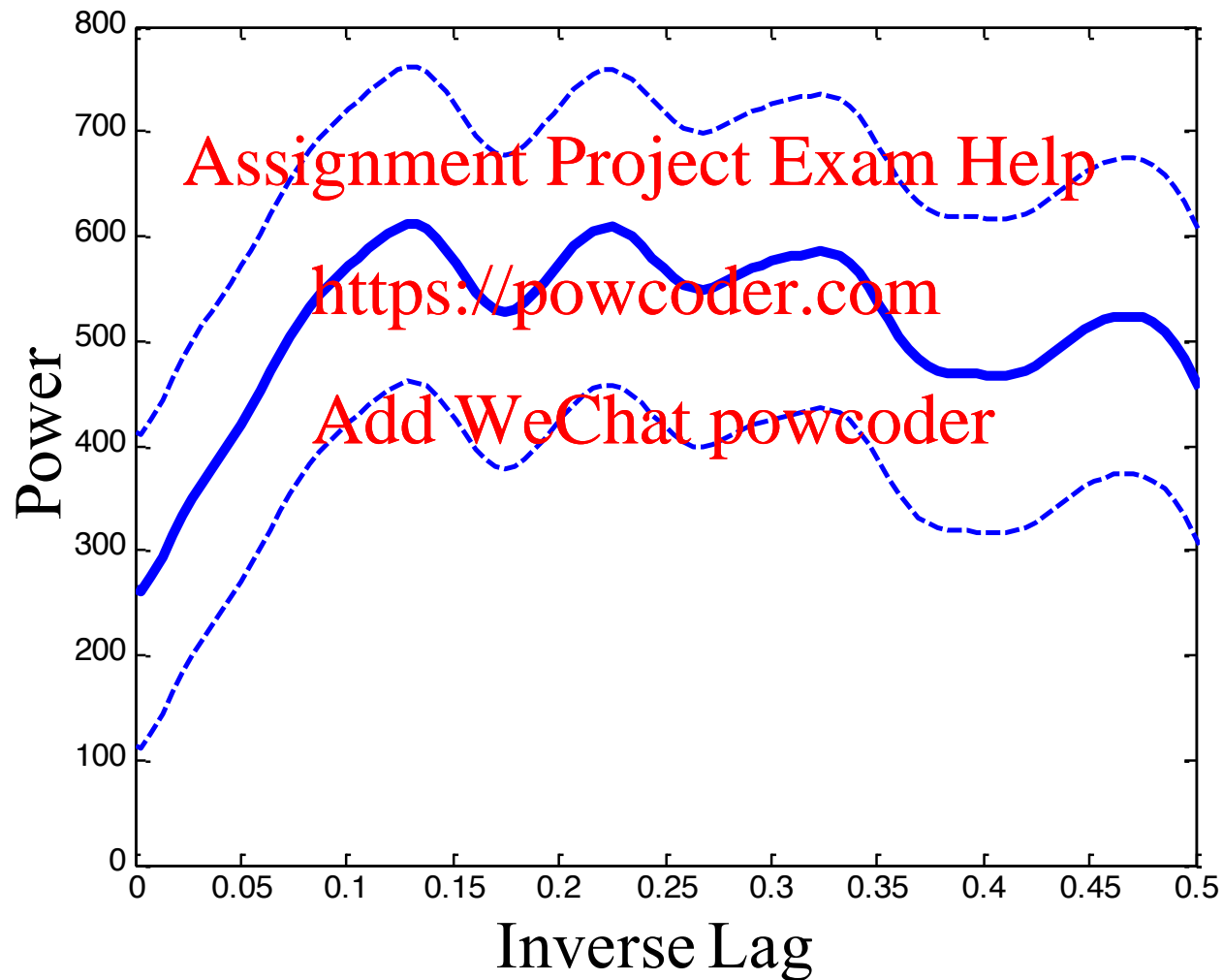
Retinal Baseline Data Spectrogram



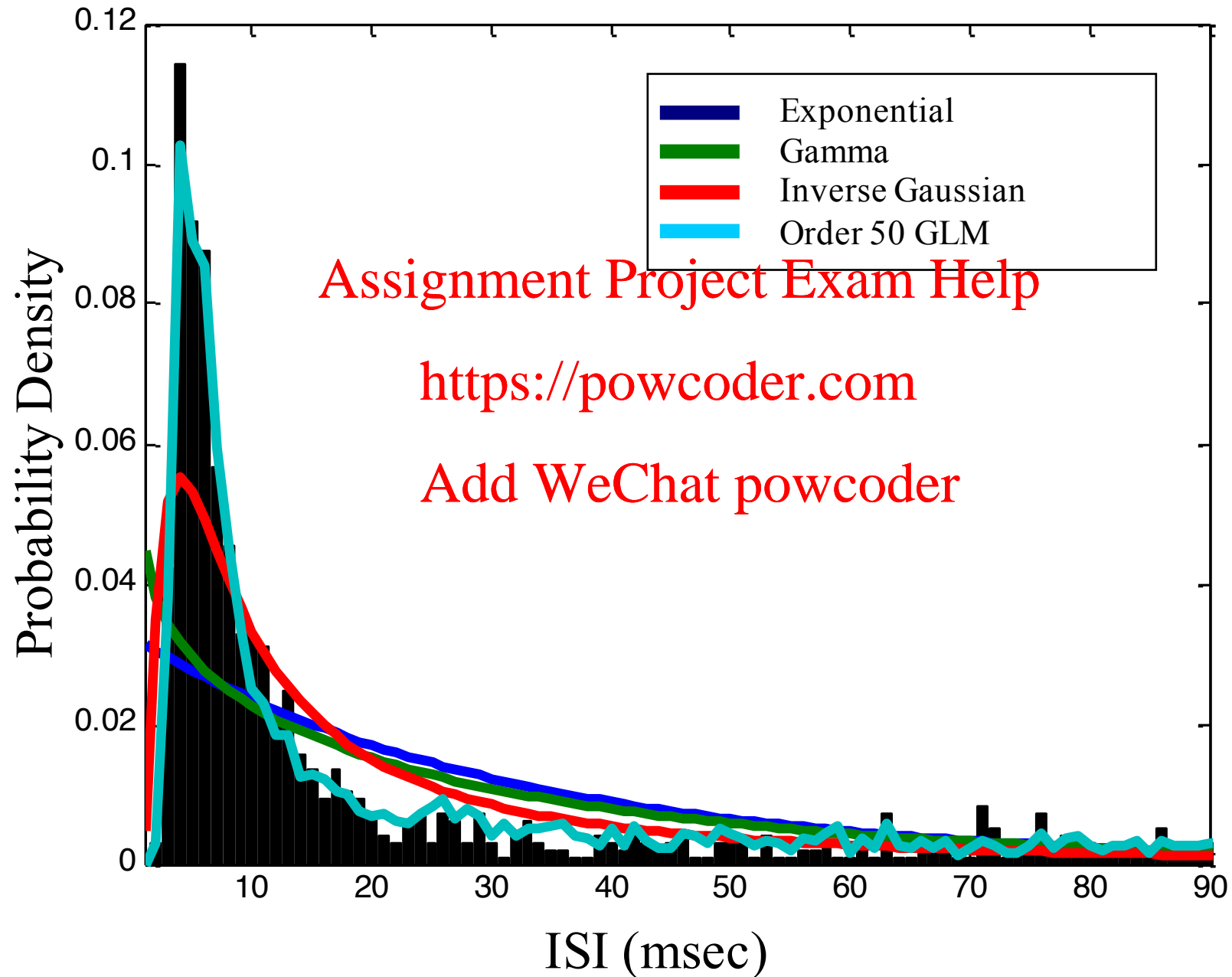
Autocorrelation of interspike intervals



