Quantitative Risk Management
Assignment 9

Due: December 3, 2019

Question 1: Let $(X_i)_{i\in\mathbb{N}}$ be independent with distribution F.

1. Let $F(x) = 1 - \exp(-\beta x)$ for $\beta > 0$ and $x \geq 0$ so that X_i is exponentially distributed. Show that $F \in MDA(H_0)$ by using the sequences $c_n = \frac{\log(n)}{\beta}$ and $d_n = \frac{1}{\beta}$.
2. Let $F(x) = 1 - (\frac{\kappa}{\kappa+x})^\alpha$ for $\alpha > 0$, $\kappa > 0$, and $x \geq 0$ so that X_i has Pareto distribution. Show that $F \in MDA(H_{1/\alpha})$ by using the sequences $c_n = \kappa n^{1/\alpha} - \kappa$ and $d_n = \frac{\kappa n^{1/\alpha}}{\alpha}$.

Question 2: Suppose X has excess distribution over the threshold u of $F_u = G_{\xi,\beta}$. Show that the excess distribution over the threshold v is equal to $F_v = G_{\xi,\beta+(v-u)\xi}$ for $v \geq u$.

Question 3: Download 5 years of Microsoft stock prices beginning on November 26, 2011.

1. Compute the negative log returns and reproduce the sample mean excess plot shown in the lecture.
2. Select a threshold of 0.01 for the negative log returns and fit a GPD model to the excess distribution over the threshold by maximum likelihood estimation. The Matlab function `gppdf` may be useful.