Point Process Spectral Analysis Examples

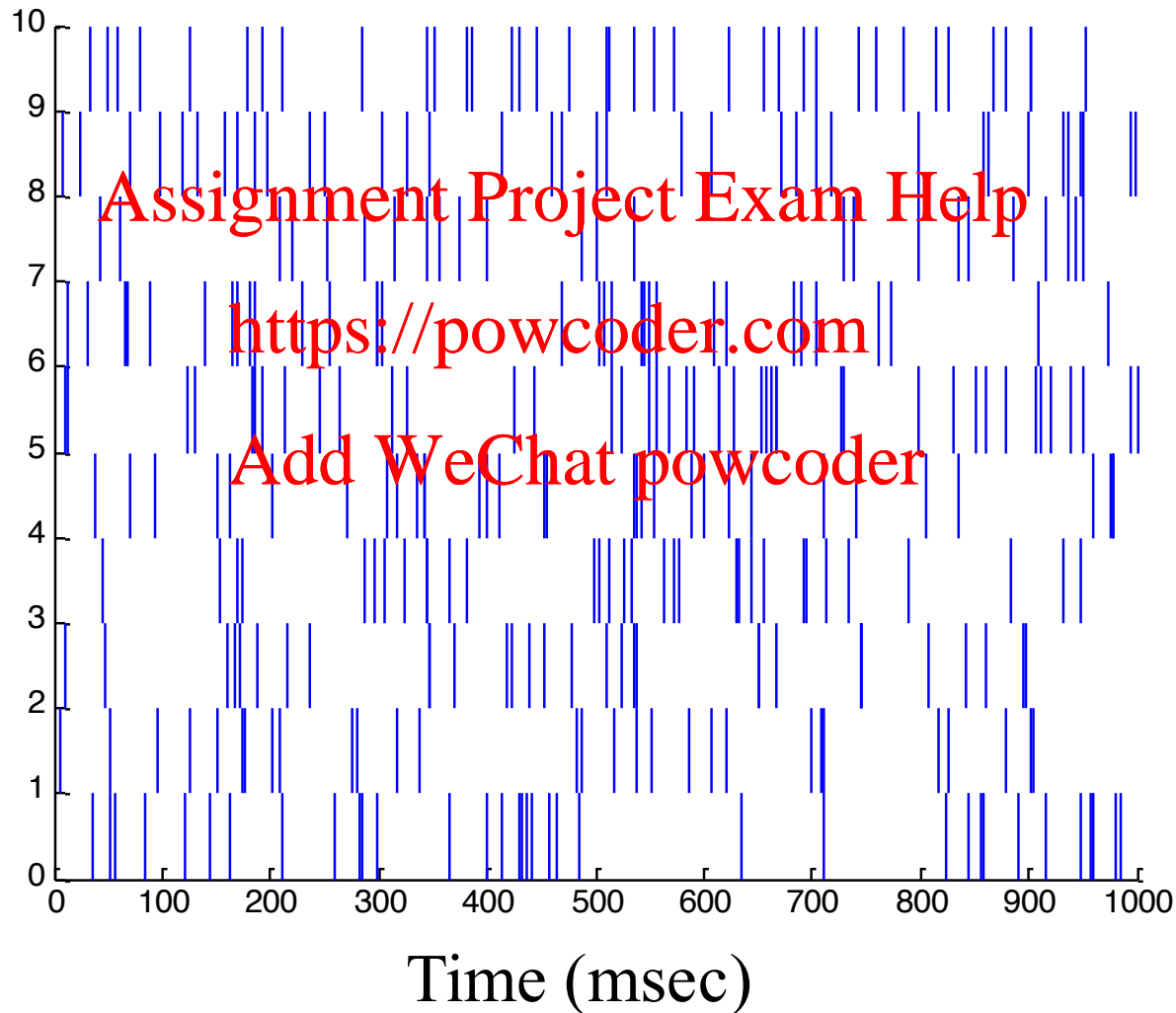# Example #1: Simple Poisson Process

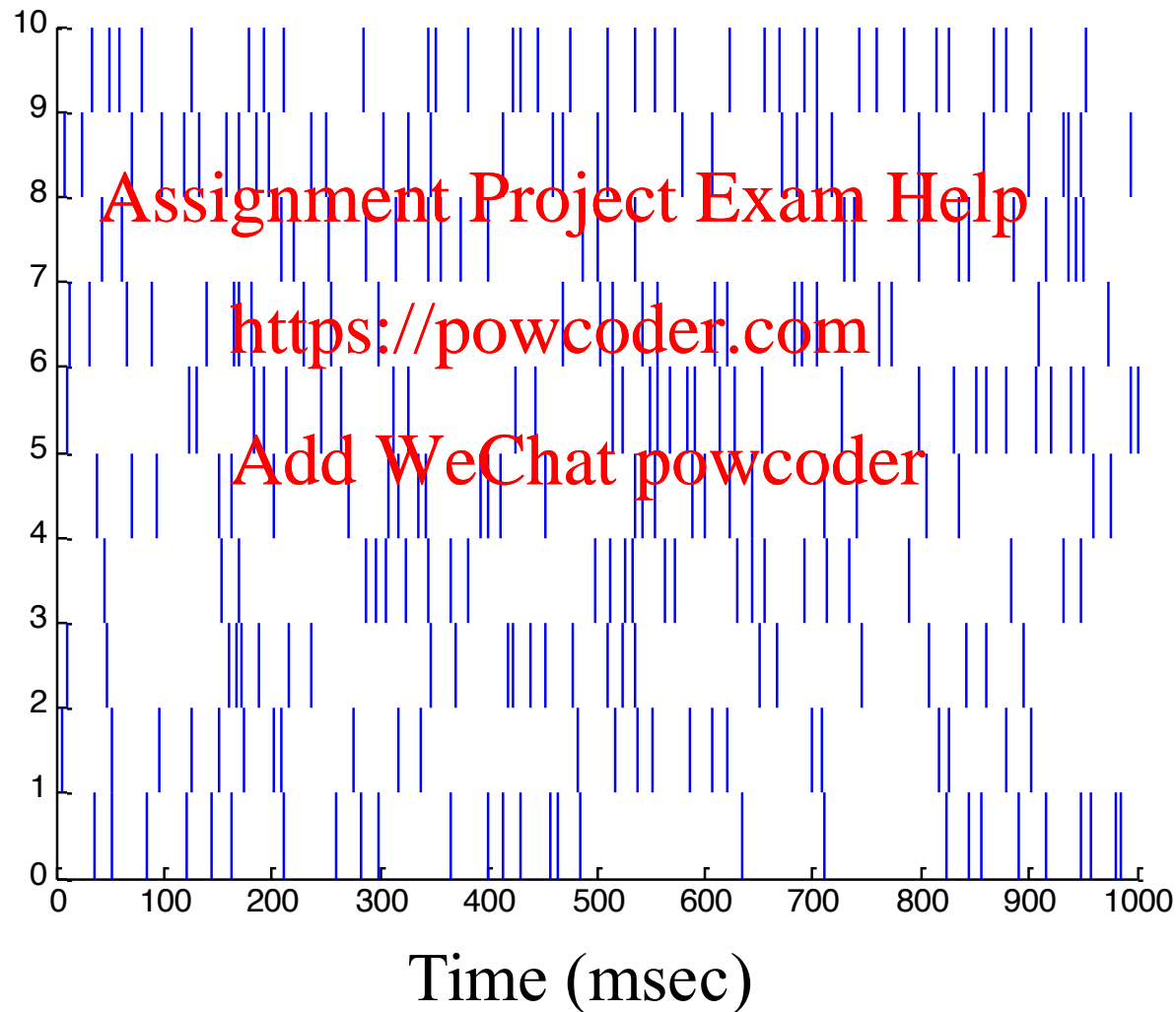# Poisson ISI Histogram

ISI (msec)
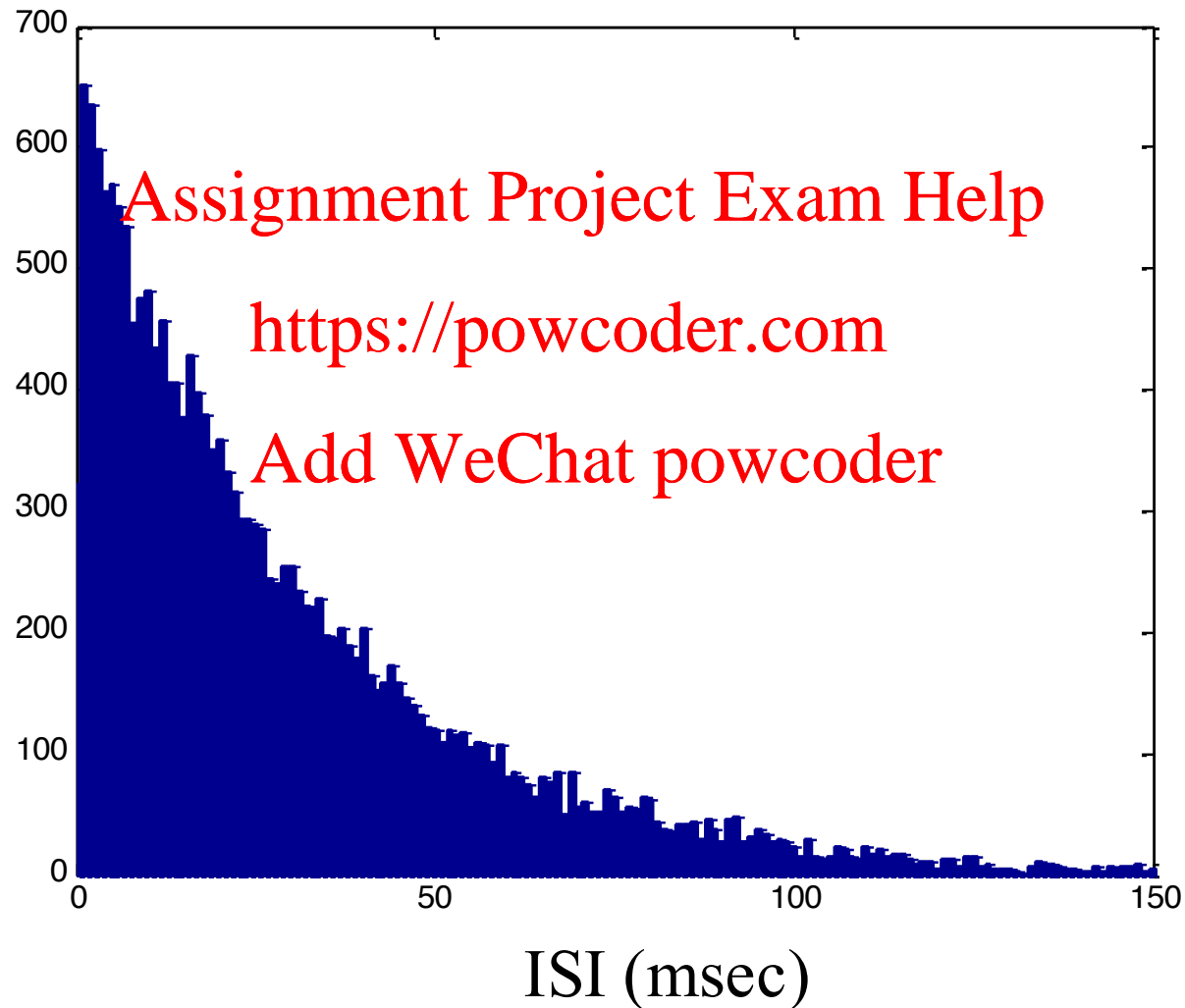
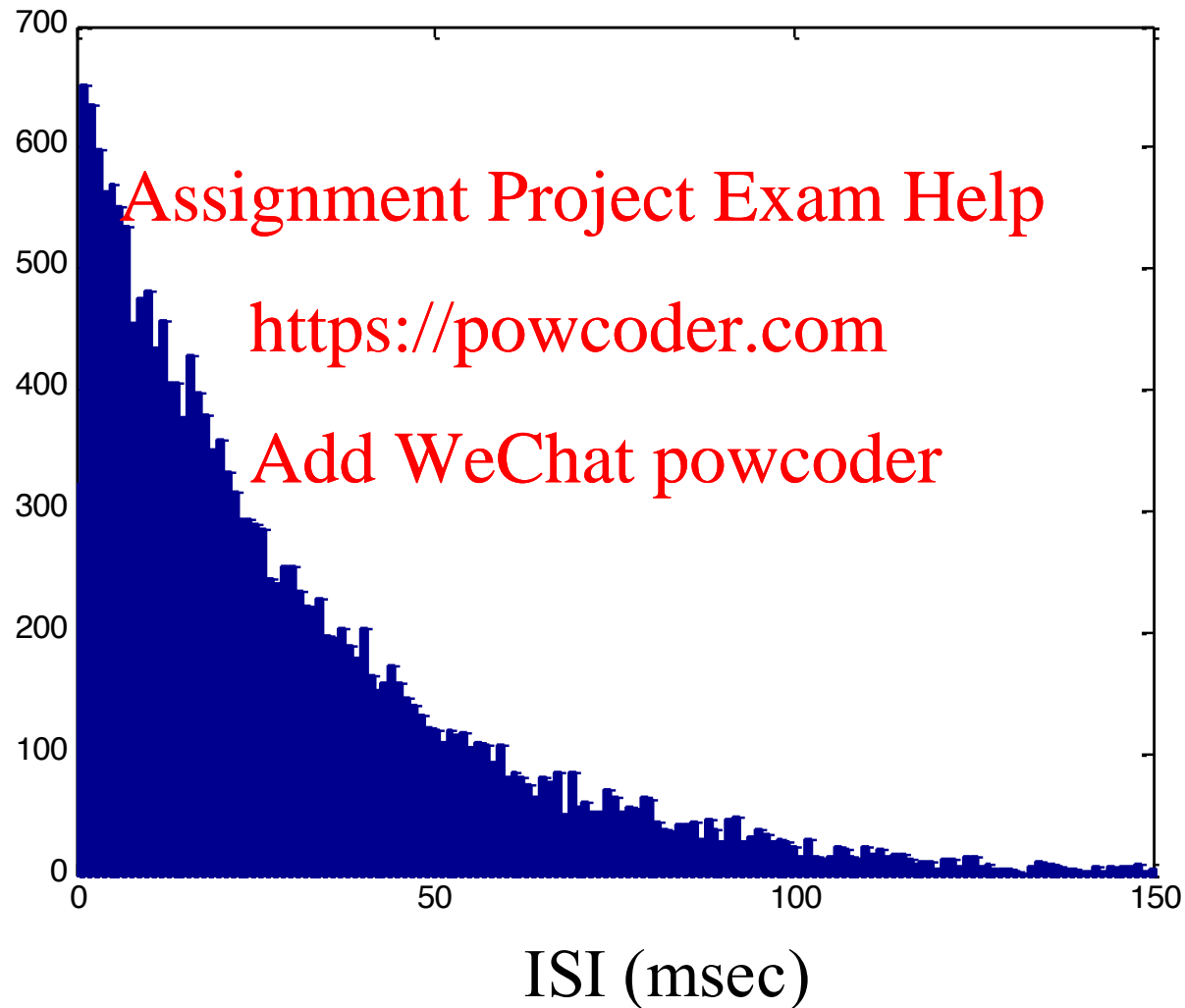# Sample Spectrum from Poisson Data
