11. Worked Example Part II

Note: The problems in this vertical depend on the final answer from Worked Example Part I. **You must have the answer to the final answerbox in order to answer the questions here.**

We now consider the **Gamma distribution**, which is a probability distribution with parameters q>0 and $\lambda>0$, has support on $(0,\infty)$, and whose density is given by

$$f\left(x
ight) =rac{\lambda ^{q}x^{q-1}e^{-\lambda x}}{\Gamma \left(q
ight) }.$$

Here, Γ is the Euler Gamma function.

Simplifying the Gamma Distribution

1/1 point (graded)

We will use proportionality notation in order to simplify the Gamma Distribution. But first, we perform a cosmetic change of variables to avoid repetitive notation with our answer in Part I: we write our parameters instead as λ_0 and q_0 .

From the expression for the Gamma distribution given above, remove outermost multipliers to simplify it in such a way that our expression for f(1) is $e^{-\lambda_0}$ regardless of the value of q_0 .

Use **q_0** for q_0 and **lambda_0** for λ_0 .

$$f(x) \propto$$

Solution:

Note that we want a function of x, so we are able to pull out factors that do not depend on the variable x. (i.e. are purely constants or a factor whose value only depends on variables other than x). From $f(x) = \frac{\lambda^q x^{q-1} e^{-\lambda x}}{\Gamma(q)}$, we can notice that both λ^q in the numerator and $\Gamma(q)$ in the denominator are independent of x, so removing those reduces our expression to $x^{q-1}e^{\lambda x}$.

Making a slight tweak of variables so that we use λ_0 and q_0 instead, as specified, gives $f(x) \propto x^{q_0-1}e^{\lambda x_0}$, and it can be seen (as an exercise) that this expression for f(x) satisfies $f(1) = e^{-\lambda_0}$.

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You have used 2 of 3 attempts

• Answers are displayed within the problem

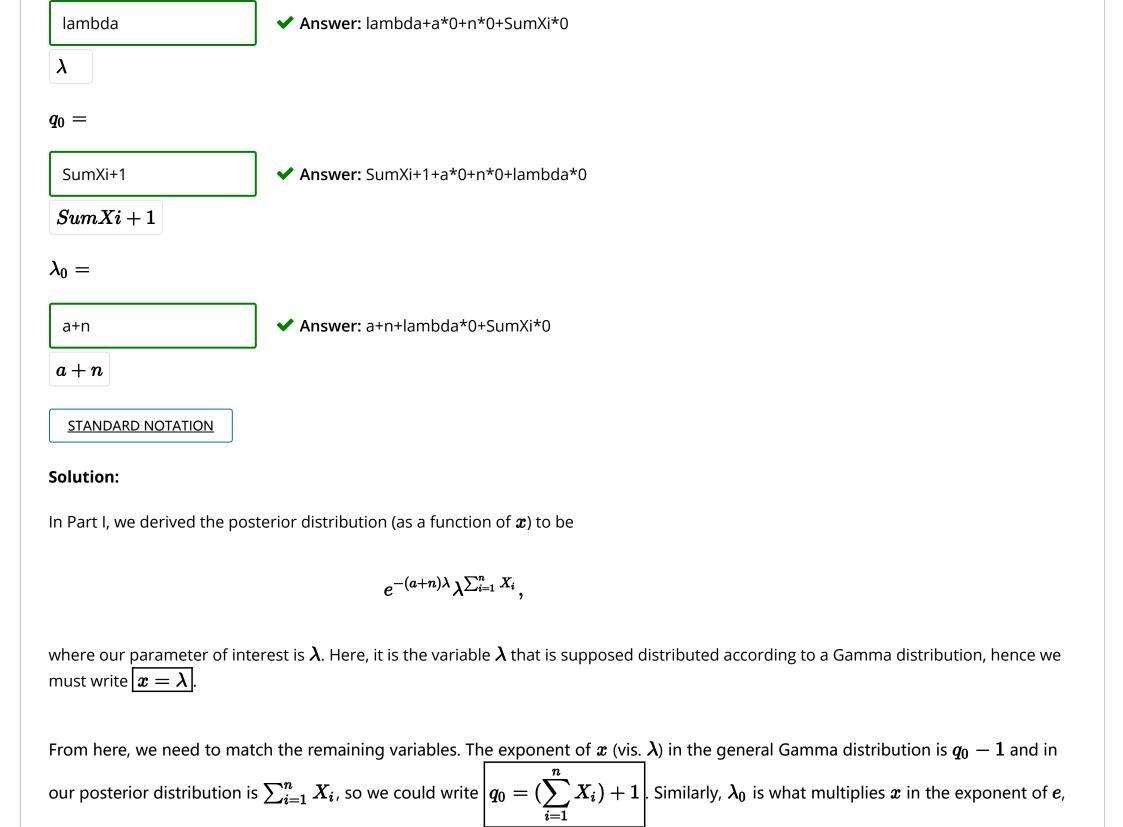
Interpreting the Posterior Distribution

3/3 points (graded)

Compare this with the posterior distribution you computed from Part I, which you should see is a Gamma distribution. What is the corresponding variable, and what are its parameters?

Use **SumXi** for $\sum_{i=1}^{n} X_i$.

$$x =$$



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which we see is a+n in our posterior distribution, so $\lambda_0=a+n$

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Part II