# Homework 3

1. Suppose that two independent investments both have 3% chance to incur a loss of US$12 million, 3% chance to incur a loss of US$2 million, and 94% chance to incur a gain of US$1 million.
   (a) What is the VaR of any single project at the 95% confidence level?
   (b) What is the ES of any single project at the 95% confidence level?
   (c) After combining the two projects together, what is the VaR at the 95% confidence level?
   (d) After combining the two projects together, what is the ES at the 95% confidence level?
   (e) Check whether VaR and ES satisfy the subadditivity property using this example.

2. In the example of historical simulation in Note 7, suppose that the portfolio is as follows:

   | Index | Amount Invested ($000s) |
   |---|---|
   | DJIA | 3,500 |
   | FTSE 100 | 3,000 |
   | CAC 40 | 1,500 |
   | Nikkei 225 | 2,000 |
   | Total | 10,000 |

   Using the data in the Excel file (HistoricalSimulation.xls) to compute the 8-day 99% VaR and 8-day 99% ES.

3. Suppose that a three-year corporate bond provides a coupon of 6% per year payable semiannually, and has a yield of 5% (expressed with semiannual compounding). The risk-free rate is 3.5% per annum. Assume that defaults can take place every six months (immediately before a coupon payment) and the recovery rate is 40%. Estimate the default probability assuming that the unconditional PDs are the same on all possible default dates.

4. Show that, under Merton's model, the credit spread on a T-year zero-coupon bond is
$$-\frac{\ln\left[\Phi(d_2) + \frac{\Phi(-d_1)}{L}\right]}{T}$$
where $L = De_{-rT}/V_0$.

**The homework is due on December 20 in class.**