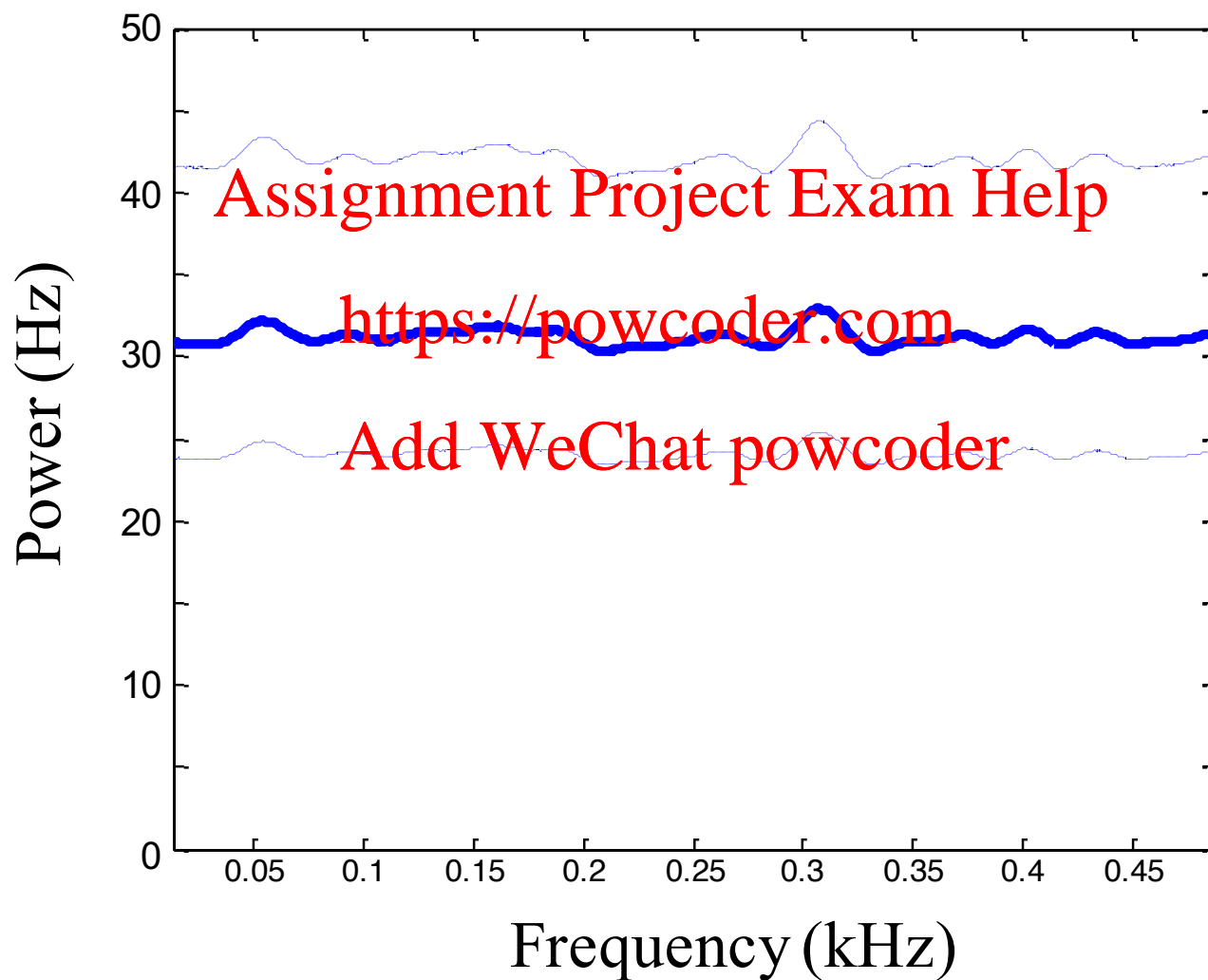
Example #1: Simple Poisson Process

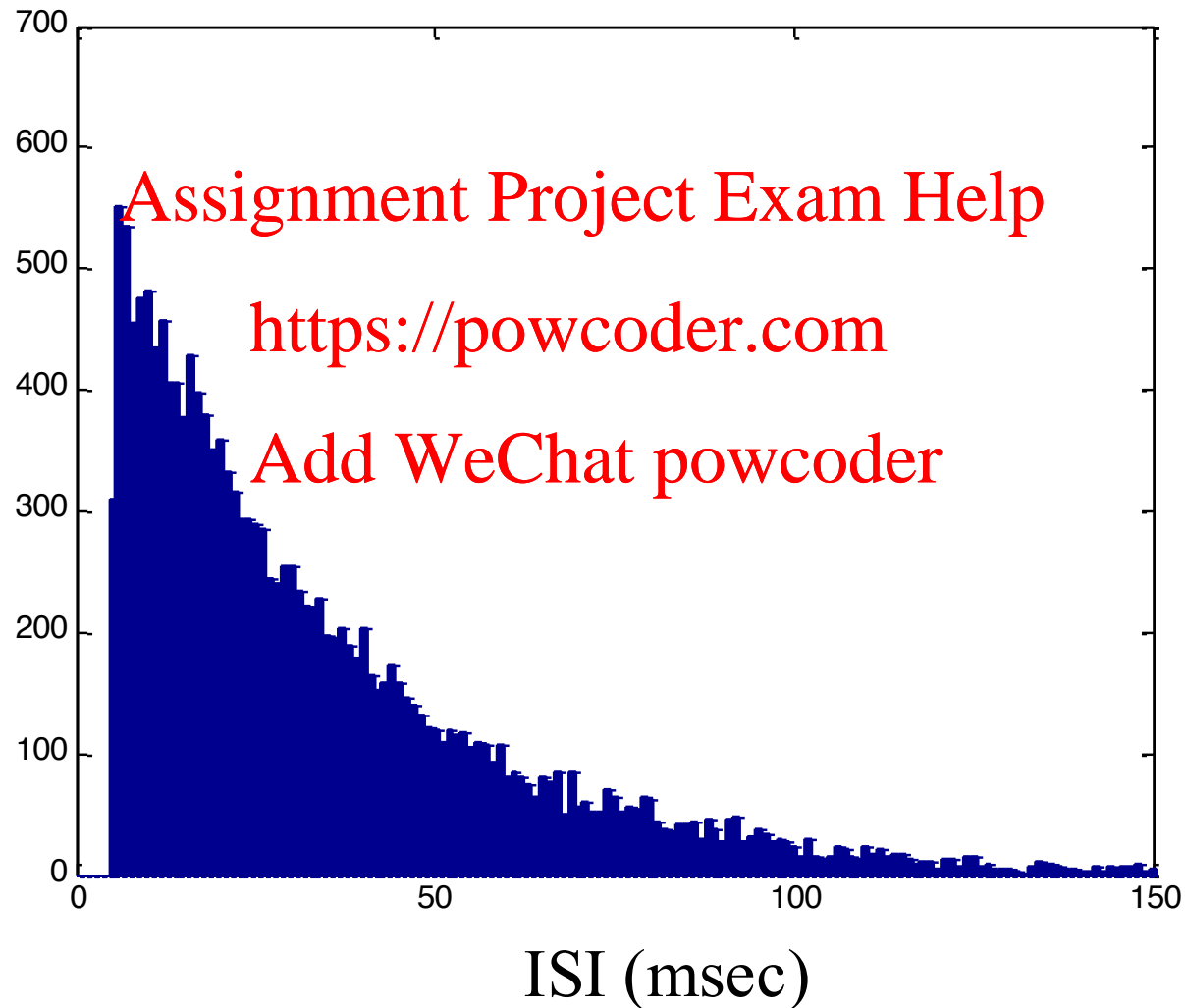# Example #2: Hard Refractory Period

Poisson ISI Histogram

Assignment Project Exam Help

https://powcoder.com
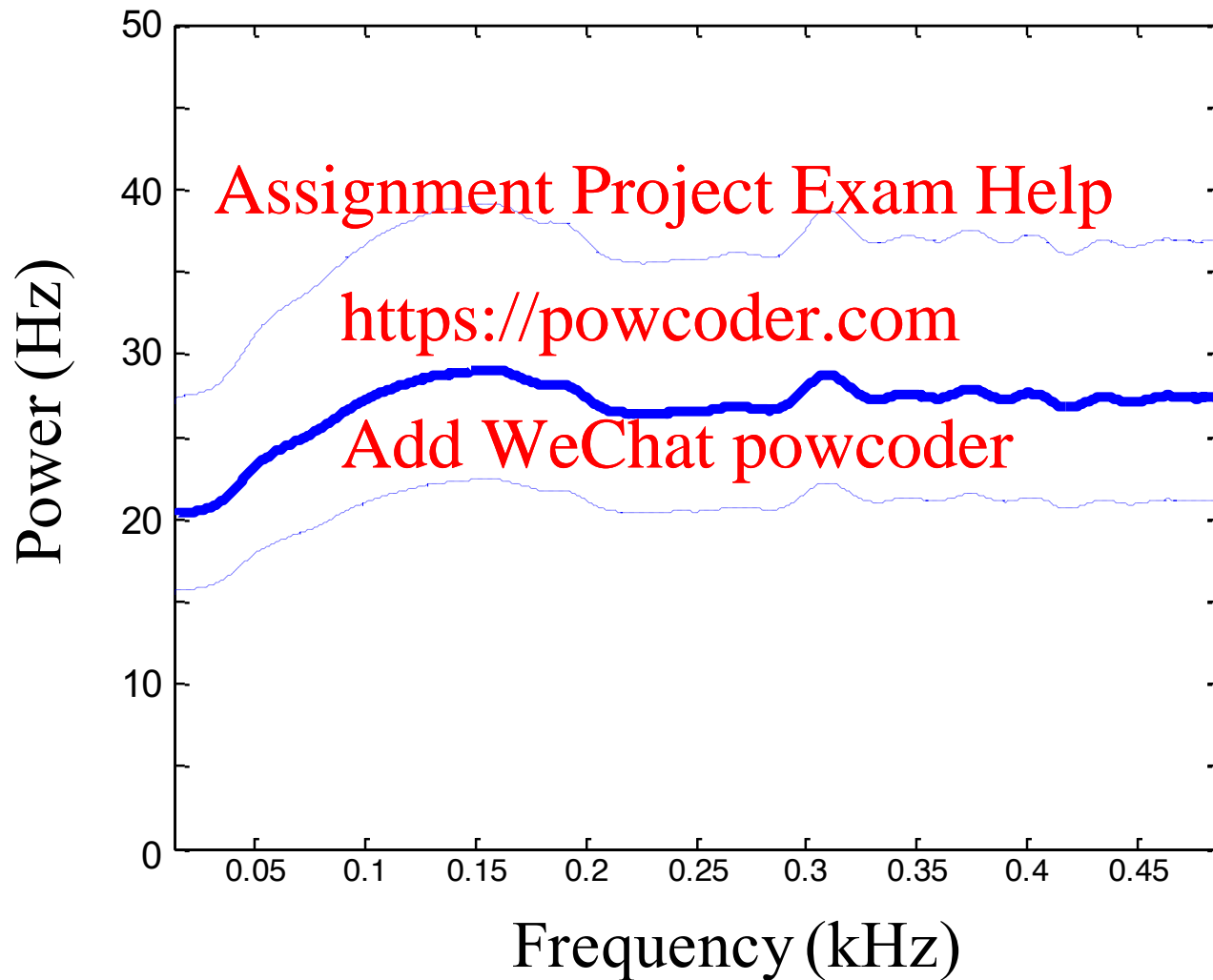
Add WeChat powcoder

