

**REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF MINERAL RESOURCES
EXAMINATION FOR THE MINE SURVEYOR'S CERTIFICATE OF
COMPETENCY**

DATE: 15 April 2010 (Thursday)
TIME: 12:30 – 15:30 (3 Hours)

TOTAL MARKS: 100
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:

a) Explain what is meant by the following terms:

- i) Co-efficient of skewness
- ii) Discretisation
- iii) Lag length
- iv) Standard deviation
- v) Search neighbourhood
- vi) Negative linear correlation
- vii) Simple Kriging

b) Explain with the aid of sketches and diagrams the difference between Classical Statistics and Spatial Statistics (Geostatistics).

c) Briefly describe with the aid of sketches the following types of variogram models.

- i) Nugget model
- ii) Exponential model

[22 Marks]

Question 2:

The table below shows calculated semi-variances against distances between samples.

| Distance between samples (h) | Experimental semivariogram (γ^*) |
|---------------------------------|--|
| 30 | 10,3 |
| 60 | 13,9 |
| 90 | 14,1 |
| 120 | 17,2 |
| 150 | 23,1 |
| 180 | 27,0 |
| 210 | 28,5 |
| 240 | 30,0 |
| 270 | 33,0 |
| 300 | 34,0 |
| 330 | 37,7 |
| 360 | 36,5 |
| 390 | 35,4 |
| 420 | 35,1 |
| 450 | 36,3 |
| 480 | 38,3 |
| 510 | 36,5 |
| 540 | 37,5 |
| 570 | 39,5 |
| 600 | 42,0 |

- a) Estimate the nugget effect, sill value and range by fitting a spherical model to the data in the above table.
- b) Test your model by calculation and re-plotting using the estimated parameters in (a).

[30 Marks]

Question 3:

The variable, of which the details are given in the table below, is known to be normally and randomly distributed.

| Initial block estimates (g/t) | Follow-up block values (g/t) |
|----------------------------------|---------------------------------|
| 3,0 | 7,4 |
| 4,8 | 4,8 |
| 5,0 | 6,2 |
| 5,4 | 3,9 |
| 5,5 | 6,2 |
| 5,9 | 5,8 |
| 6,2 | 8,1 |
| 6,4 | 6,8 |
| 7,2 | 6,9 |
| 8,2 | 8,1 |
| 9,2 | 9,0 |
| 11,0 | 9,7 |
| 11,8 | 5,6 |
| 12,0 | 11,8 |
| 14,0 | 14,0 |
| 16,2 | 13,1 |

Calculate:

- a) The regression to estimate future actual block values from initial block estimates.
- b) The correlation co-efficient between the variables.
- c) Test whether the correlation co-efficient is significant at a level of significance of 0,05.
- d) The 90% confidence limits for the correlation co-efficient.
- e) The co-variance between the block values.
- f) The probability distribution for an initial value of 8,6g/t.

[20 Marks]

Question 4:

The area of a working mine amounts to 1 800 claims of which 12% is already stoped out. Of the remaining area 8% is barren due to faults; 12% of the monthly tonnage hoisted is obtained from reclamation in old areas; surface sorting amounts to 7% and 5% of the ore broken in stopes is sorted and packed underground. The average stoping width is 145 cm and the average dip of the reef is 30°. Ignoring development tonnages, determine the life of mine, assuming:

- a) 95 000 metric tons are milled per month
- b) The percentage payability is 53%
- c) The density of rock is 2,75 t/m³
- d) 1 claim = 5 948m²

[15 Marks]

Question 5:

A mining company wants to undertake a project whereby they will be processing an old waste rock dump. During the expected duration of the project the following cash flow streams is expected to be generated;

| <u>Year</u> | <u>Cash Flow (R`000)</u> |
|-------------|--------------------------|
| 0 | (R1 500) |
| 1 | R900 |
| 2 | R800 |
| 3 | R500 |

- a) Calculate the IRR of this project.
- b) If the company has a hurdle rate (cost of capital) of 29%, is the project an acceptable proposition?

[13 Marks]

Total Marks [100]