Introduction to Quantitative Finance   Name: _____
Finalterm Exam
22/11/2018
Time Limit: 180 Minutes   **Total marks is 50**

1.   i. Explain the two important factors of risk measure. (4 marks)

   ii. What does represent the average value at risk as the optimal value of the optimization problem. (2 marks)

   iii. Describe the following R codes.(4 marks)
(SENSEX_rtn is the daily return of SENSEX).

```
> library(gnFit)
> gnfit(SENSEX_rtn,dist="logis")

Test of Hypothesis for logis distribution
Cramer-von Misses Statistics:  0.1583   P-Value:  0.01854
Anderson-Darling Statistics:   0.8398   P-Value:  0.03057

> rskFac(SENSEX_rtn,dist="logis", alpha=0.2)

Under assumption *logis* df,
E(X) = 0.05 (%)
VaR(X) = -0.5 (%), at level alpha = 0.2
Lower AVaR(X) = -1.03(%), at level alpha = 0.2
Upper AVaR(X) =  0.65(%), at level alpha = 0.2
```

2. Justify the threshold model. Explain two methods for selection of the threshold. (10 marks)

3. Define the Pearson correlation function. Let's consider two variables X and Y. What is the test statistics for testing the null hypothesis that

$$H_0 : \rho_{XY} = 0 \text{ against, } H_1 : \rho_{XY} \neq 0.$$

Give the formula, R command and details with an example. (10 marks)

4. Let's consider the daily log return SENSEX and BSE100. Explain the purpose of using the commands:

```
> library("mvtnorm")
> rtn_cov<-var(cbind(RBSE100,RSENSEX),use="pairwise.complete.obs")
> rtn_mu<-c(mean(na.omit(RBSE100)),mean(na.omit(RSENSEX)))
> N<-length(RSENSEX)
> sim<-rmvnorm(N,rtn_mu,rtn_cov)
```

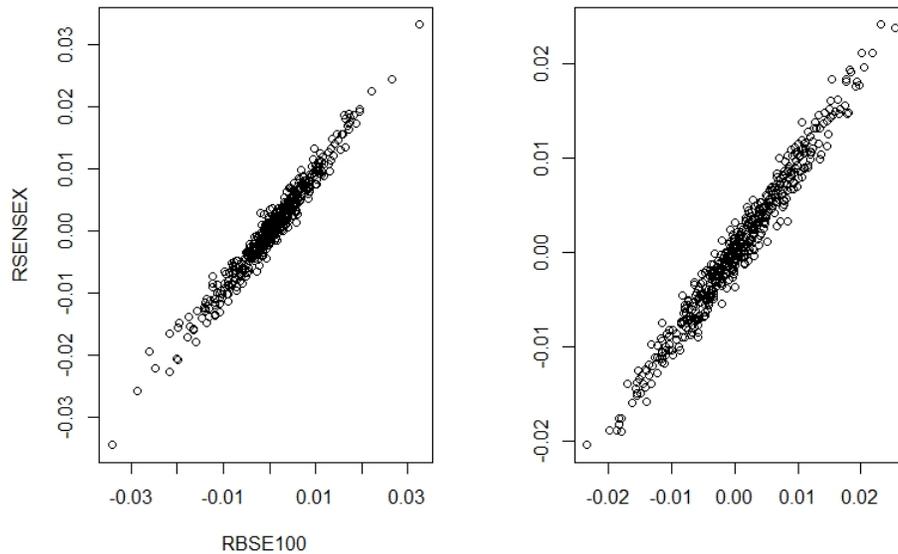What is the results of the following figure. (10 marks)

Figure 1: The empirical scatterplot of the SENSEX and BSE100 log-returns (left) and the scatterplot of the sample of the same size simulated from a jointly Gaussian distribution with the same mean and covariance structure (right).

5. i. Define the properties of Copula distribution functions. (4 marks)

   ii. What is the Extreme Copula? Explain with the formula. (4 marks)

   iii. If $X \sim N(3,4)$ and $Y \sim T(3)$ (T is Student t) write the R code to generate the observation from Gumbel Copula with parameter 1.4. (2 marks)

Good luck,
Saeb