ISI (msec)

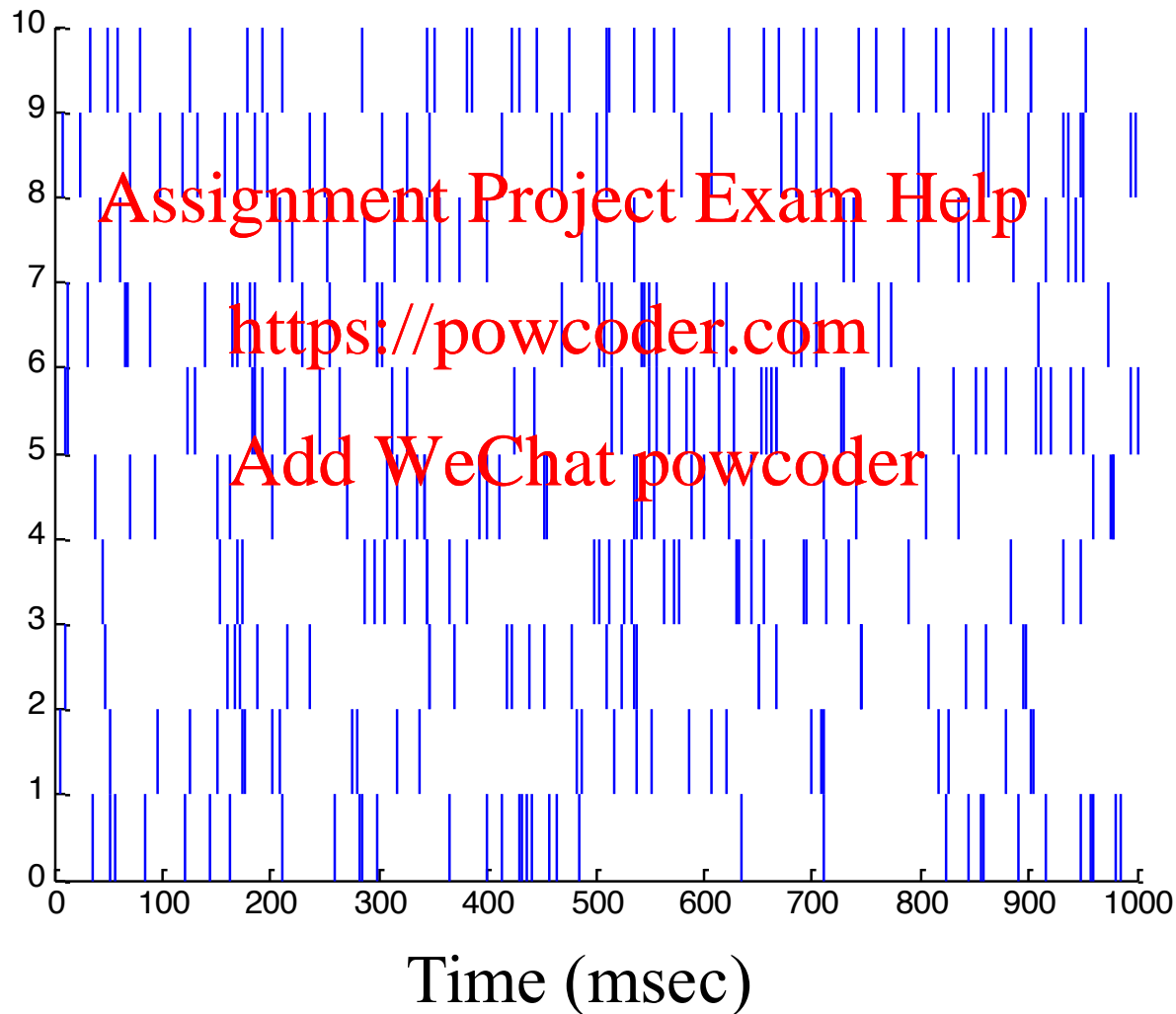# Refractory Process ISI Histogram

ISI (msec)

Sample Spectrum from Poisson Data
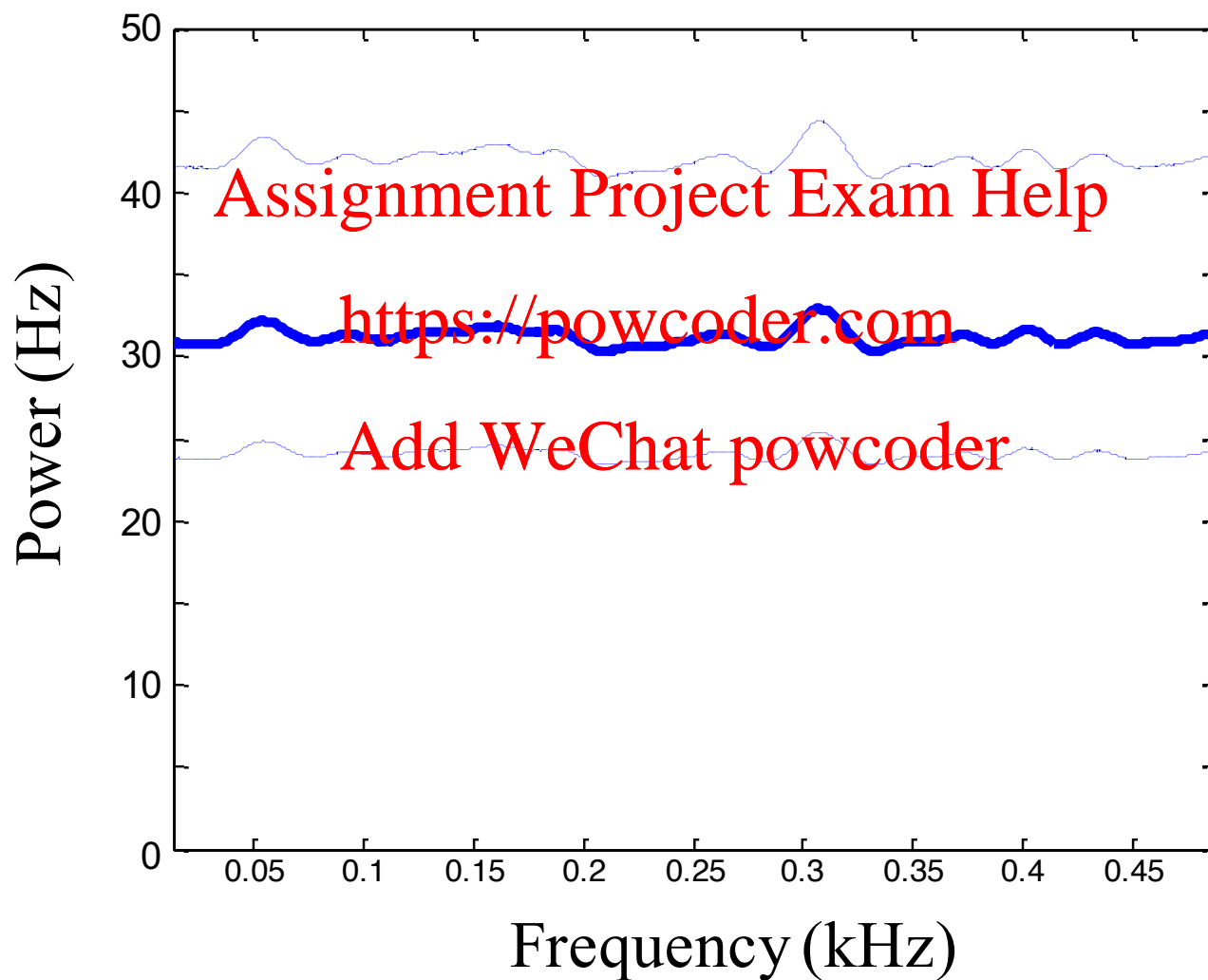
Refractory Process Sample Spectrum

Example #1: Simple Poisson Process

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Time (msec)

Example #3: Duplicate each spike at 10 ms lag

Time (msec)
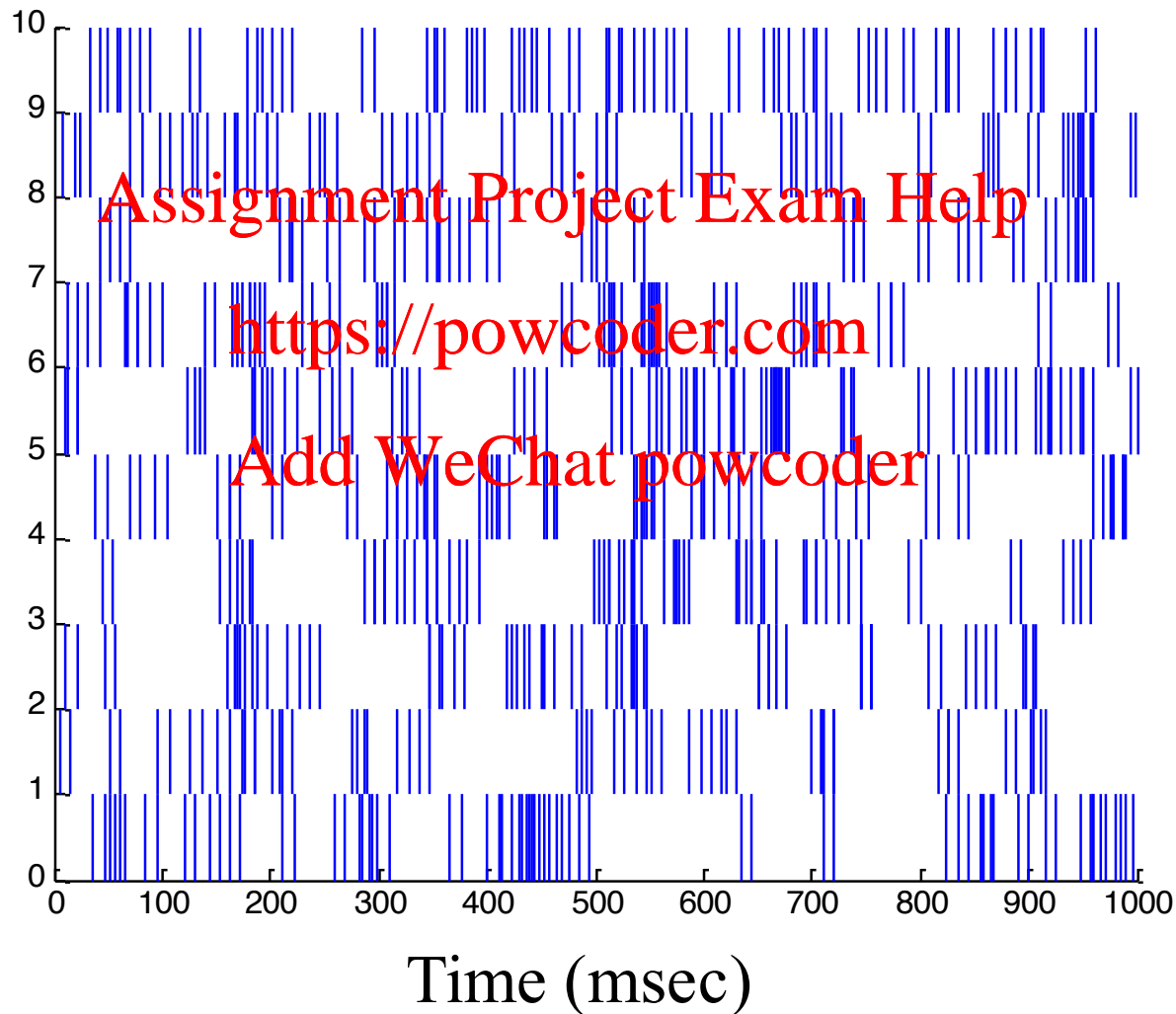
10 ms Repetition ISI Histogram

