FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

EMN 4205 - MINERAL RESOURCES EVALUATION
Examination Paper JUNE 2024

Time Allowed: **3 hours**
Total Marks: **100**

Examiner's Name: **MANESWA G**

Additional Requirements

- Calculator

INSTRUCTIONS:
1. This paper contains **TWO** sections
2. Answer all questions in Section **A** and any **3** questions in Section **B**.
3. Illustrate your answer, where appropriate, with large clearly labelled diagrams.
4. Start each question on a new page.

This examination paper consists of 4 pages

SECTION A (40 Marks)
Answer all questions

Question One

a) True and False Questions. No penalty for a wrong answer. [**2 marks each**]

(i) The most important modifying factors that affects the conversion from mineral resources to mineral reserves are always the price of the commodity and the cost of mining.

(ii) Inverse distance squared weighting tends to give higher weights to closer samples than inverse distance cubed weighting.

(iii) The fundamental principle in volume variance is that grade variability decreases as volume support increases, and that variances are additive.

(iv) Resource classification considers only drillhole spacing and the potential for eventual economic extraction.

(v) Negative Kriging weights indicate a fundamental flaw in the variogram model.

b) Define and explain
(i) Volume variance effect [**5**]
(ii) Quartiles [**5**]
(iii) Sketch an exponential semivariogram model and explain the nugget effect and range [**5**]

c) (i) What is the difference between ore resource and reserve? [**2**]

(ii) State the 3 main groups of mineral resource/reserve estimation methods [**3**]

d) Draw and label the box diagram that is used for resource and reserve classification using arrows to show how the categories of resources and reserves are related to each other and how they are increased in confidence and modifying factors. Name three modifying factors that are used. [**10**]

SECTION B (60 Marks)
Answer any 3 questions

Question Two

There are no prescriptive rules for resource classification. It is often left to the Qualified Person to decide on the resource categories that summarize their confidence in the resource model.

a) Describe two quantitative factors that are taken into consideration for resource classification. [**10**]
b) Give two examples of how the variogram can be used to classify resources, use sketches to show your reasoning.[**10**]

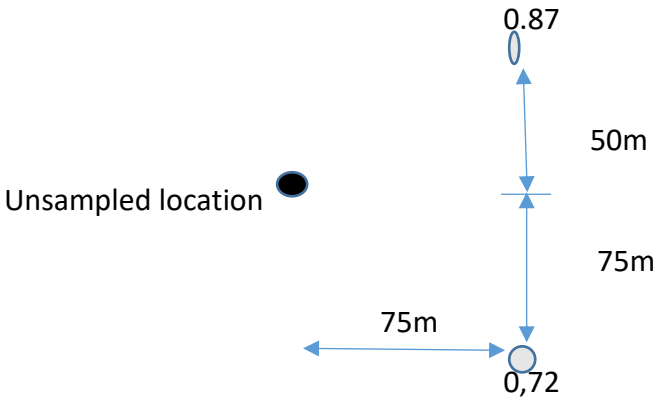
Question Three

a) State 4 geometric/conventional computation methods [**4**]
b) Name any 2 factors considered when selecting a conventional computation method [**2**]
c) Describe the triangular method, include all computation steps, diagram and equations. [**14**]

Question Four

a) Derive the Simple Kriging system of equations to determine weights for a random variable Z(**u**), with mean m(**u)** and variance, C(0). State all assumptions and show all steps. [**10**]

b) Consider the configuration below. The global mean is 1.3 and the variance is 0.2. Calculate the simple Kriging estimate at the unsampled location given that the isotropic covariance function C(**h**) = **exp**(− 3h/275). Show all steps clearly. [**10**]



Question Five

a) Evaluate P(16<x<24) and P(x>30.32) for an n(20,16) population. [**5**]

b) 20 boreholes were drilled through a gold deposit and analyzed in bulk for gold. The distribution of the Au values in g/t was found to be lognormal. The mean of the logarithmic ($\log_e$) transform of the concentration data of gold is 1.8($\log_e$g/t) and the small sample variance, s^2 of the logarithmic ($\log_e$) transform of the concentration data of gold is 0.78947. Calculate the best estimate of the average gold concentration in the deposit and give the 90% confidence limits. [**15**]

Question Six

a) Could a sample of gold ore with bar-x =15.6ppm Au (s^2 = 9 and n = 11) be regarded as a sample of a population with μ_0 = 13.5ppm Au at the 95% level of confidence? [**10**]

b) A mineralogist did point counting on a gold ore deposit with an assay grade of 8g/t. How many gold grains can he expect to find after counting 2 polished sections of solid rock, each containing 5 x 106 grains? What is the probability of observing only 2 grains? Assume the density of gold to be 18g/cc and that of the rock 2.7g/cc, that all the grains form perfect spheres with a diameter of 12 microns and that the gold grains are randomly distributed through the ore. [**10**]

Bon Courage!!!

Boa Sorte!!!