Assignment - 3

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Batch - 35

```
from google.colab import drive
drive.mount('/content/drive')

import pandas as pd
from scipy.stats import norm
import matplotlib.pyplot as plt
import numpy as np

# Load the dataset
file_path = 'housing.csv'
california_housing = pd.read_csv('/content/drive/MyDrive/
housing.csv')

# Columns to analyze
columns_to_analyze = ['latitude', 'total_rooms',
'housing_median_age', 'total_bedrooms']

# Question 1: Calculate the MLE for each specified column
mle_results = {}
for column in columns_to_analyze:
    mu, std =
norm.fit(california_housing[column].dropna())
    mle_results[column] = {'Mean (mu)': mu, 'Std
(sigma)': std}

# Print the MLE results
print("Question 1: MLE Results")
for column, params in mle_results.items():
    print(f"{column} - Mean (μ): {params['Mean (mu)']},
Std (σ): {params['Std (sigma)']}")

# Question 2: Calculate log-likelihood for latitude at
values 50, 75, 80
latitude_mu = mle_results['latitude']['Mean (mu)']
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latitude_sigma = mle_results['latitude']['Std (sigma)']
values_to_evaluate = [50, 75, 80]

log_likelihoods = {value: norm.logpdf(value, latitude_mu,
latitude_sigma) for value in values_to_evaluate}

# Print the log-likelihood results
print("\nQuestion 2: Log-Likelihood Results for
Latitude")
for value, log_likelihood in log_likelihoods.items():
    print(f"Log-Likelihood for latitude = {value}:
{log_likelihood}")

# Question 3: Estimate density for each column and bins
bins = [5, 10, 15, 20]
density_estimates = {}

for column in columns_to_analyze:
    density, bin_edges =
np.histogram(california_housing[column].dropna(),
bins=bins, density=True)
    density_estimates[column] = (density, bin_edges)

    # Plotting the density estimates
    plt.figure(figsize=(8, 6))
    plt.hist(california_housing[column].dropna(),
bins=bins, density=True, alpha=0.6, color='g')
