Coding Assignment 3

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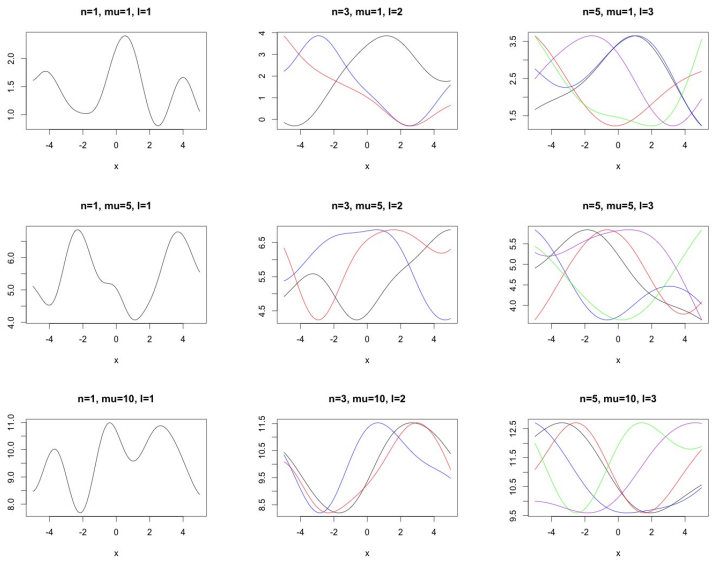
For this assignment, I'm asked to plot samples from a Gaussian processes using the squared exponential and two other covariance functions. I will used the squared exponential, gamma exponential, and rational quadratic.

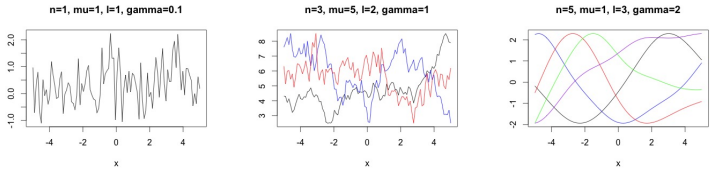
1) Squared Exponential

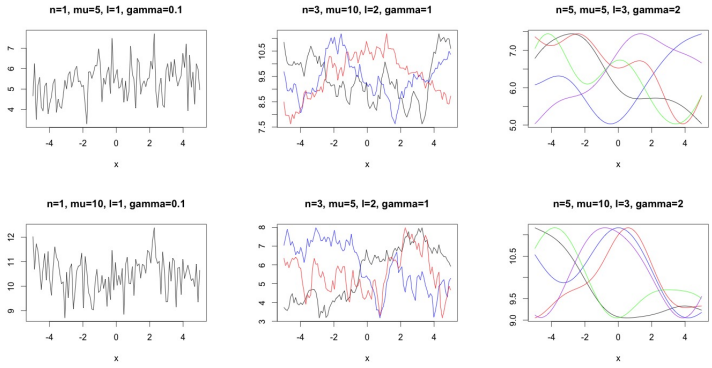
The squared exponential covariance function is: $k_{se}(r) = exp(-\frac{r^2}{2^2\ell})$, where r is the distance between two points, x and y. Next I generate plots using the squared exponential and varying n (the number of samples), μ (the mean of the normal distribution), and ℓ (the scaling parameter). In my plots, the x values go from -5 to 5. The number of samples are either 1,3, or 5. ℓ is either 1,2, or 3, and μ is either 1, 5, or 10. See the plots below.



2) Gamma Exponential

The gamma exponential covariance function is $k_{ge}(r) = exp(-(\frac{r}{\ell})^\gamma)$, where r is the distance between two points, x and y. I will vary n (number of samples) from 1, 3, and 5. ℓ will be either 1,2, or 3. γ will be either 0.1,1, or 2. μ will again vary between 1, 5, and 10. See the plots below. You can see that as γ and ℓ increase, the functions become smoother.





3) Rational Quadratic

The rational quadratic is $k_{RQ}(r) = (1 + \frac{r^2}{2\alpha\ell^2})^{-\alpha}$, where r is the distance between two points, x and y. I will vary n (number of samples) from 1, 3, and 5. ℓ will be either 1,2, or 3. α will be either 0.1,1, or 3. μ will again vary between 1, 5, and 10. Note that α and ℓ can be thought of a scale mixture of squared scale mixture of squared exponential covariance functions. See the plots below.