import numpy as np

import scipy.stats as sts

import matplotlib.pyplot as plt

# Grid of possible true baby body temperatures (in Celsius)

mu = np.linspace(36, 39, 300)

# Prior: Healthy baby's temperature ~ N(37, 0.2)

# This represents our prior belief before any measurement

prior = sts.norm.pdf(mu, loc=37, scale=0.2)

prior = prior / prior.sum() # Normalize

# Plot the prior distribution

plt.plot(mu, prior, label='Prior')

plt.xlabel("Baby's Body Temperature (°C)")

plt.ylabel("Probability Density")

plt.title("Prior Belief About Baby's Temperature (No Flu Assumed)")

plt.legend()

plt.show()

# Likelihood: Observed baby temperature = 38.0°C

# Thermometer has measurement error with std dev = 0.3°C

def likelihood\_func(observation, mu\_values):

likelihood = sts.norm.pdf(observation, loc=mu\_values, scale=0.3)

return likelihood / likelihood.sum()

# Compute the likelihood

likelihood = likelihood\_func(38.0, mu)

# Plot the likelihood

plt.plot(mu, likelihood, label='Likelihood')

plt.xlabel("Baby's Body Temperature (°C)")

plt.ylabel("Likelihood")

plt.title("Likelihood Given Baby's Observed Temp = 38.0°C")

plt.legend()

plt.show()

# Compute unnormalized posterior (Bayes Rule: posterior ∝ prior × likelihood)

unnormalized\_posterior = prior \* likelihood

# Plot the unnormalized posterior

plt.plot(mu, unnormalized\_posterior, label='Unnormalized Posterior')

plt.xlabel("Baby's Body Temperature (°C)")

plt.ylabel("Unnormalized Probability")

plt.title("Posterior Belief After Observing High Temp (Possible Flu)")

plt.legend()

plt.show()

