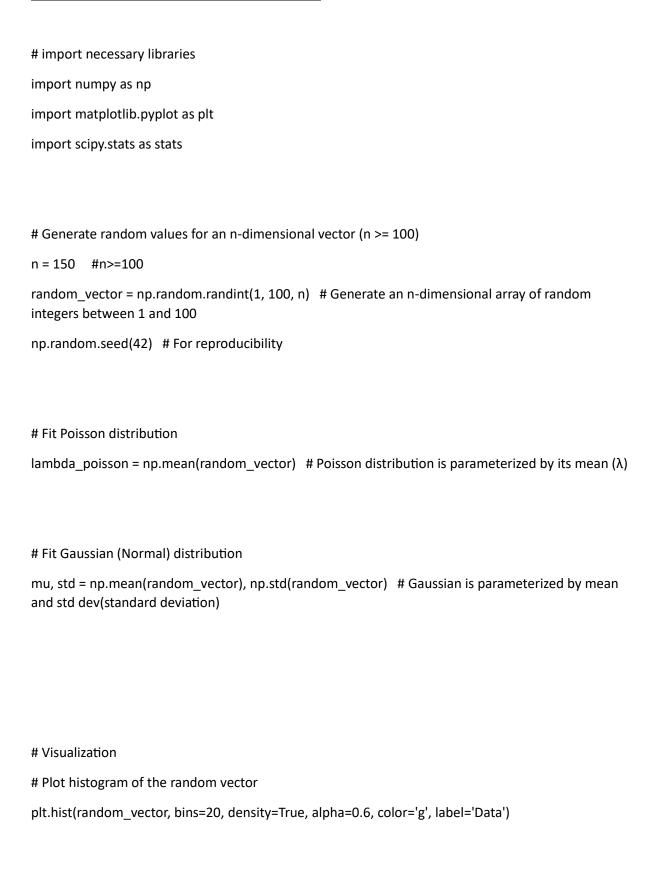
## # Problem Statement: Consider a random vector, a collection of random values of n-dimension [min 'n' = 100]. Fit Poisson's distribution and Gaussian distribution for these collected values.



#creates a histogram of the random\_vector data with 20 bins, normalizes the height to form a probability density (Probability density is a way to show how likely it is for a value to occur, with higher values meaning more likely, and the total area under the curve always adding up to 1.),

#adds 60% transparency, sets the color to green, and labels it as 'Data'.

# Generate points for plotting fitted Poisson and Gaussian curves

x = np.arange(0, 150) #creates an array of values from 0 to 149 to use as the x-axis for plotting

poisson\_pmf = stats.poisson.pmf(x, lambda\_poisson) # Poisson PMF, calculates the Poisson probability mass function (PMF) at each value in x using lambda poisson

#The Poisson probability mass function (PMF) gives the probability of a given number of events happening in a fixed interval of time or space,

#assuming the events occur independently and at a constant average rate ( $\lambda$ ). It's used for counting events, like the number of phone calls a call center gets in an hour

gaussian\_pdf = stats.norm.pdf(x, mu, std) # Gaussian PDF, calculates the Gaussian (Normal) probability density function (PDF) at each value in x using the mean mu and standard deviation std

#A probability density function (PDF) shows how likely different values of a continuous random variable are,

#with the area under the curve representing the probability of the variable falling within a specific range. The total area under the curve equals 1

# Plot Poisson fit

plt.plot(x, poisson pmf, 'bo', ms=9, label='Poisson Fit (λ={:.2f})'.format(lambda poisson), alpha=0.6)

#plots the Poisson probability mass function as blue circles ('bo') at the x-values, sets the marker size to 8,

#labels the plot with the calculated  $\lambda$  value, and adds 60% transparency to the points

# Plot Gaussian fit

plt.plot(x, gaussian\_pdf, 'r-', lw=3, label='Gaussian Fit ( $\mu$ ={:.2f}),  $\sigma$ ={:.2f})'.format(mu, std), alpha=0.6)

#plots the Gaussian probability density function as a red line ('r-') at the x-values, sets the line width to 2, labels the plot with the calculated mean ( $\mu$ ) and standard deviation ( $\sigma$ ),

#and adds 60% transparency to the line

# Add labels and legend

plt.xlabel('Value')

plt.ylabel('Probability Density')

plt.legend(loc='best') #adds a legend to the plot at the best location, automatically determining the most suitable position to avoid overlapping with the plotted data

plt.title('Fitting Poisson and Gaussian Distributions')

## # Show the plot

plt.show()