ISI (msec)
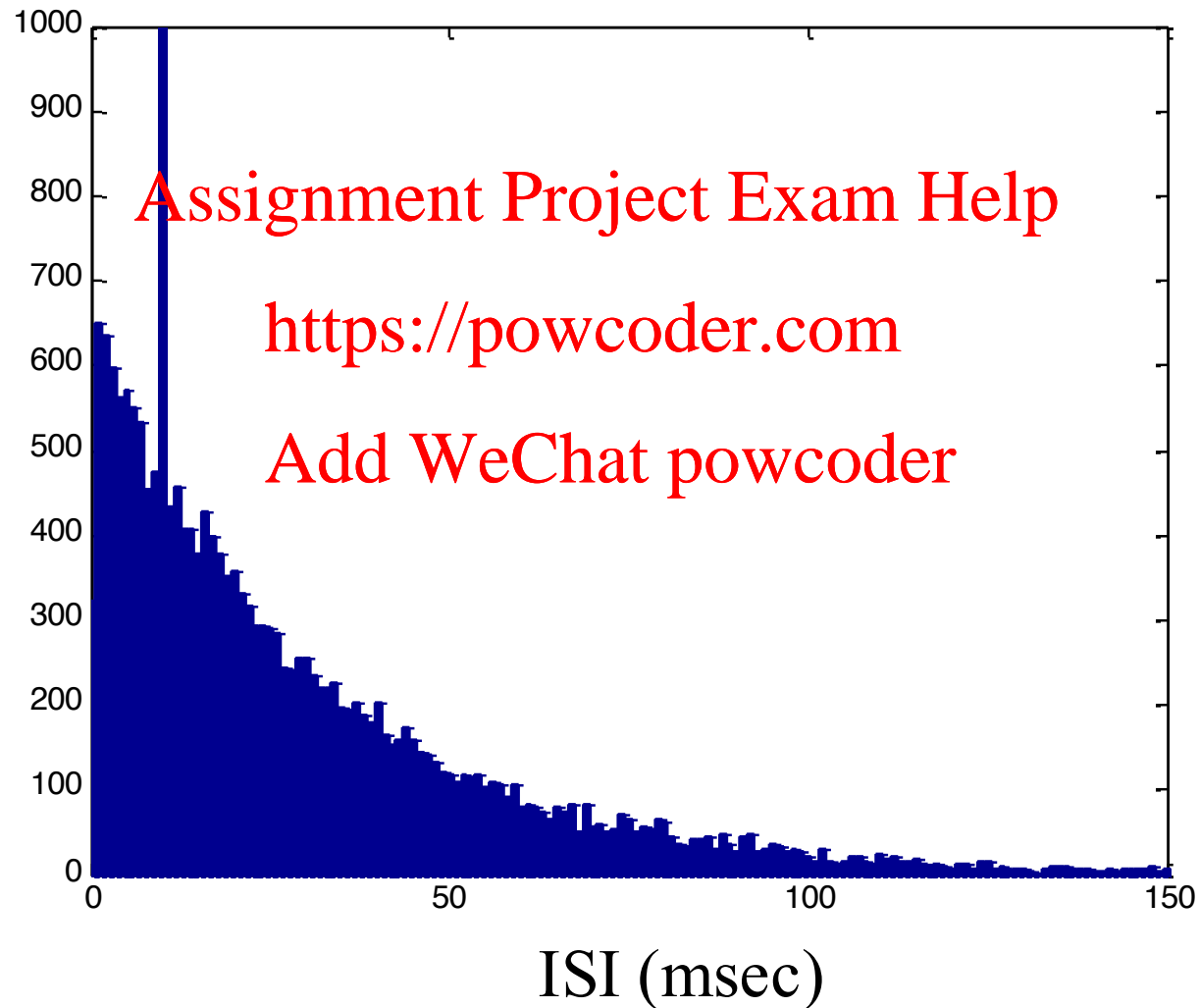
Repeated Spike Sample Spectrum

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder
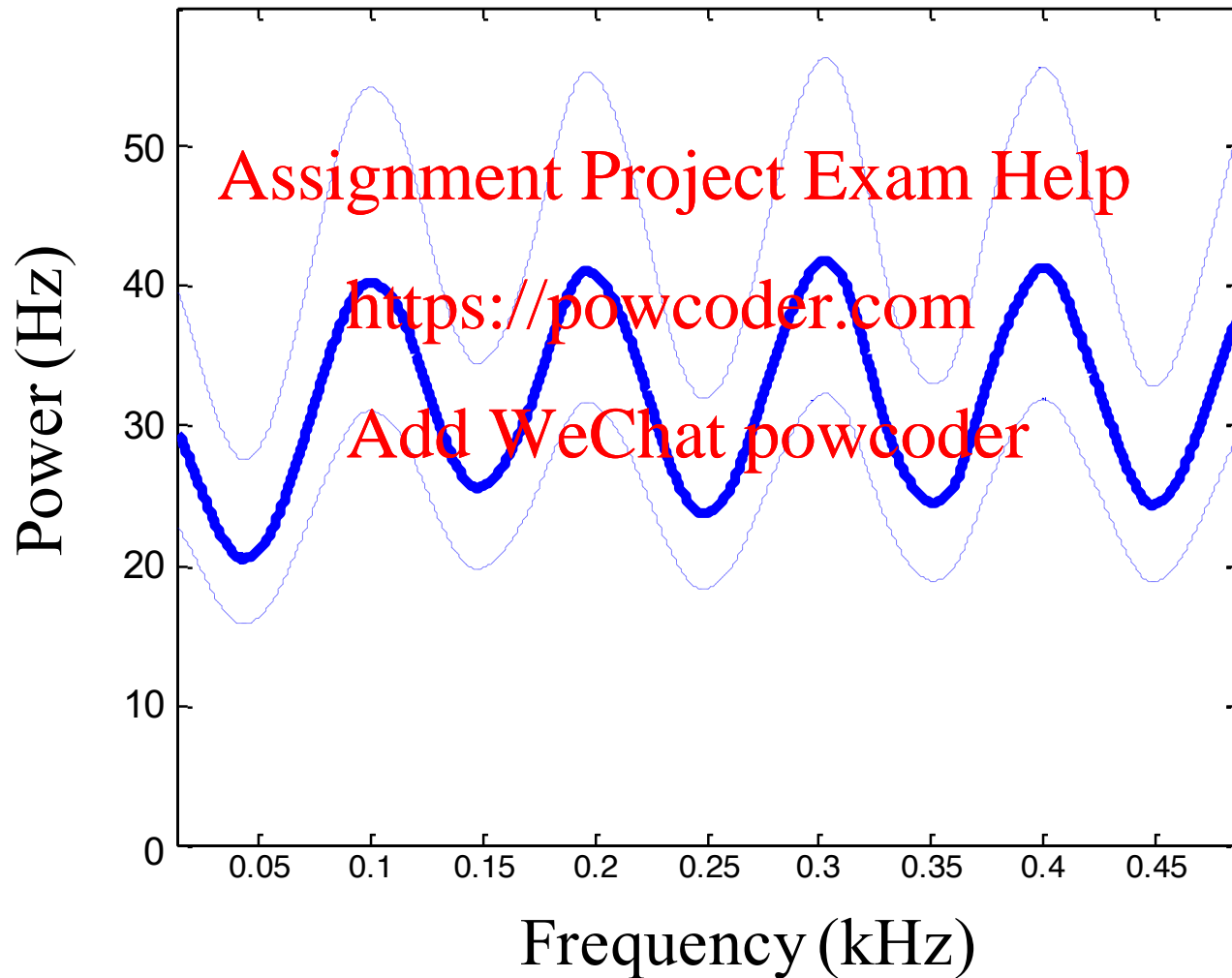
Example #4: Realistic Baseline Spiking Data