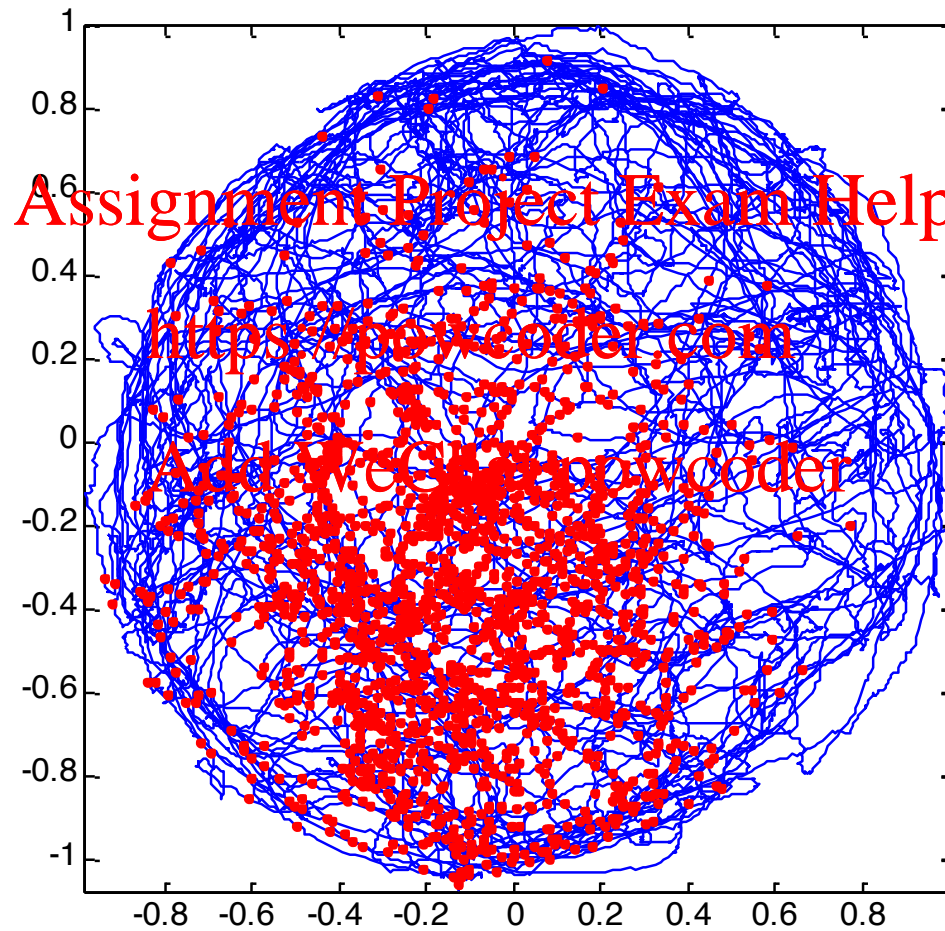
Interval Spectrum



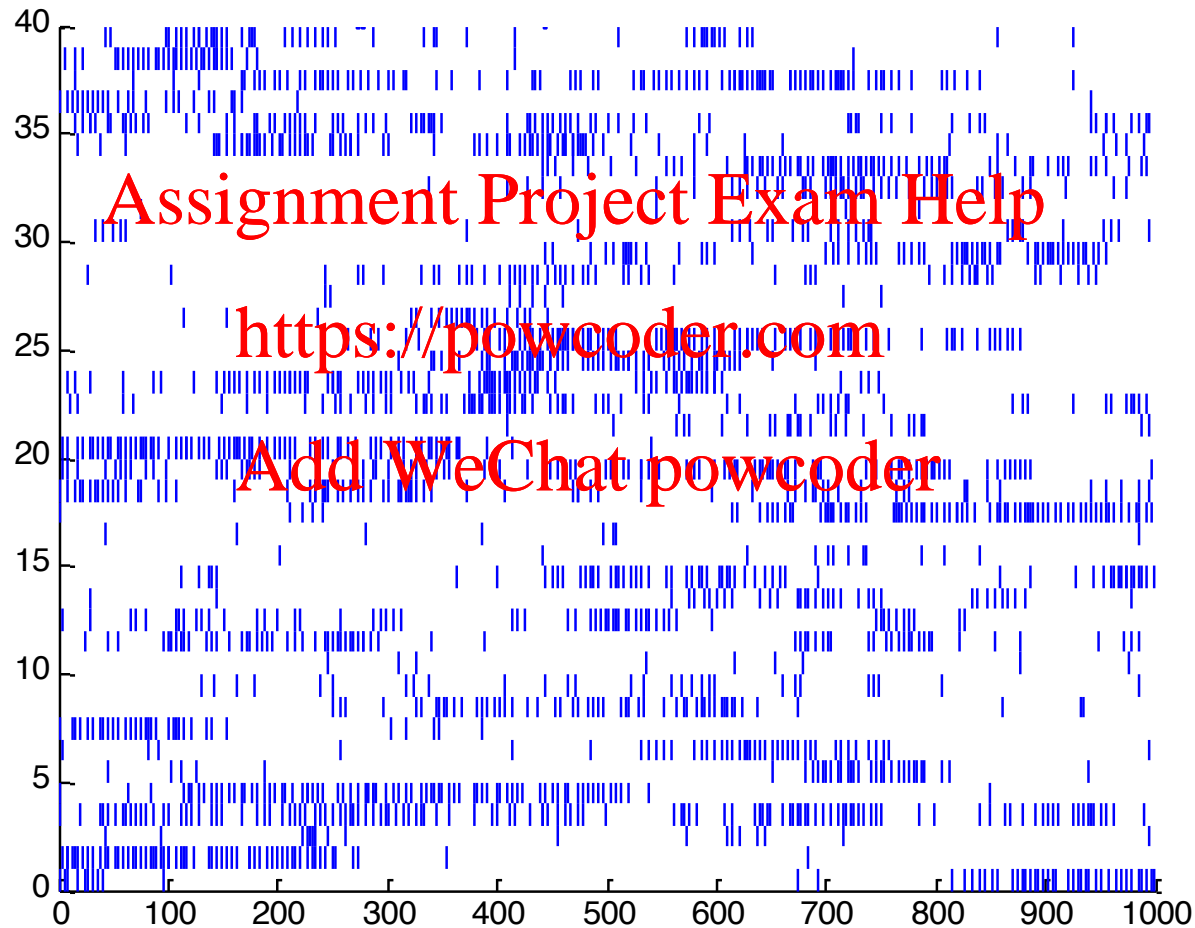
ISI Histogram



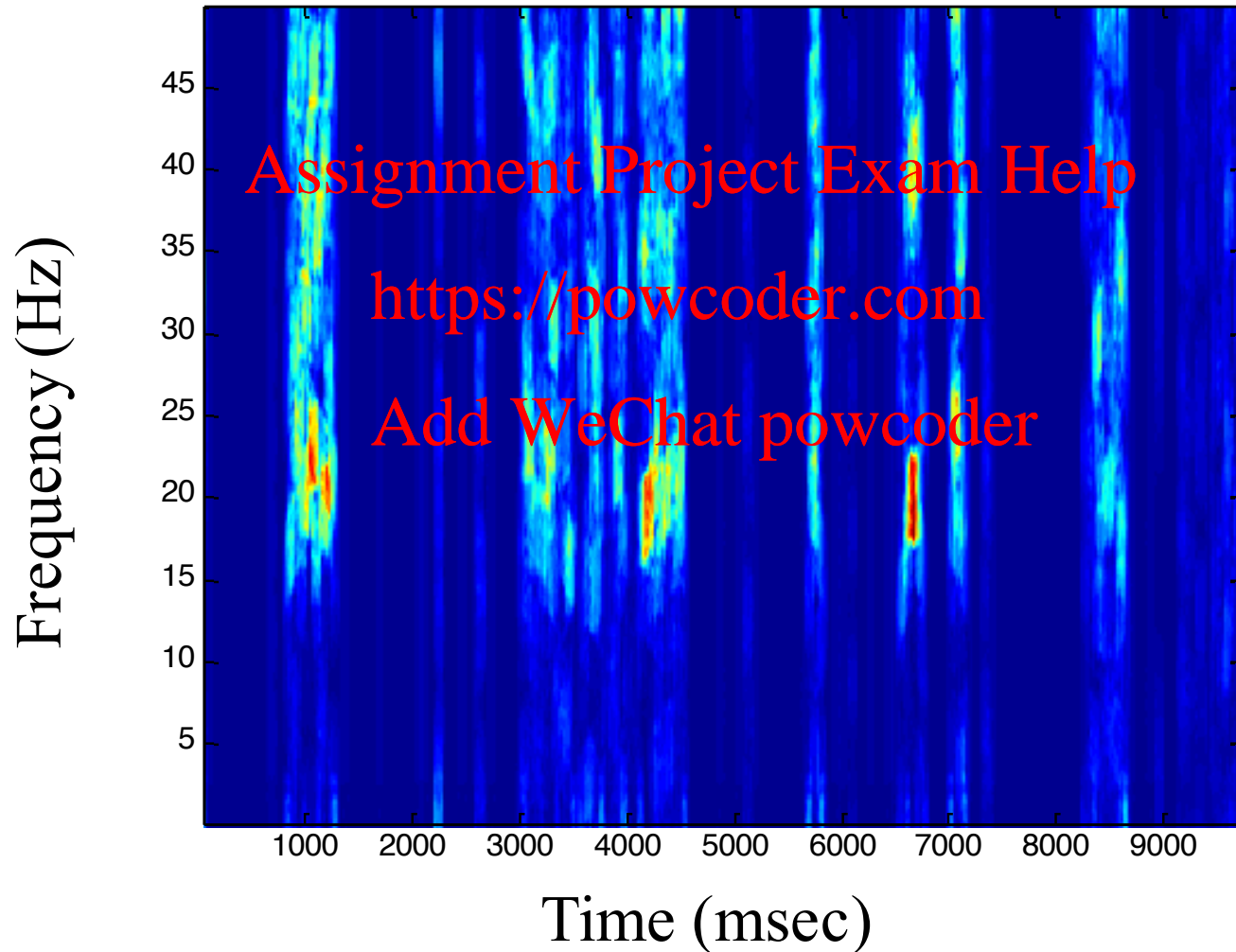
Hippocampal Place Field



