% Extract the columns from the imported table

dates = datetime(Book91.Date, 'InputFormat', 'dd/MM/yyyy'); % Convert strings to datetime

values = Book91.Value;

maxValues = Book91.MaxValue;

minValues = Book91.MinValue;

% Convert datetime to numeric for interpolation

numericDates = datenum(dates);

% Check for non-finite values and remove them

finiteIdx = isfinite(numericDates) & isfinite(values) & isfinite(maxValues) & isfinite(minValues);

numericDates = numericDates(finiteIdx);

values = values(finiteIdx);

maxValues = maxValues(finiteIdx);

minValues = minValues(finiteIdx);

% Interpolating data to fill gaps if necessary

% Create a full range of dates

fullNumericDates = min(numericDates):max(numericDates);

valuesInterp = interp1(numericDates, values, fullNumericDates, 'linear');

maxValuesInterp = interp1(numericDates, maxValues, fullNumericDates, 'linear');

minValuesInterp = interp1(numericDates, minValues, fullNumericDates, 'linear');

% Convert numeric dates back to datetime

fullDates = datetime(fullNumericDates, 'ConvertFrom', 'datenum');

% Plotting the Time Series

figure;

plot(fullDates, valuesInterp, 'Color', 'b', 'DisplayName', 'Value');

hold on;

plot(fullDates, maxValuesInterp, 'Color', 'r', 'DisplayName', 'Max Value');

plot(fullDates, minValuesInterp, 'Color', 'g', 'DisplayName', 'Min Value');

xlabel('Date');

ylabel('Values');

title('Time Series Plot');

legend('show');

grid on;

hold off;

% Manual calculation of CDF

figure;

[sortedValues, sortIdx] = sort(valuesInterp);

cdfValues = (1:length(sortedValues)) / length(sortedValues);

plot(sortedValues, cdfValues, 'b', 'DisplayName', 'Value');

hold on;

[sortedMaxValues, sortMaxIdx] = sort(maxValuesInterp);

cdfMaxValues = (1:length(sortedMaxValues)) / length(sortedMaxValues);

plot(sortedMaxValues, cdfMaxValues, 'r', 'DisplayName', 'Max Value');

[sortedMinValues, sortMinIdx] = sort(minValuesInterp);

cdfMinValues = (1:length(sortedMinValues)) / length(sortedMinValues);

plot(sortedMinValues, cdfMinValues, 'g', 'DisplayName', 'Min Value');

legend('Value', 'Max Value', 'Min Value');

xlabel('Value');

ylabel('CDF');

title('Cumulative Distribution Function (CDF)');

grid on;

hold off;

% Manual calculation of PDF using histogram

figure;

histogram(valuesInterp, 'Normalization', 'pdf', 'DisplayName', 'Value', 'FaceColor', 'b');

hold on;

histogram(maxValuesInterp, 'Normalization', 'pdf', 'DisplayName', 'Max Value', 'FaceColor', 'r');

histogram(minValuesInterp, 'Normalization', 'pdf', 'DisplayName', 'Min Value', 'FaceColor', 'g');

xlabel('Value');

ylabel('Density');

title('Probability Density Function (PDF)');

legend('show');

grid on;

hold off;

% Calculate Mean, Variance, and Standard Deviation

meanValue = mean(valuesInterp);

meanMaxValue = mean(maxValuesInterp);

meanMinValue = mean(minValuesInterp);

varValue = var(valuesInterp);

varMaxValue = var(maxValuesInterp);

varMinValue = var(minValuesInterp);

stdValue = std(valuesInterp);

stdMaxValue = std(maxValuesInterp);

stdMinValue = std(minValuesInterp);

% Display the calculated statistics

fprintf('Statistics for Value:\n');

fprintf('Mean: %.2f\n', meanValue);

fprintf('Variance: %.2f\n', varValue);

fprintf('Standard Deviation: %.2f\n\n', stdValue);

fprintf('Statistics for Max Value:\n');

fprintf('Mean: %.2f\n', meanMaxValue);

fprintf('Variance: %.2f\n', varMaxValue);

fprintf('Standard Deviation: %.2f\n\n', stdMaxValue);

fprintf('Statistics for Min Value:\n');

fprintf('Mean: %.2f\n', meanMinValue);

fprintf('Variance: %.2f\n', varMinValue);

fprintf('Standard Deviation: %.2f\n', stdMinValue);

% Time series forecasting with linear regression

% Define forecast horizon (3 years)

forecastHorizon = 365 \* 3;

% Prepare the regression model

X = (1:length(valuesInterp))';

y = valuesInterp;

mdl = fitlm(X, y);

% Create future dates and indices for prediction

futureX = (length(valuesInterp) + 1 : length(valuesInterp) + forecastHorizon)';

[futureValues, futureCI] = predict(mdl, futureX);

% Create future dates

futureDates = (fullDates(end) + caldays(1:forecastHorizon))';

% Plot forecasted values

figure;

plot(fullDates, valuesInterp, 'b', 'DisplayName', 'Historical Data');

hold on;

plot(futureDates, futureValues, 'r--', 'DisplayName', 'Forecast');

plot(futureDates, futureCI(:,1), 'k--', 'DisplayName', 'Confidence Interval');

plot(futureDates, futureCI(:,2), 'k--', 'HandleVisibility', 'off');

xlabel('Date');

ylabel('Values');

title('Forecasted Time Series');

legend('show');

grid on;

hold off;