Time (msec)
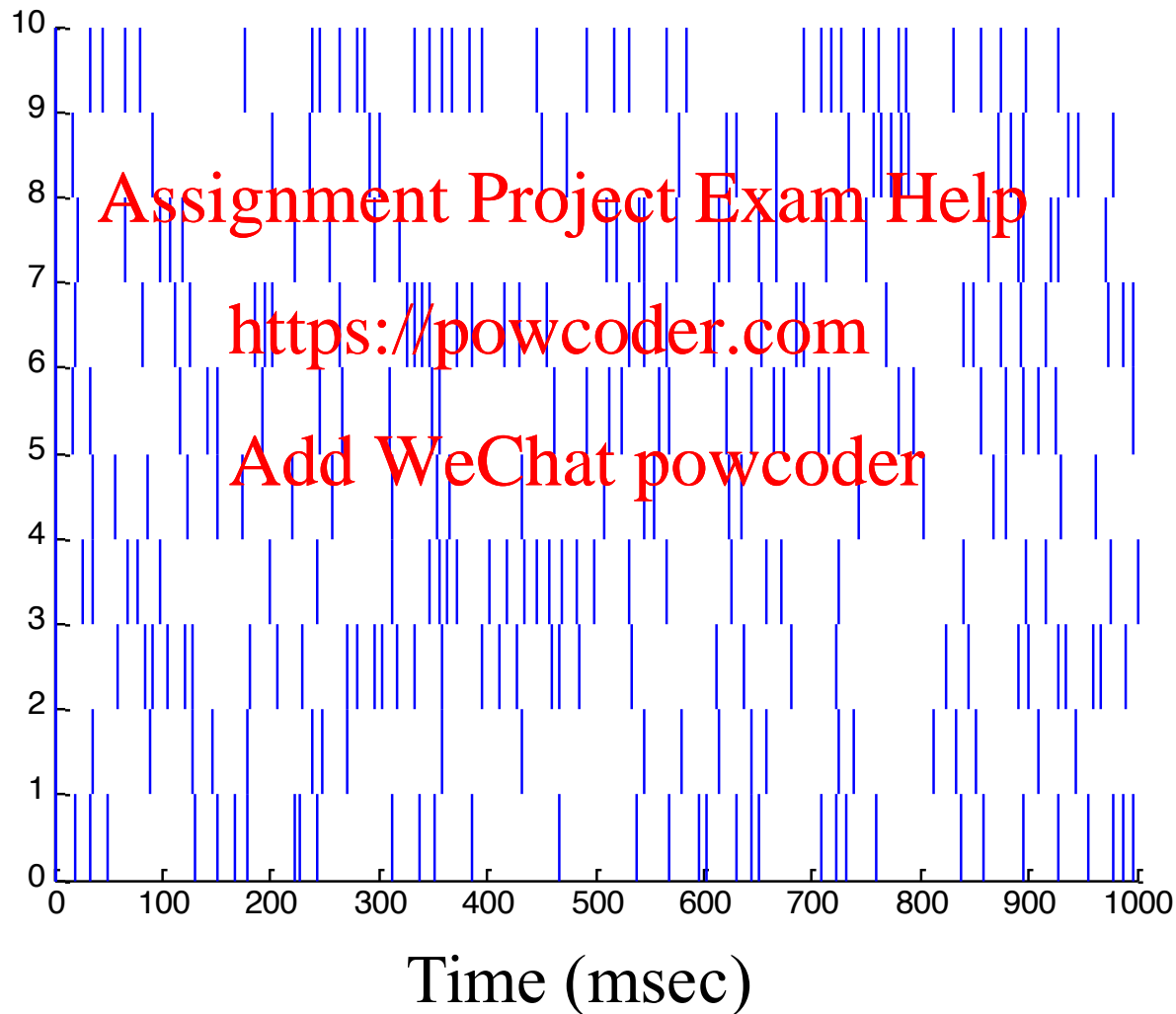
Baseline Spiking ISI

ISI (msec)
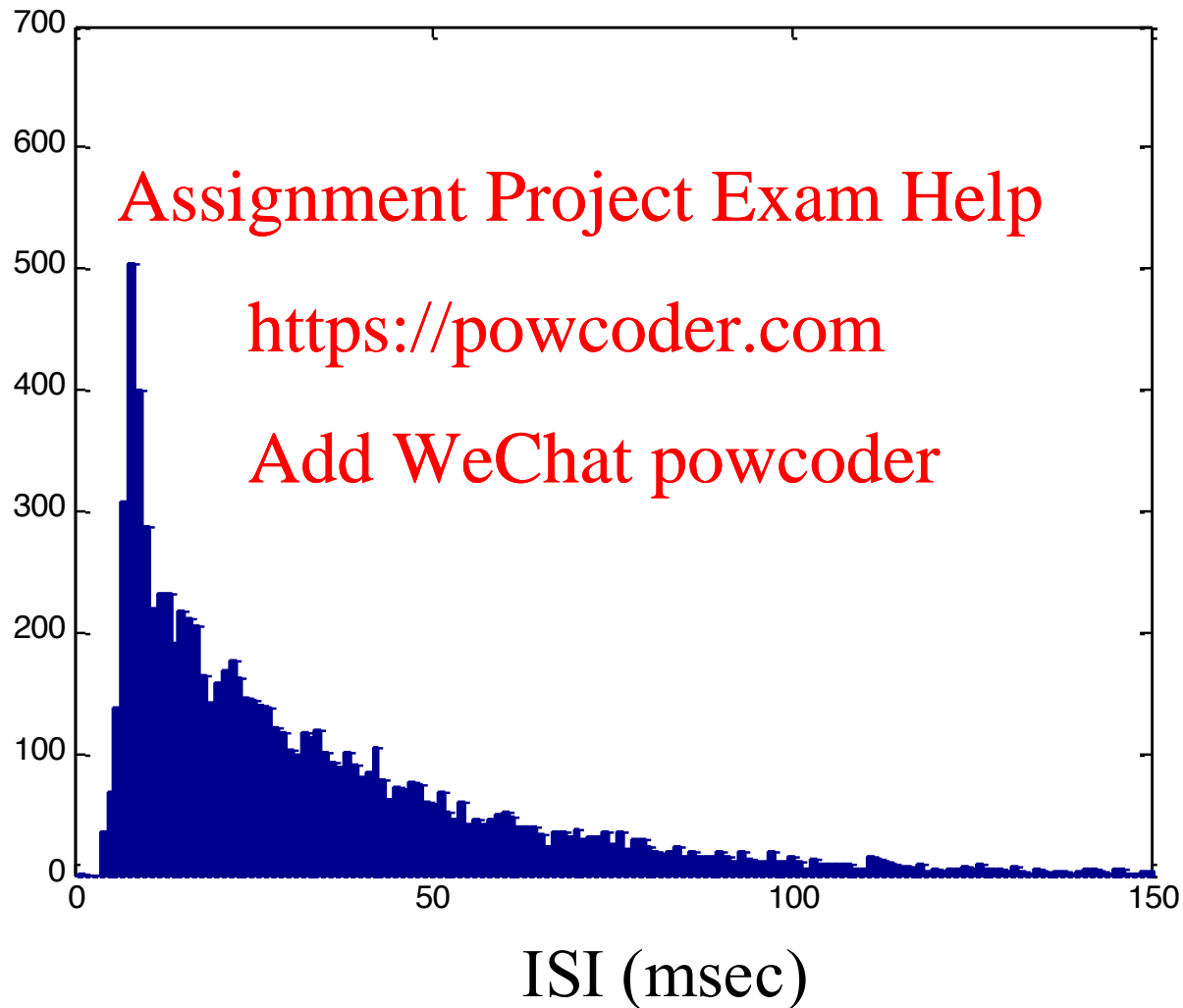
Sample Spectrum for Baseline Spiking

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder
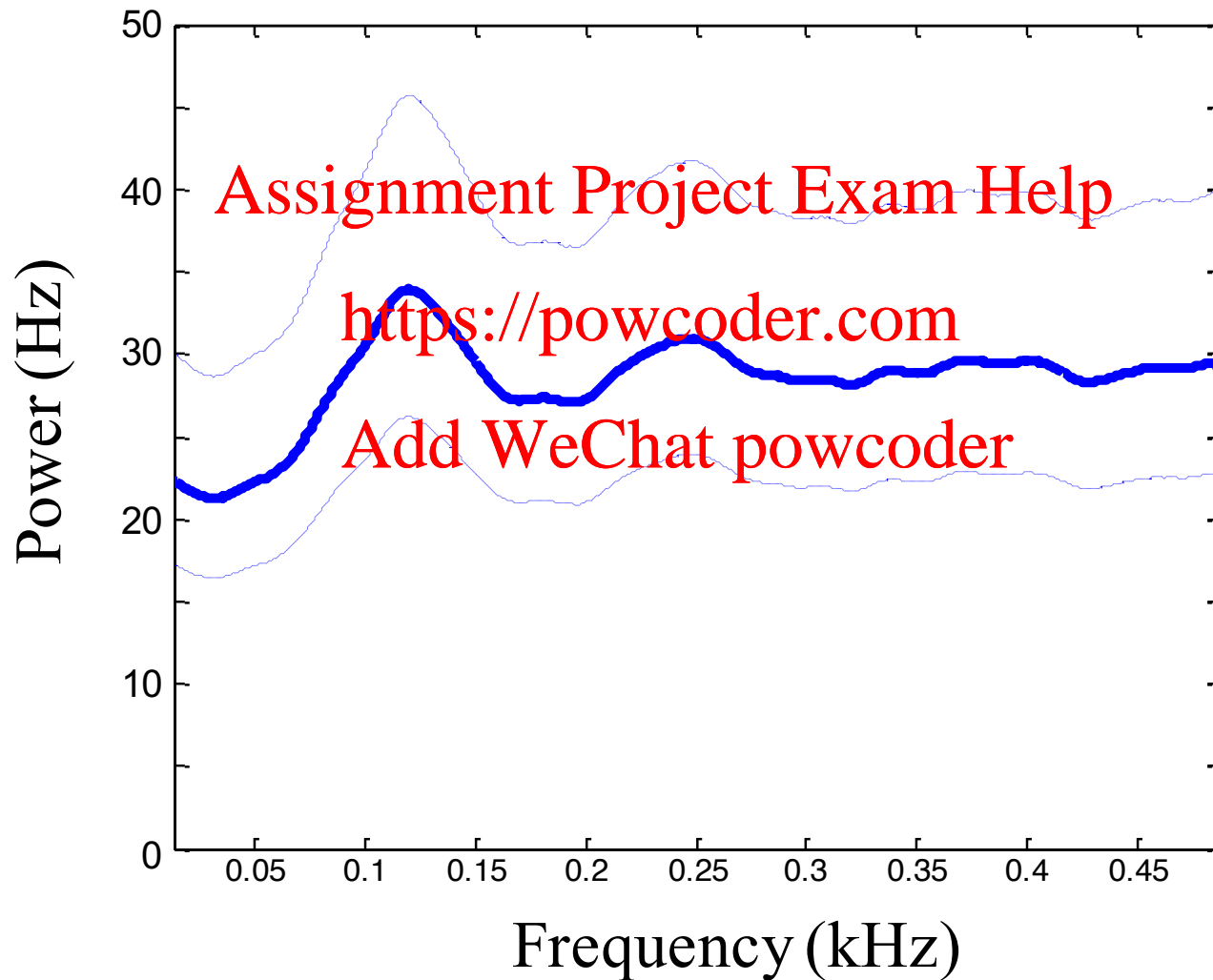
Case 1: An Analysis of the Spiking Activity of Retinal Neurons in Culture (Iygengar and Liu, 1997)
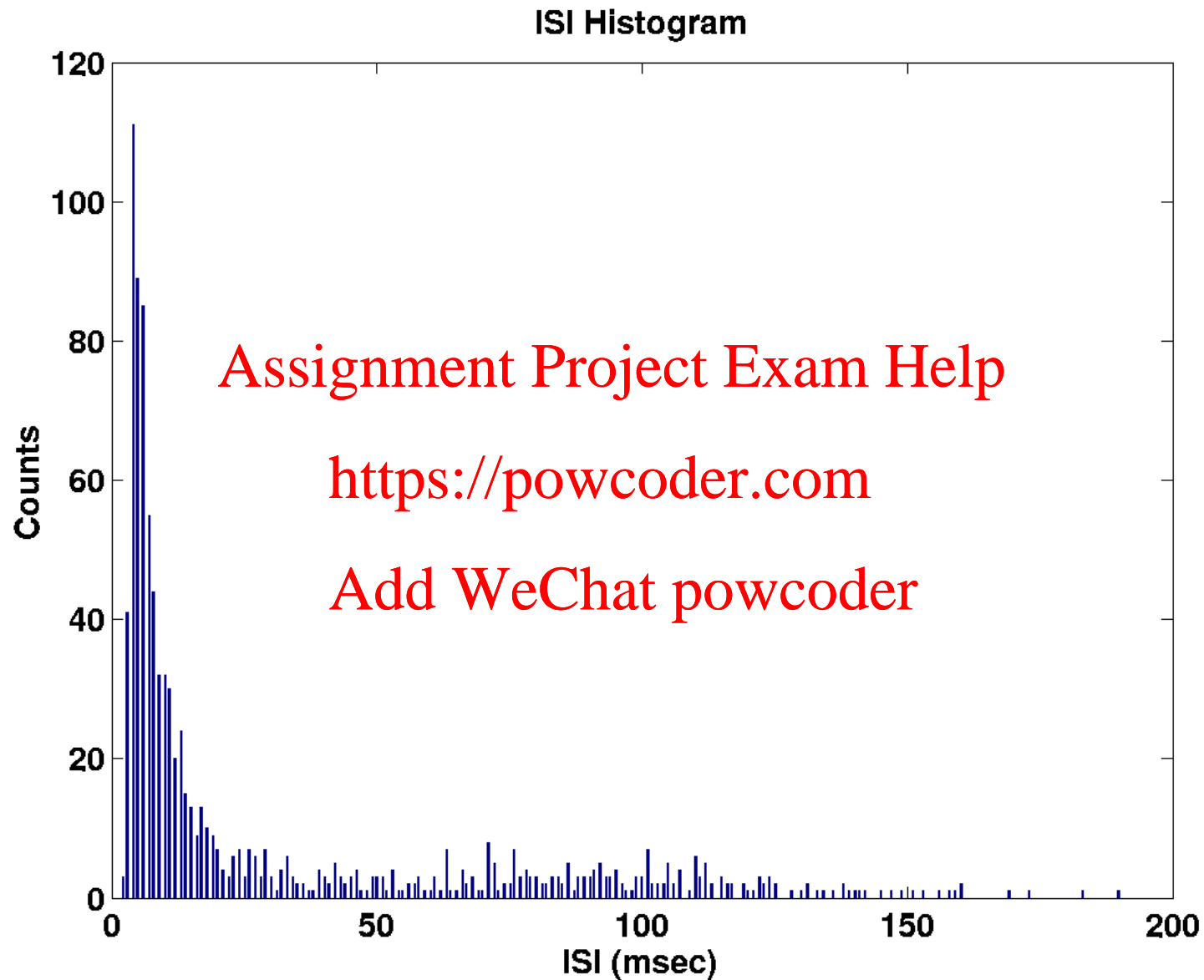
Retinal neurons are grown in culture under constant light and environmental conditions. The spontaneous spiking activity of these neurons is recorded. The objective is to develop a statistical model which accurately describes the stochastic structure of this activity.

