***Preliminaries***

The solutions to the assignments involving R coding should be reported in details, all R code that you write should be **included** into the report. Also, all appropriate pictures or diagrams should be included.

***Assignment 1: Control variates***

The data you are going to analyze is the database of home prices in Albuquerque , 1993.

The variables present are Price, SqFt – the area of a house, FEATS – number of features such as dishwasher, refrigerator and so on. Explore the file ***prices.xls***

1. Import necessary information to R
2. Determine the price per square meter *PriceSq* for each house. Determine the average *PriceSq*
3. Make a scatter plot *PriceSq* versus *FEATS.* Is there any correlation?
4. Plot the histogram of *PriceSq* and compute sample variance of *PriceSq*
5. Use FEATS as control variate in the control variates method to reduce the variance of computing the average of *PriceSq*. What is the improved value of the average you obtained?
6. Assume that the new variable used in the control variate method is called *Z.* Plot the histogram of *Z* and compare with the histogram from step 4. Conclusions?

***Assignment 2: Computations with Metropolis-Hastings***

Consider the probility density function:

You can see that the distribution is known up to some constant of proportionality.

1. Use Metropolis-Hastings algorithm to generate samples from this distribution by using proposal distribution as log-normal LN(*Xt*, 1). Plot the chain you obtained as a time series plot. What was the starting point of the chain? What can you guess about the convergence of the chain? If there is a burn-in period, what can be the size of this period?
2. Perform step 1 using proposal distribution as chi-square distribution where floor(x) means integer part of *x*.
3. Compare the results of steps 1 and 2 and make conclusions.
4. Estimate using the samples from steps 1 and 2.
5. (If you have time) The distribution to be generated is in fact a gamma distribution. Look in the literature and define the actual value of the integral. Compare it with what you obtained.

## Submission procedure

If you are neither speaker or opponent, you should just send-in the solutions via It’s learning. **Note that there is a deadline for submission!** If you are *speaker*, you must also do the following:

* Put your report and PowerPoint presentation to the folder *Lab 2* which is in the folder *Seminars*. Specify Active : “Set time span”. Specify activation time as **22 april 17:00. Make sure that the time settings are specified!**

If you are *opponent*, you may find the report and PPT-file for revision available immediately after **22 april 17:00** in the folder*Seminars->Lab 2*