

**AMSC/Math 420, Spring 2014**  
**Sixth Team Homework**  
**Modeling Portfolios: Central Limit Theorem**

Due Monday, 14 April, 2014

In the following exercises consider the risky assets in groups (A) and (B) of your final project. Consider one-year histories of daily share price data for each asset over the years ending December 31 of 2008-2013. Use the  $\hat{\mu}$  and  $\hat{\xi}$  you computed in the previous assignment for the Markowitz portfolios with value equally distributed among the assets in group (A), group (B), and groups (A) and (B) combined.

**Exercise 1.** Simulate each of these 18 portfolios 100 times by drawing daily growth rates  $\{X(d)\}_{d=1}^D$  from a normal distribution with mean  $\hat{\gamma}$  and variance  $\hat{\theta}$ , where  $\hat{\gamma}$  and  $\hat{\theta}$  are given in Exercise 1 of the previous assignment. Determine the number of these portfolios that satisfy

$$\frac{1}{D} \sum_{d=1}^D X(d) \geq \hat{\gamma} - \zeta \sqrt{\frac{\hat{\theta}}{D}},$$

where  $\zeta = 0, .5, 1, 1.5,$  and  $2$ . How do your results compare with what you expect from the central limit theorem?

**Exercise 2.** Simulate each of these 18 portfolios 100 times by drawing daily return rates  $\{R(d)\}_{d=1}^D$  from a normal distribution with mean  $\hat{\mu}$  and variance  $\hat{\xi}$  and then converting them to daily growth rates  $\{X(d)\}_{d=1}^D$ . Determine the number of these portfolios that satisfy

$$\frac{1}{D} \sum_{d=1}^D X(d) \geq \hat{\gamma} - \zeta \sqrt{\frac{\hat{\theta}}{D}},$$

where  $\zeta = 0, .5, 1, 1.5,$  and  $2$ . How do your results compare with what you expect from the central limit theorem?