Spike Train

Time (sec)
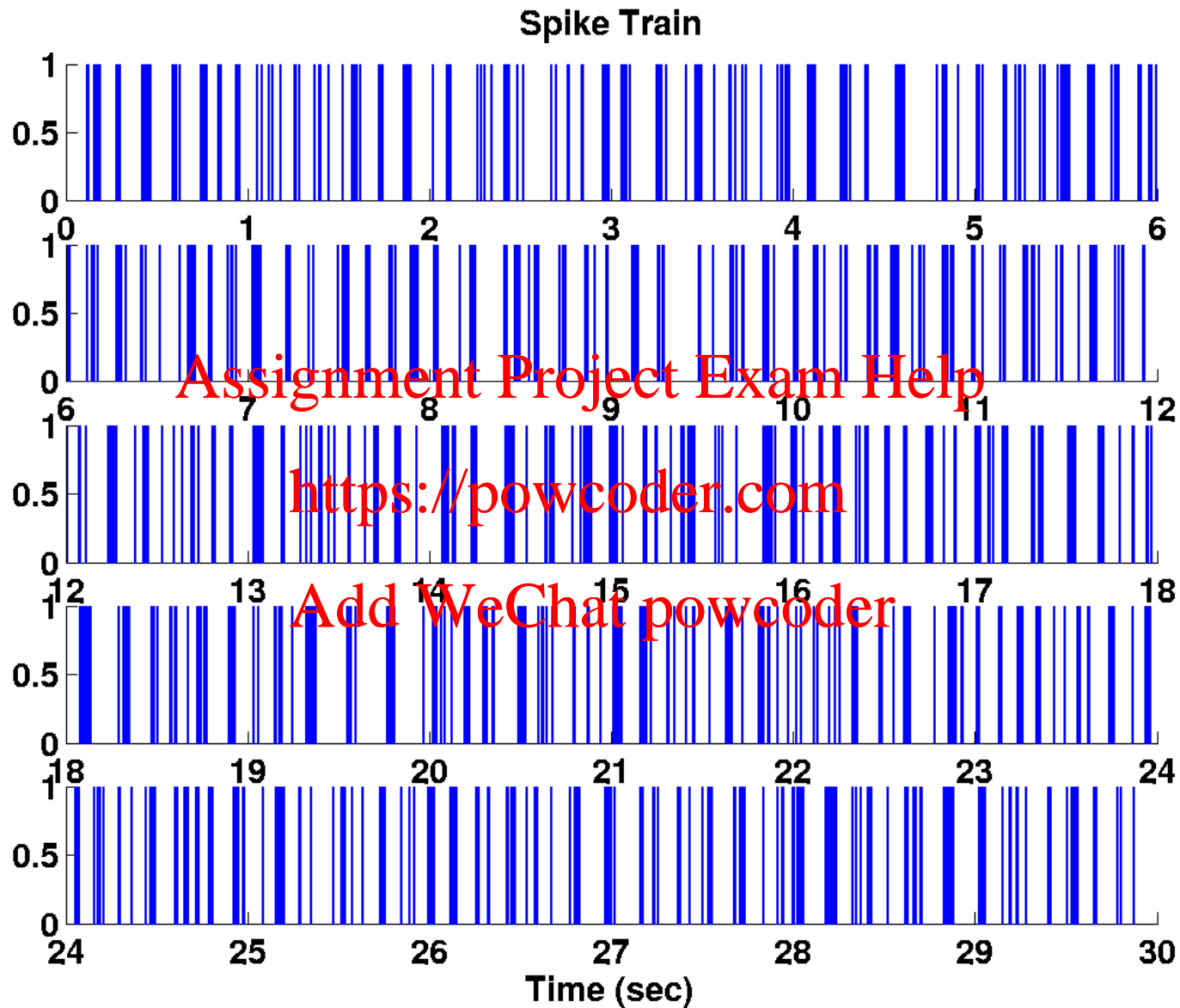
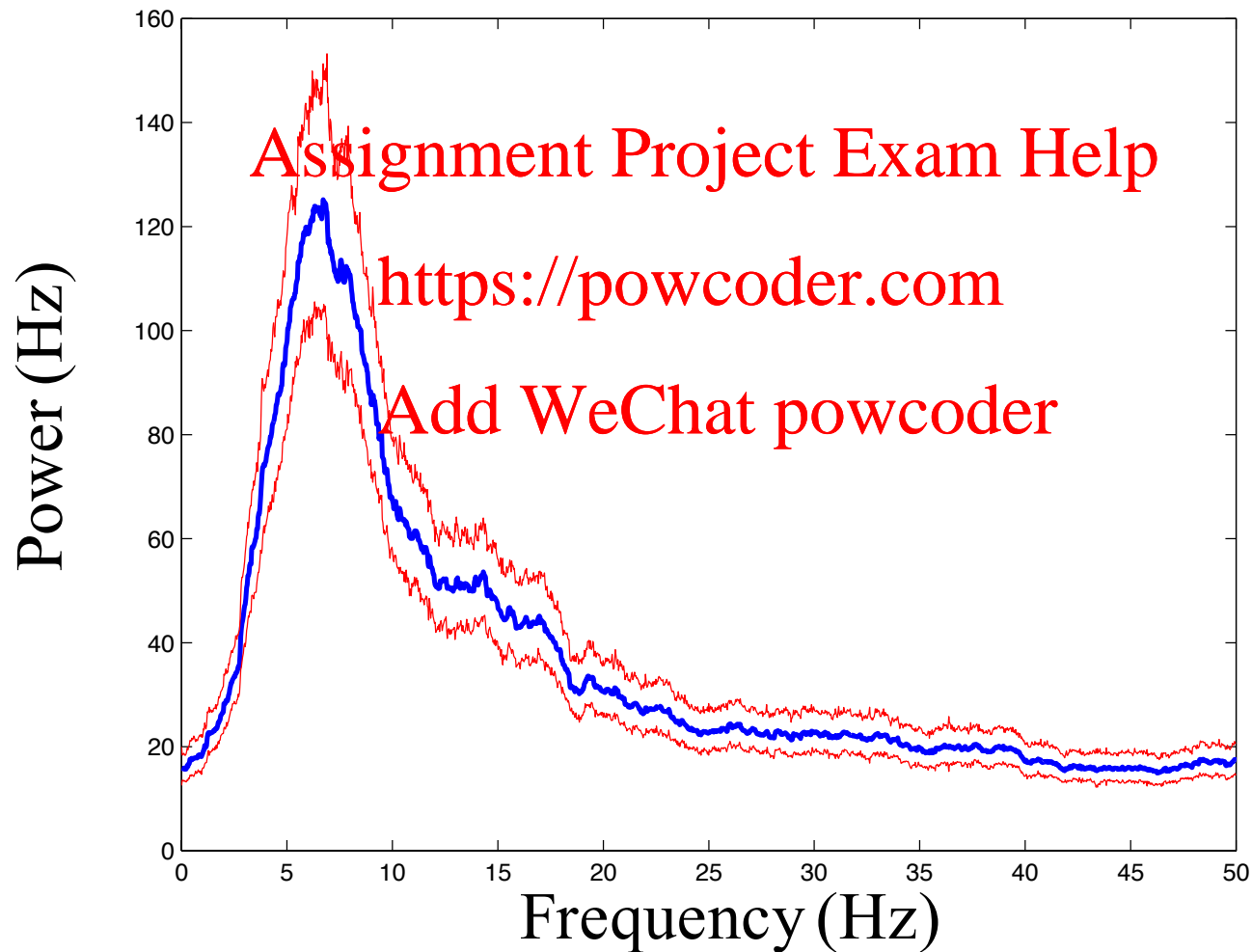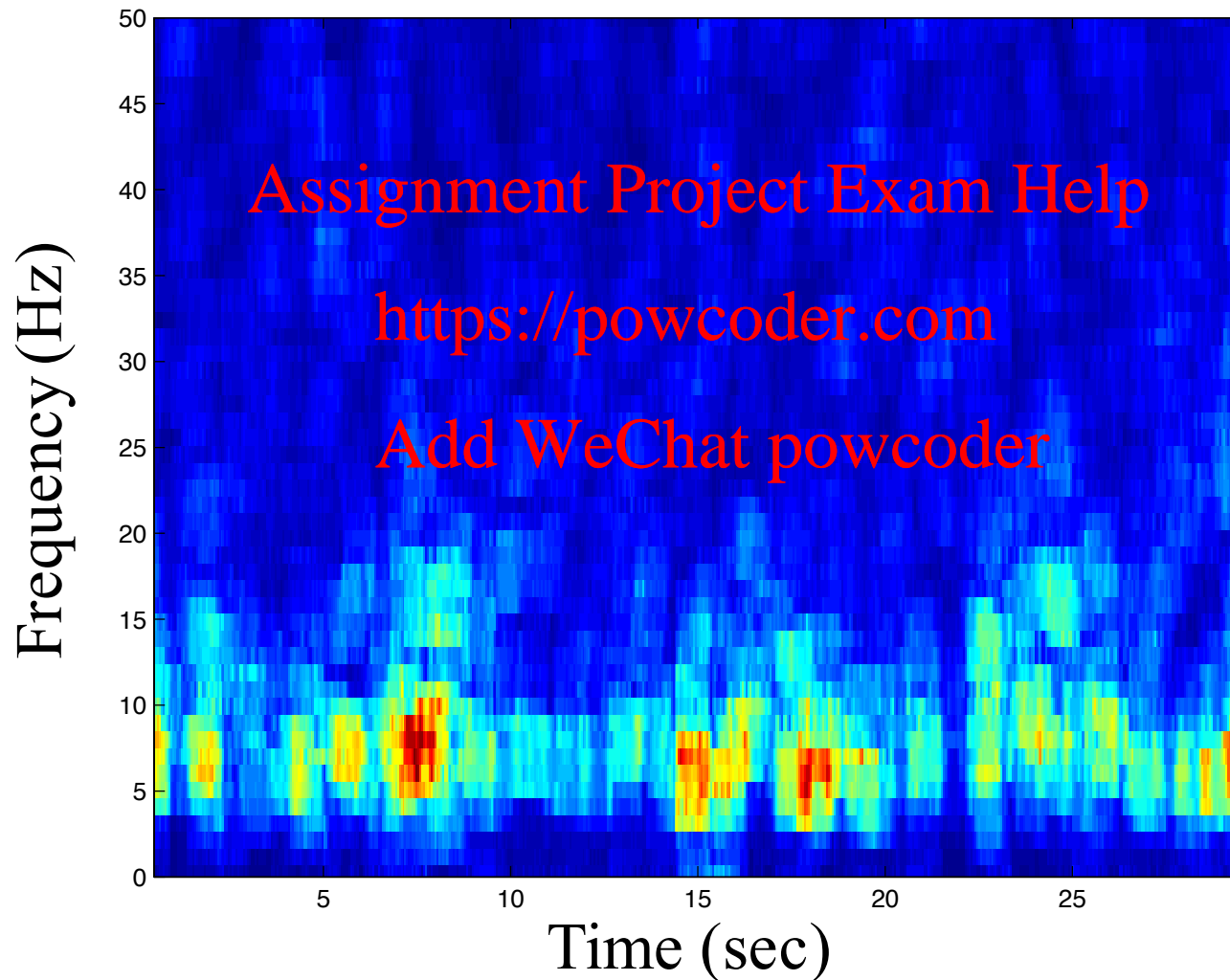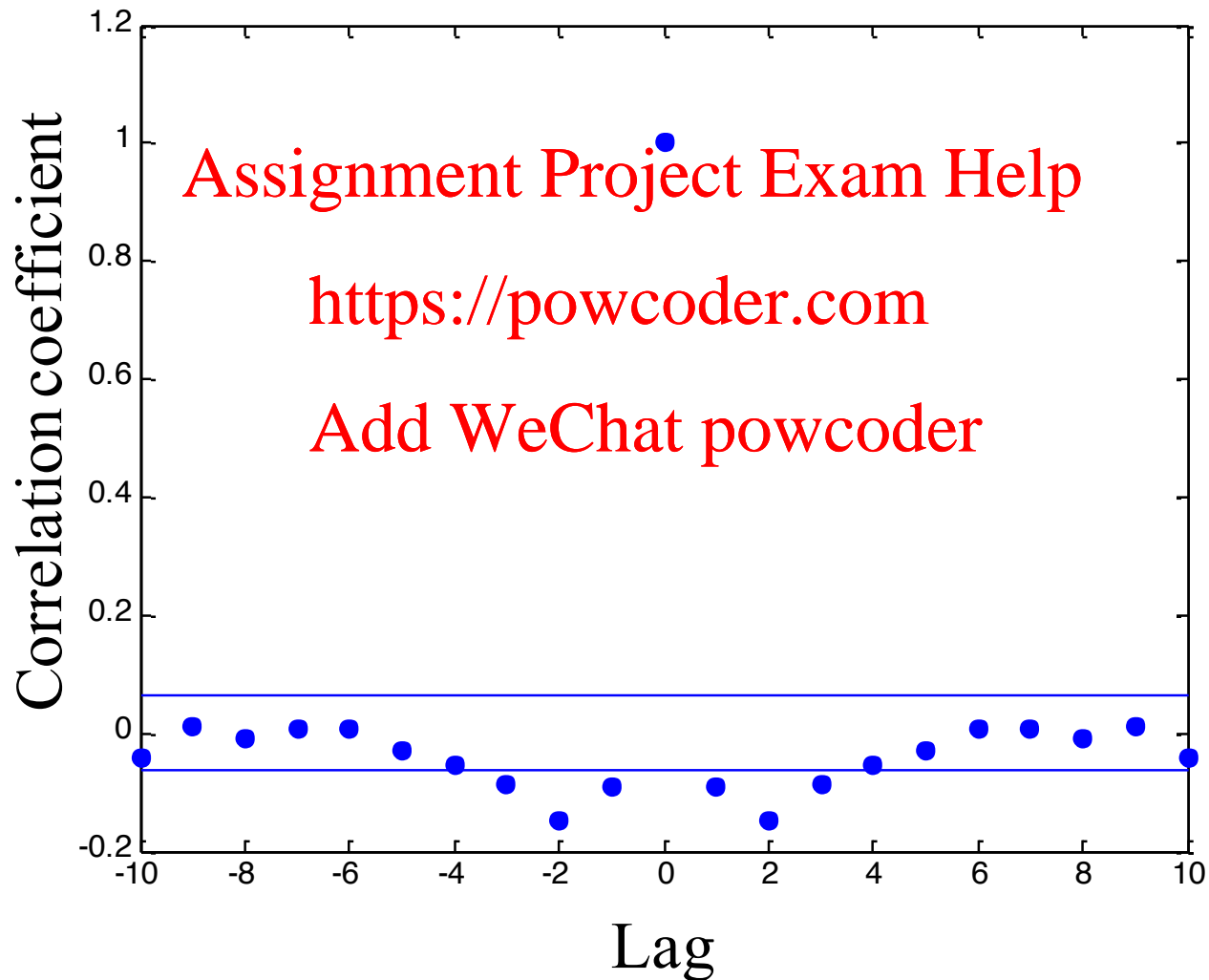ISI Histogram

