

Homework 2

IEOR: 4574

Due date: Feb. 03.

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- **Question 1a:** In the class Normal distribution $\mathcal{N}[\mu, \sigma^2]$ was discussed. Using the PDF of the Normal distribution, $f_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$, plot the bell curves for the following parameters. [**Points 15**]

- $\mu = 0, \sigma^2 = 1$. Let RV $X \in [-8, 8]$.
- $\mu = -5, \sigma^2 = 6$. Let RV $X \in [-15, 15]$.
- $\mu = 100, \sigma^2 = 0.5$. Let RV $X \in [-105, 105]$.

Submit appropriately labeled visuals.

- **Question 1b:** In the class Poisson Distribution $\mathcal{P}[\lambda]$ was discussed. Using the Probability Mass Function (PMF) of the Poisson distribution, $P[X = i] = e^{-\lambda} \frac{\lambda^i}{i!}$, where λ , plot the PMF for the following parameters. [**Points 15**]

- $\lambda = 0.03$.
- $\lambda = 50$.
- $\lambda = 1000$.

Choose appropriate ranges of RV X for each parameter value.

Submit appropriately labeled visuals.

- **Question 2:** [**Points 20**]

Part a: Simulate the Poisson random process X_t for $t \in 0, \dots, 100$. Let $\lambda = 50$. Repeat the simulation four times.

Part b: Simulate the Normal random process X_t for $t \in 0, \dots, 100$. Let $\mu = 0, \sigma^2 = 1$. Repeat the simulation four times.

Submit appropriately labeled visuals.

- Example code HW2_ExampleCode.py is posted.

- **Question 3: [Points 20]**

Part a: Run the example code HW2_ExampleCode_2.py for plotting autocorrelation and PSD for “IPN31152N_Fred_Industrial Production Manufacturing Non-Durable Goods Ice Cream and Frozen Dessert.xlsx”.

Part b: Run the example code HW2_ExampleCode_2.py for plotting autocorrelation and PSD for “WholeFood.xlsx”, “Pharmaceutical.xlsx”, and “Viscosity.xlsx”. And provide a 50-word description of each.

Submit appropriately labeled visuals.

- Example code HW2_ExampleCode_2.py is posted.
- Data sets “IPN31152N_Fred_Industrial Production Manufacturing Non-Durable Goods Ice Cream and Frozen Dessert.xlsx”, “WholeFood.xlsx”, “Pharmaceutical.xlsx”, and “Viscosity.xlsx” are posted.