Department of Mathematical Sciences
Carnegie Mellon University

Spring 2002

21-256 Multivariate Analysis and Approximation

Exam #4

NAME: _____

Please circle your recitation section.

A	A. Cohen	TuTh 12:30	PH A18A
B	A. Winger	TuTh 12:30	WeH 5403
C	A. Winger	TuTh 1:30	SH 220
D	A. Cohen	TuTh 2:30	Old SC 200

- This exam consists of 3 problems. It is your responsibility to make sure you have all 5 pages.
- No notes or books may be consulted during the exam.
- No calculators may be used during the exam.
- All solutions that you submit must be your own work. You may not look at or copy the work of others during this exam.
- Show your work. No credit will be given for unsupported incorrect answers.

Problem	Points	Score
1	35	
2	35	
3	30	
Total	100	

1. (35 points) Use Lagrange multipliers to solve the followng problem:

Minimize: $2x_1 + 4x_2 + 1$

Subject to: $x_1^2 + 2x_2^2 = 4$

(Show all your work.)

2. (35 points) Solve the following mathematical program:

Maximize: $1 - x^2 - y^2 - z^2$

Subject to: $x + y \leq -1$

(Show all your work.)

3. (30 points) You decide to invest up to \$1000, distributing your investment between two stocks: stock 1 and stock 2. Based on historical data:

- the expected return for stock 1 is 5%;
- the expected return for stock 2 is 12%.

Letting x_1 and x_2 denote the amount invested in stock 1 and stock 2, respectively, an estimate for the variance in the expected return (risk) is

$$.001x_1^2 + .006x_2^2 - .003x_1x_2.$$

You wish to maximize your expected return on your investment, while keeping the variance below 400.

(a) Formulate the above problem as a minimization problem with constraints.

(b) What is the Lagrangian for this problem?

(c) What equations must a solution to this problem satisfy? (Include any conditions on the lagrange multipliers; i.e. the λ's.) **Do not solve the equations.**