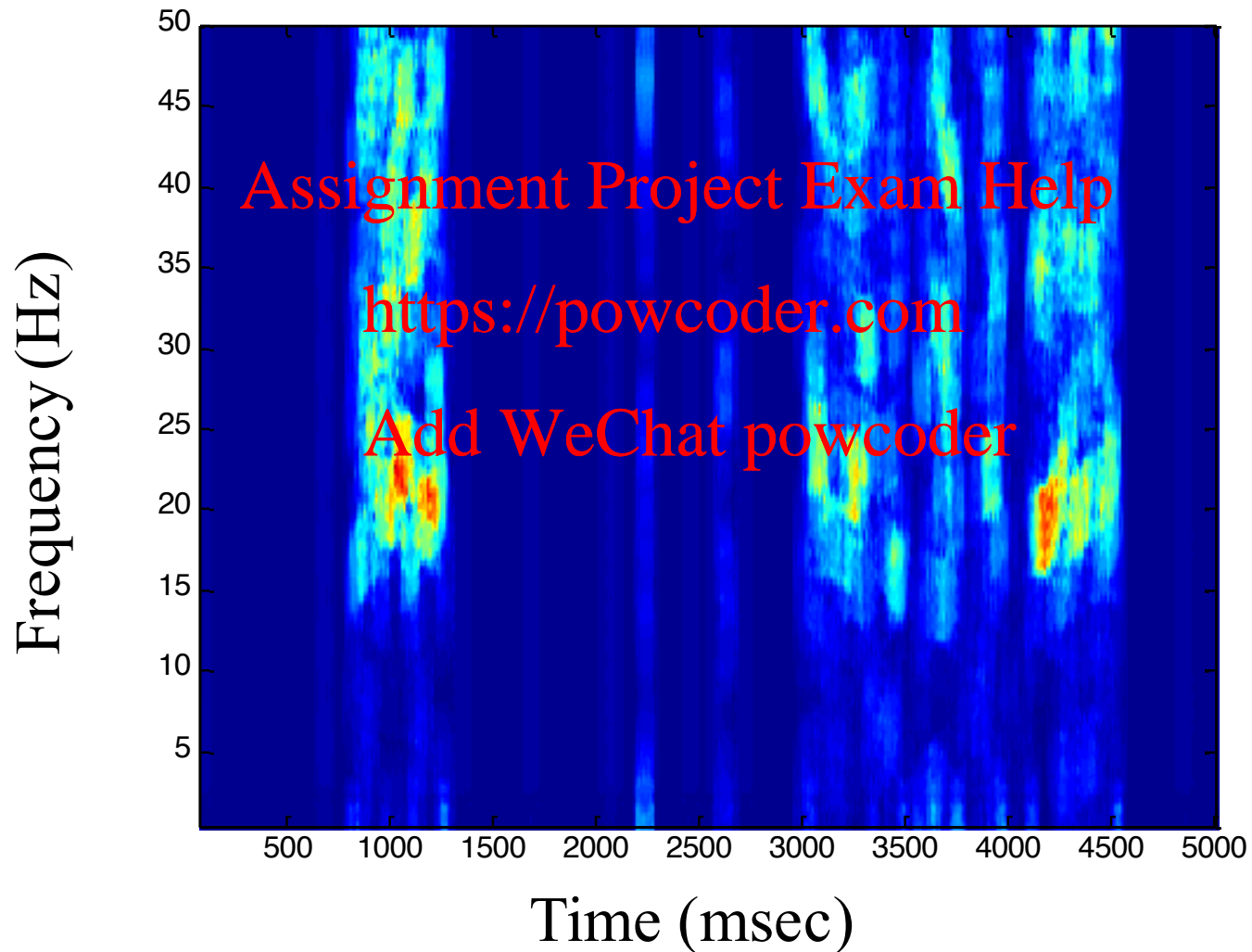
Hippocampal Place Field



Place Field Spectrogram



Place Field Spectrogram



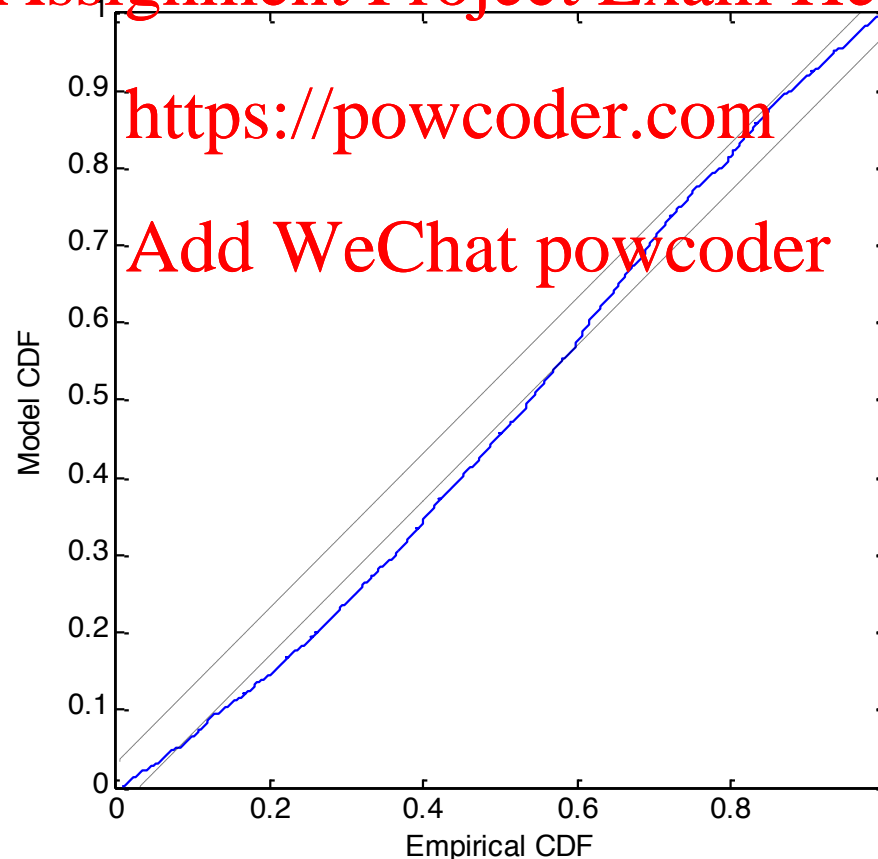
Place Field Analysis from Problem Set #3

$$\lambda(t | H_t) = \lambda^S(\mathbf{xN}(t), \mathbf{yN}(t)) \exp \left\{ \sum_{i=1}^p \beta_i \cdot \text{spikes_hist}(:, i) \right\}$$

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Conclusions

- Point process spectral analysis is useful for visualizing point process data and suggesting classes of conditional intensity models.

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- The interpretation of sample point process spectra differs from that of continuous valued signals.