REPUBLIC OF SOUTH-AFRICA
DEPARTMENT OF MINERALS AND ENERGY
EXAMINATION FOR THE MINE SURVEYOR'S CERTIFICATE OF COMPETENCY

DATE: 10 April 2003 (Thursday) TOTAL MARKS: **100**
TIME: 12:30 – 15:30 (3 Hours) TO PASS: **50**

MINING ECONOMICS II

NOTE:

1. Any pocket calculator may be used and intermediate results need not be shown. The make and model number of the calculator used must be noted on the front cover of the answer book.
2. Tables that may be used are attached hereto.
3. Graph-, Probability-, and Log paper will be supplied if required.
4. Your examination number must be written on all graph paper and loose sheets that are handed in with your examination script.

Question 1

Given a set of 20 random mineral sample values, describe how you would determine what distribution the values belong to.

[5 marks]

Question 2

Directional semi-variograms of a lead deposit yielded the following results.

Direction	range
0	45
45	65
90	75
135	50

The omni-directional semi-variogram has a range of 60 metres and a sill of $3,5^2$ %

Determine the axis and direction of anisotrophy.

[5 Marks]

Question 3

An ore body divided into 50m by 50m blocks has a mean of 35,4% and standard deviation of 8,13%.

(a) How much of the 17million ton resource is payable at a pay limit of 29% and what is the grade of the payable ore?
(b) How much will be payable if the block size is changed to 80m by 80m.

[10 Marks]

Question 4

The following grams per ton values were obtained from broken ore samples at an ore pass.

24 16 6 4 12 11 44 18 9 8

(a) Plot a histogram with 5 gram intervals as well as a cumulative frequency curve of the above values.
(b) Calculate the mean and standard deviation of the ten values, assuming normality.
(c) Calculate 95% confidence limits for the mean grade of the ore.(Not the 95% confidence interval)
(d) Calculate the Sichel mean and standard deviation of the ten values, assuming log normality.
(e) Calculate 95% confidence limits for the mean log normal grade of the ore.

[30 Marks]

Question 5

In the tabulation below, X are the original estimated block values in g/t and Y the actual values of the blocks as they were mined.

Y	6,1	6,2	6,4	6,4	6,6	6,8	6,9	6,9	7,2	7,4	7,6	7,7	7,7	7,8
X	6,2	6,8	6,6	7,0	6,2	7,7	6,6	7,2	8,0	6,9	7,7	8,2	7,3	6,7

Y	8,0	8,1	8,2	8,3	8,4	8,5	8,8	8,8	8,9	10,2	10,4
X	8,0	8,6	7,4	7,0	8,2	7,8	8,7	8,1	8,5	8,4	9,0

Calculate the:

(a) Correlation coefficient.
(b) Regression line.
(c) Covariance.
(d) Test whether $\rho=0$ at the 0,05 level of significance.
(e) What is the probability distribution of the actual value of a block whose estimated value is 8g/t.
(f) Calculate the effective pay limit by which a sample may be judged if the mining pay limit is 7g/t.

[20 Marks]

Question 6

The following details of a gold mine resource are available.

Mean value	1035 cm.g/t
Additive constant	190
Stoping width	125
Relative variance	0,2
Resource tons	160×10^6

Draw grade tonnage curves for mining pay limits from 4,0g/t to 9,0g/t.

[20Marks]

Question 7

Draw annotated sketches of: (a) Spherical model
(b) Exponential model
(c) Generalized linear model
(d) Random model

[10 Marks]

[TOTAL 100 Marks]

SOME USEFUL FORMULAE

$$s^2 = \frac{1}{n-1}\sum (x-\bar{x})^2$$

$$s^2 = \frac{1}{n-1}\sum x^2 - n\bar{x}^2$$

$$T = \frac{\bar{x}-\mu}{s\sqrt{n}}$$

$$P = PV\frac{i}{1-(1+i)^n}$$

$$PV = P(1-(1+i)^n)/i$$

$$b = \frac{n\sum xy - \sum x\sum y}{n\sum x^2 - (\sum x)^2}$$

$$r = \frac{\sum xy - \sum x\sum y/n}{[\sum x^2 - (\sum x)^2/n][\sum y^2 - (\sum y)^2/n]}$$

$$\gamma(h) = C(\frac{3h}{2a} - \frac{h^3}{2a^3})$$

$$\gamma(h) = C(1-\exp(\frac{-h}{a}))$$

$$T = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

$$PV = A/(1+r)^n$$

$$\theta = \frac{Mx^2 - x_p x_{1-p}}{x_p + x_{1-p} - 2Mx}$$

$$2\gamma(h) = \frac{1}{n}\sum [g(x) - g(x+h)]$$

$$\sigma^c = \hat{s}_y\sqrt{1-r^2}$$