    plt.title(f'Density Estimate for {column}')
    plt.xlabel(column)
    plt.ylabel('Density')
    plt.show()

# Observations based on density estimates
print("\nQuestion 3: Density Observations")
for column, (density, bin_edges) in
density_estimates.items():
    print(f"{column} - Density: {density}, Bin edges:
{bin_edges}")

#Details
print("\nBandi Rithwik (2303A52330)")
print('Batch - 35')
```

Output -

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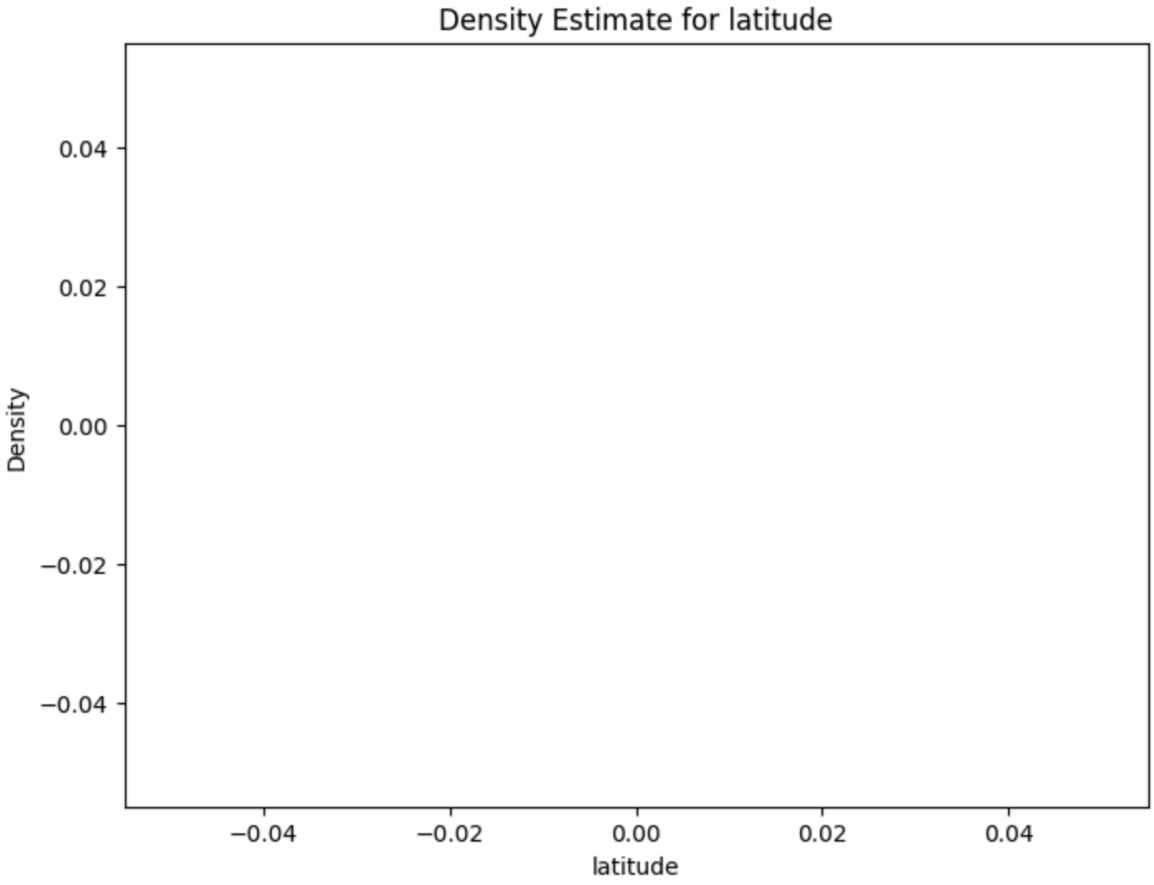
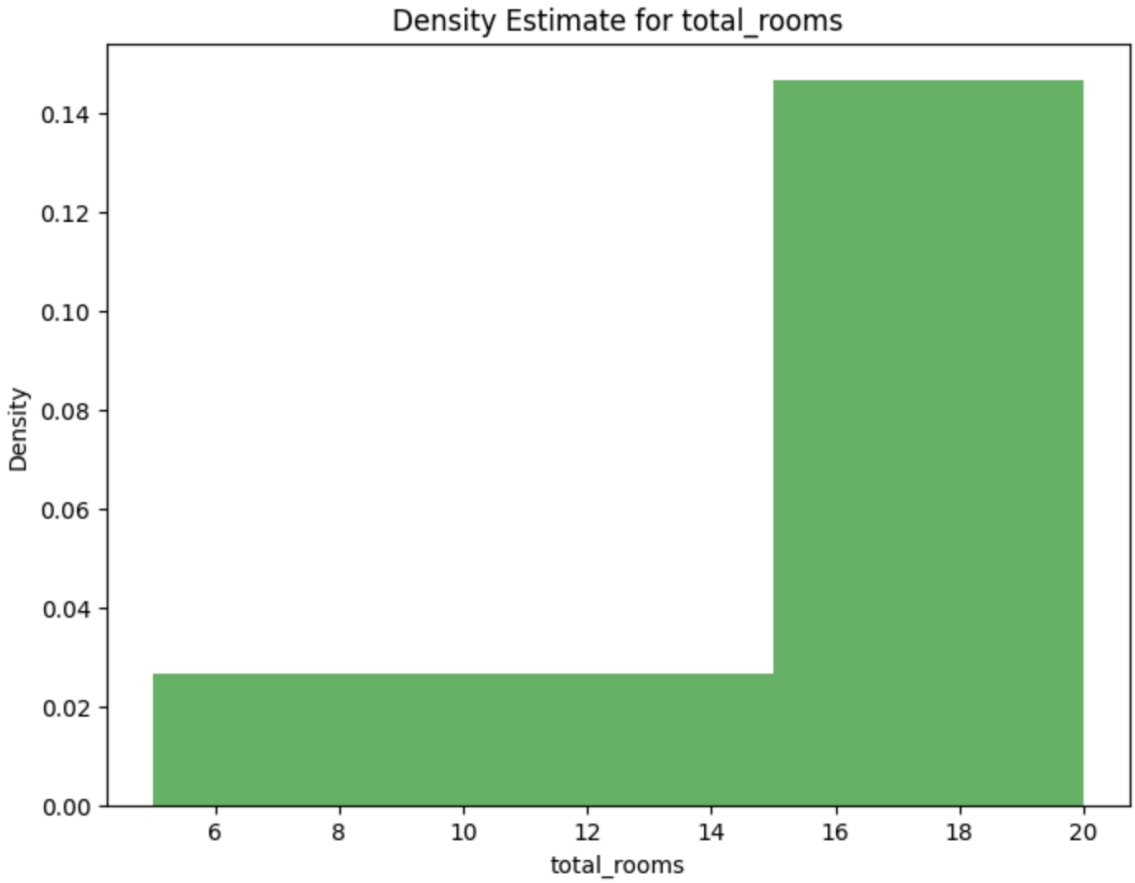
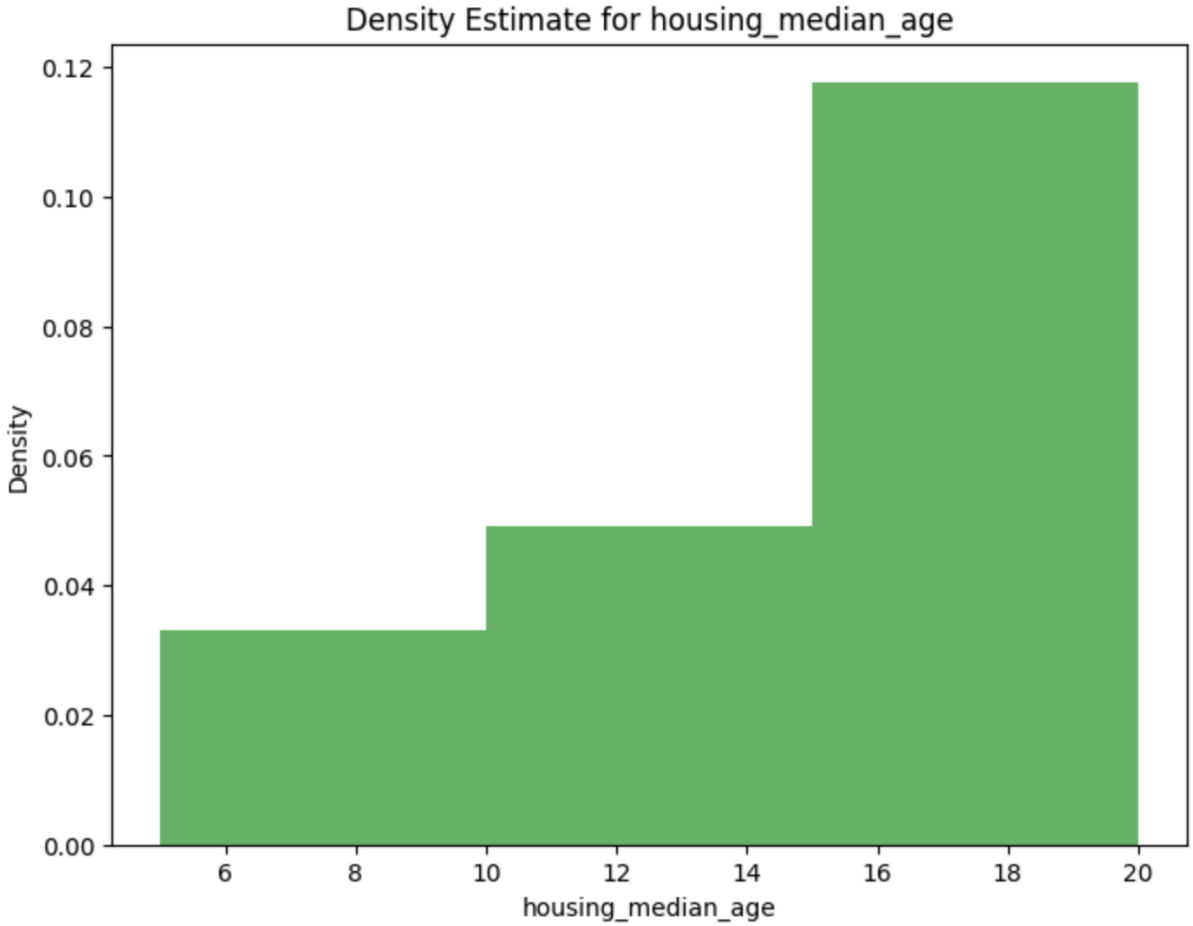
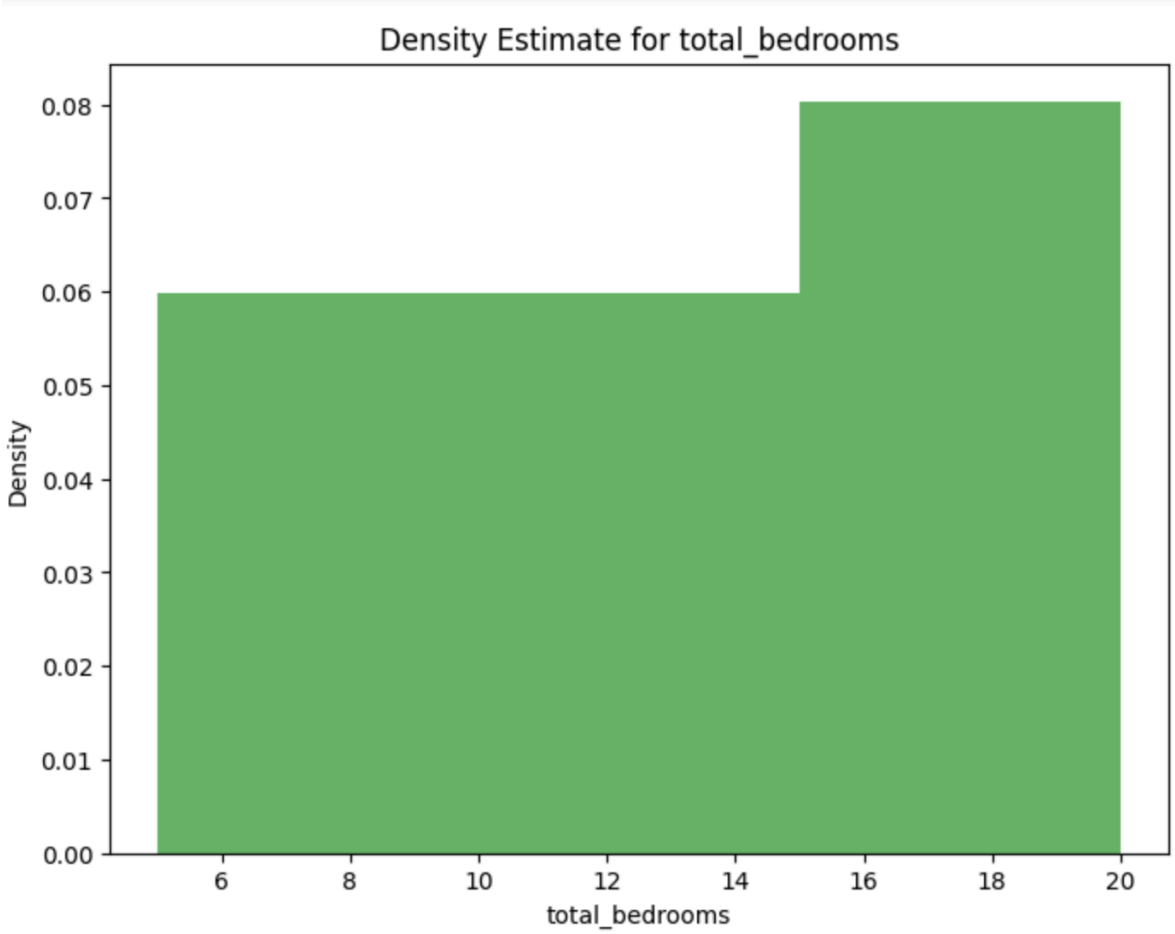
Question 1: MLE Results
latitude - Mean (μ): 35.63186143410853, Std (σ):
2.135900653797483
total_rooms - Mean (μ): 2635.7630813953488, Std (σ):
2181.5624017359723
housing_median_age - Mean (μ): 28.639486434108527, Std
(σ): 12.585252725724606
total_bedrooms - Mean (μ): 537.8705525375618, Std (σ):
421.37475856260727

Question 2: Log-Likelihood Results for Latitude
Log-Likelihood for latitude = 50: -24.30388630999708
Log-Likelihood for latitude = 75: -171.5403881924758
Log-Likelihood for latitude = 80: -217.42758836196197
/usr/local/lib/python3.10/dist-packages/numpy/lib/
histograms.py:885: RuntimeWarning: invalid value
encountered in divide
  return n/db/n.sum(), bin_edges
```




Density Estimate for total_rooms
Density
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
6
8
10
12
14
16
18
20
total_rooms


Density Estimate for housing_median_age
Density
0.00
0.02
0.04
0.06
0.08
0.10
0.12
6
8
10
12
14
16
18
20
housing_median_age



Question 3: Density Observations
latitude - Density: [nan nan nan], Bin edges: [5 10 15 20]
total_rooms - Density: [0.02666667 0.02666667 0.14666667], Bin edges: [5 10 15 20]
housing_median_age - Density: [0.03312145 0.04918033 0.11769823], Bin edges: [5 10 15 20]
total_bedrooms - Density: [0.05981308 0.05981308 0.08037383], Bin edges: [5 10 15 20]

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