

Exercise Sheet 1:

**1. (a)** Consider an equally-weighted portfolio of two risky assets. The RM dept is using a binomial model to model the daily P/L on these risky assets. The current price of both assets is \$100.

	Return to Asset 1	Return to Asset 2	
State 1	10%	- 10%	Prob(state 1) = 0.5
State 2	-10%	10%	Prob(state 2) = 0.5

(a) Compute the Mean, Standard Deviation and Correlation Coefficient for the P/L on two securities.

(b) Compute the Mean and Standard Deviation for the P/L on the equally weighted portfolio.

(c) What is the 99% VaR for each of the assets and for the portfolio. What does your result mean? Explain.

(d) Do the assets have any drift term? If there is a riskless asset, then can you relate the return on the portfolio to the riskless rate?

**(b)** Now the RM Dept is worrying about increases in downward shocks in a third and fourth state that will either lead to a large loss, or a very large loss on both assets. The returns and probabilities are:

	Return to Asset 1	Return to Asset 2	
State 1	10%	- 10%	Prob(state 1) = 0.49
State 2	- 10%	10%	Prob(state 2) = 0.49
State 3	- 15%	- 15%	Prob (state 3) = 0.01
State 4	- 30%	- 30%	Prob (state 4) = 0.01

Redo the calculations in (a)-(d) and explain the difference in the results from the previous results.

**2. (Group Effort)** Consider the examples in question 1.

(a) You are computing VaR for two horizons: 10 trading days ahead and 100 trading days ahead. Assuming an initial portfolio of \$100,000 compute and graph the frequency distribution for the two cases in 1(a) and (b).

(b) Each student will use a Monte Carlo simulation to create a histogram for 50, 200 and 500 day samples drawn from each example and compare with their theoretical frequencies.

Note the importance of the number of simulation runs in approximating the true distribution. Compare the histograms obtained by each student. What does that tell you about the importance of stationarity of parameters and sample size? And what does that tell you about nonparametric techniques to compute VaR?

(c) Consider these examples so that they could illustrate other properties discussed in Dowd Chs.4 and 5, especially modeling non-constant volatilities. Construct an example to illustrate “ghost” effects. Also illustrate the dangers in predicting risks around the time of a change in volatility. (We can discuss this in class.)

**3.** Frank’s Bank has a portfolio of two major funds, A and B.

The mean monthly, return for the two funds are 1.5% and 2.2% respectively.

The standard deviation of monthly returns for the two funds are 0.9% and 1.2% respectively. The correlation between the two funds is 0.13. Given the bank holds 70% in A and 30% in B, and returns are assumed to be multivariate normal, then compute the monthly VaR at 99% level, given that the portfolio is \$100 million.

How critical is the assumption of normality in the distribution?

A third fund C has been created and is writing out of the money puts. How would that effect your VaR calculations? Explain.

**4.** You have observed one of your traders writing many options on an index. The VaR on each of his positions are regarded as riskless at the usual level. Does this imply that his total position is riskless? (Hint: see Beneplane and Rochet Ch. 5 Section 5.7.4.)