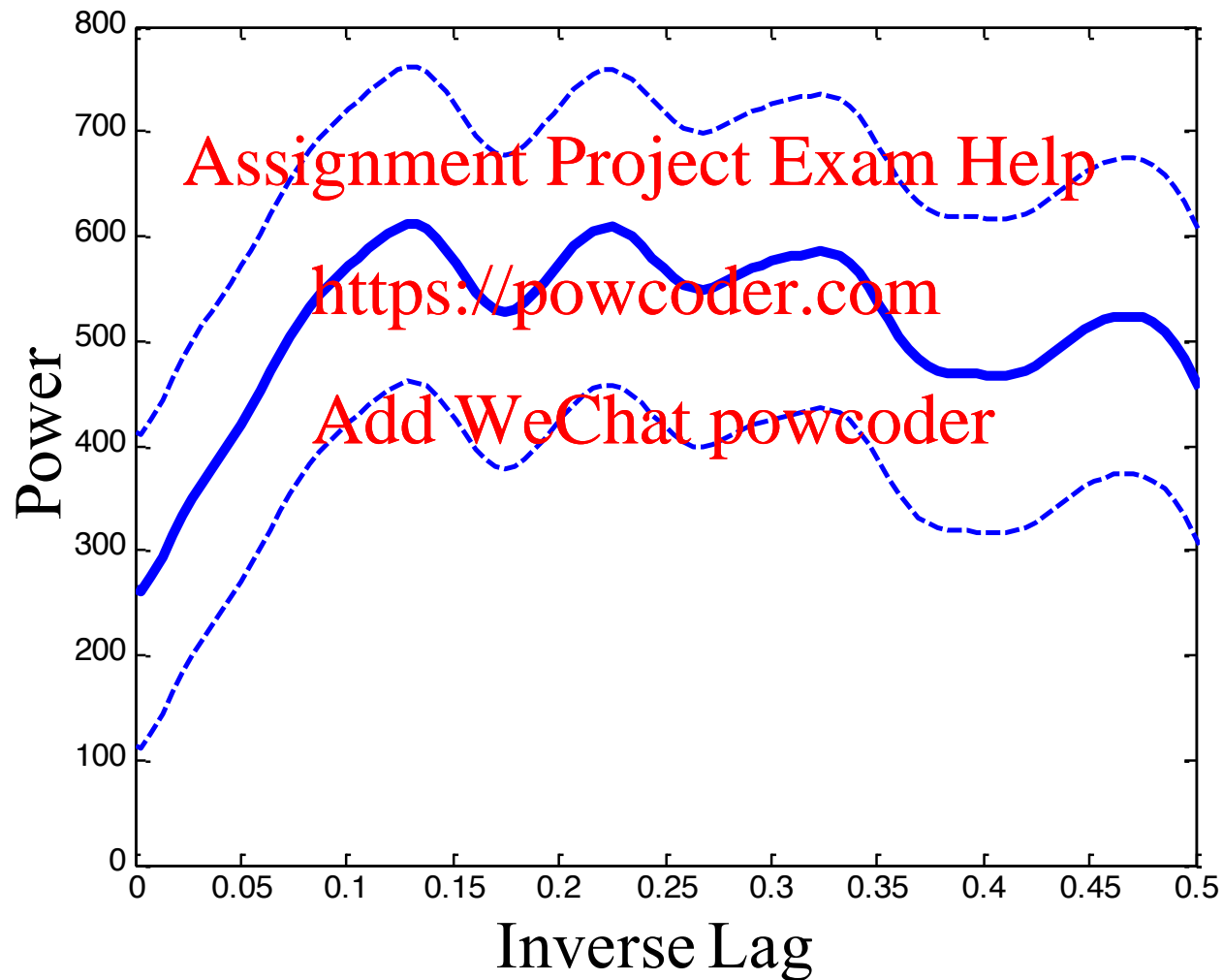# Retinal Baseline Data Spectrum

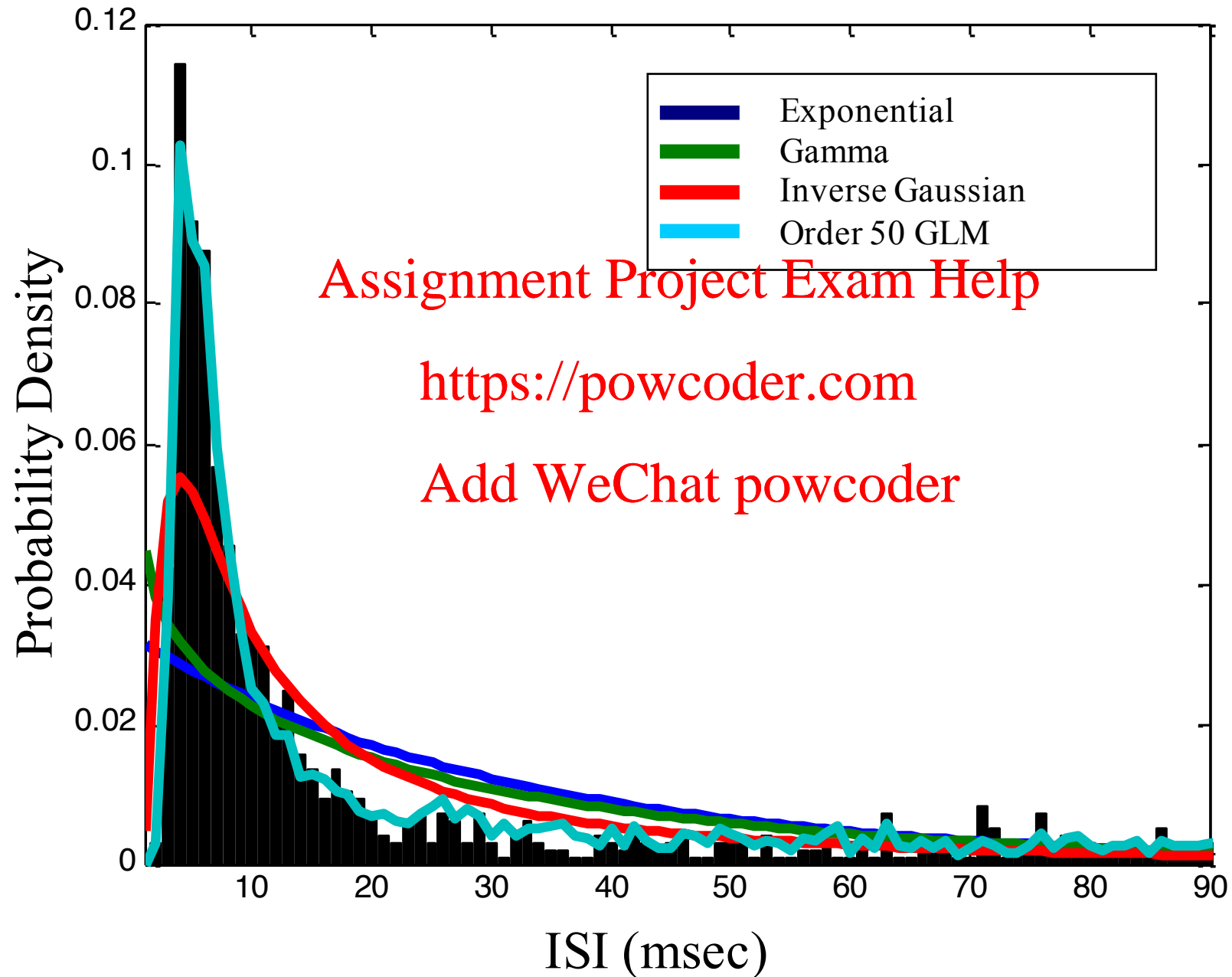# Retinal Baseline Data Spectrogram

Autocorrelation of interspike intervals

Interval Spectrum

ISI Histogram

Legend:
- Exponential
- Gamma
- Inverse Gaussian
- Order 50 GLM

Y-axis: Probability Density (0, 0.02, 0.04, 0.06, 0.08, 0.1, 0.12)
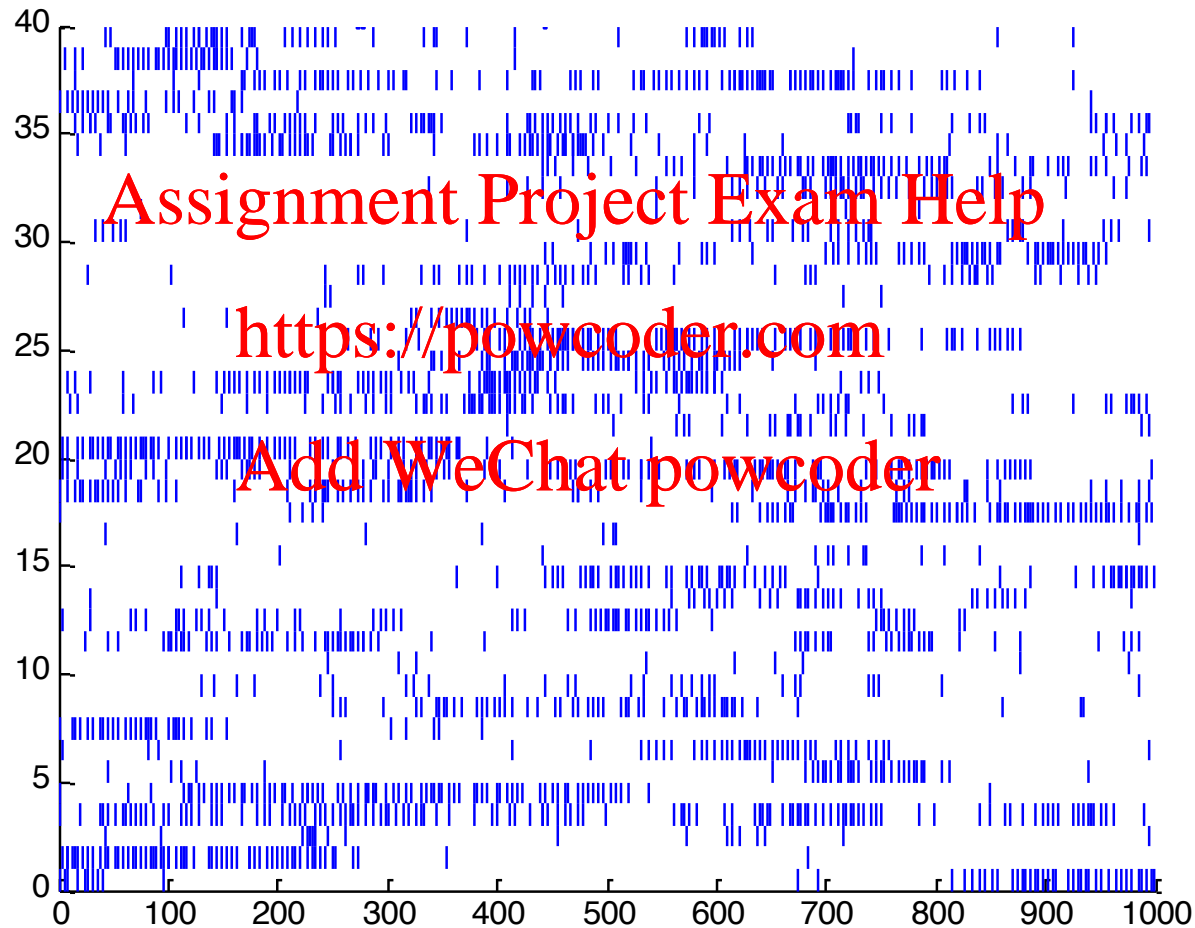
X-axis: ISI (msec) (10, 20, 30, 40, 50, 60, 70, 80, 90)
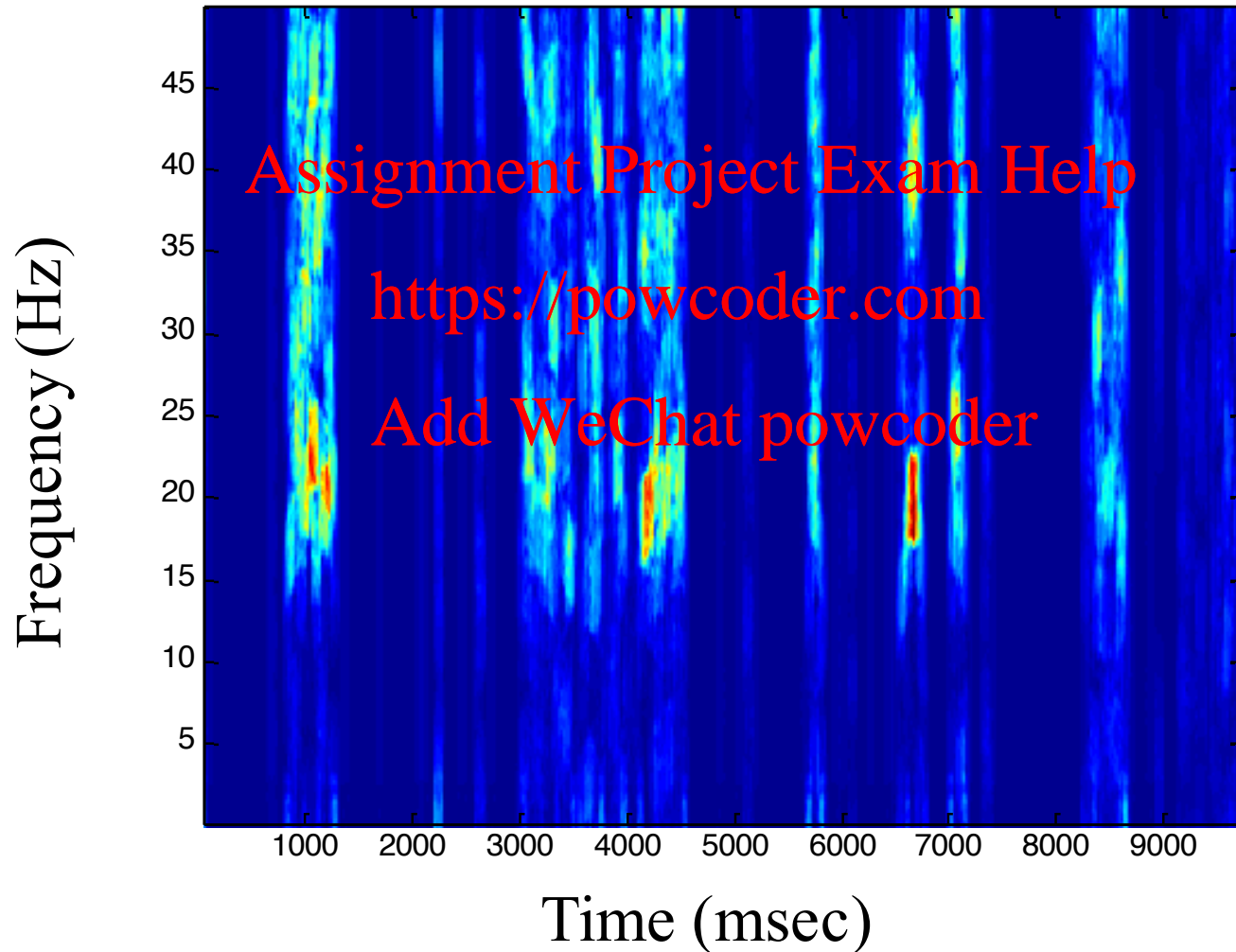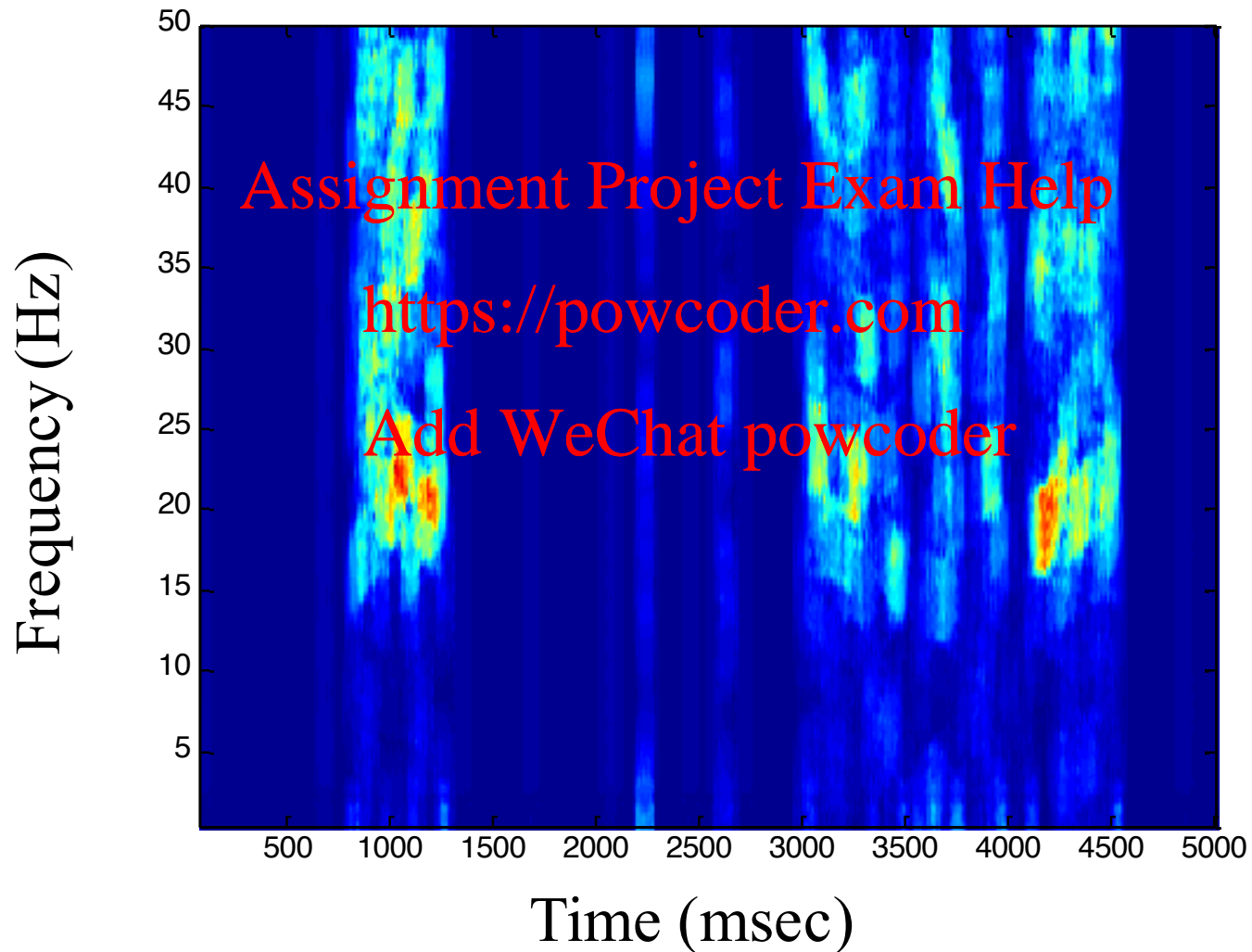
Hippocampal Place Field
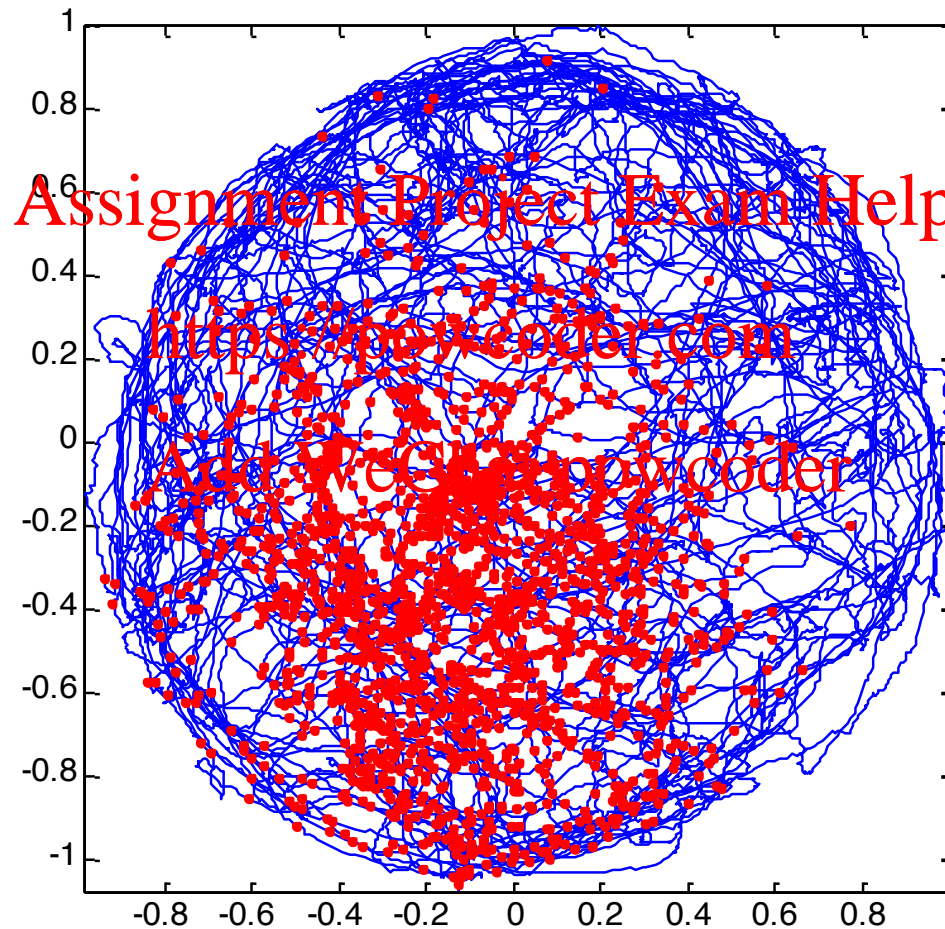
Hippocampal Place Field

Place Field Spectrogram
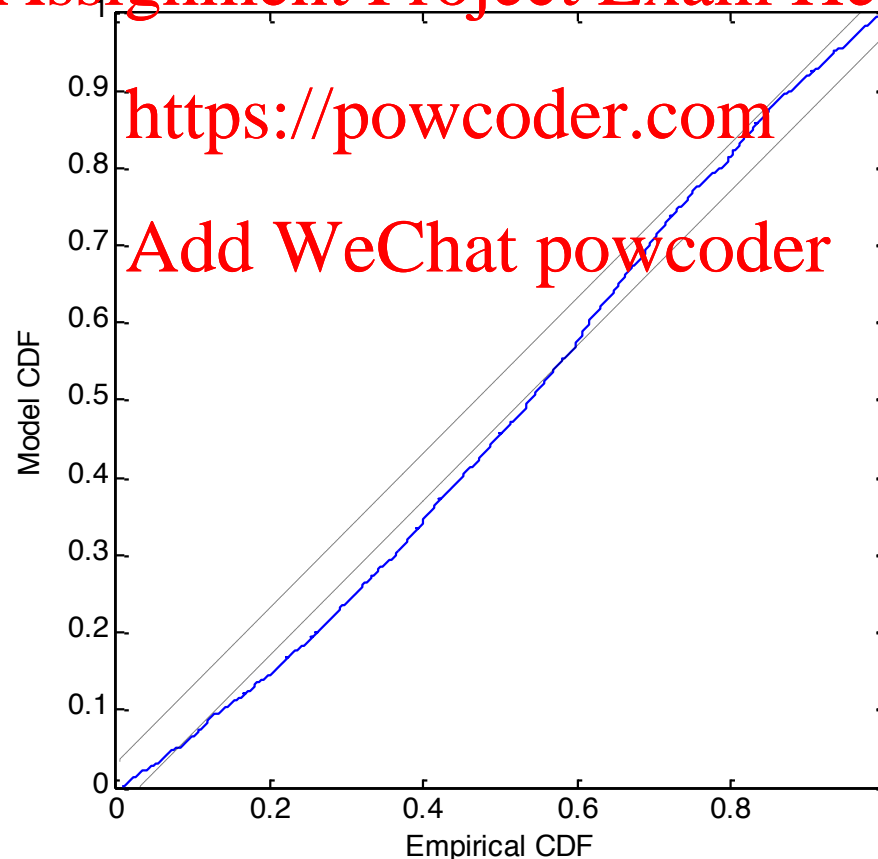
Place Field Spectrogram

Place Field Analysis from Problem Set #3

$$\lambda(t \mid H_t) = \lambda^S(\mathbf{xN}(t), \mathbf{yN}(t)) \exp\left\{ \sum_{i=1}^{p} \beta_i \cdot \texttt{spikes\_hist(:,i)} \right\}$$

Conclusions

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

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