Introducing a software to calculate the grade and ore deposit probability related problems

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Abstract

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1. Introduction

2. Theoretical principles

2.1. Normal distribution

1.1.1. Standardization of normal distribution

$$\int_{x_1}^{x_2} f(x) dx$$

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-1/2((x-\mu)/\sigma)^2}$$

$\mu \quad \sigma$

$$x_1 < x < x_2$$

$f(x)$

$$Z = (x - \mu)/\sigma$$

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$$F(-z) = 1 - F(z)$$

2. The tonnage of ore reserve and metal content of a certain cut-off grade

Cut-off grade greater than mean grade		Altered cut-off grade	Cut-off grade below mean grade	
Ratio of ore tonnage	ω		ω	Ratio of ore tonnage
50	0.798	0	0.798	50
46.02	0.863	0.1	0.735	53.98
42.07	0.929	0.2	0.675	57.93
38.21	0.998	0.3	0.617	61.79
34.45	1.069	0.4	0.562	65.54
30.85	1.142	0.5	0.509	69.15
27.43	1.217	0.6	0.459	72.57
24.2	1.295	0.7	0.411	75.8
21.19	1.375	0.8	0.367	78.81
18.41	1.457	0.9	0.326	81.59
15.87	1.542	1	0.287	84.13
13.57	1.631	1.1	0.251	86.43
11.51	1.724	1.2	0.219	88.49
9.68	1.721	1.3	0.189	90.32
8.08	1.923	1.4	0.162	91.92
6.68	2.033	1.5	0.138	93.32
5.48	2.147	1.6	0.117	94.52
4.46	2.27	1.7	0.098	95.54
3.59	2.403	1.8	0.082	96.41
2.87	2.546	1.9	0.067	97.13
2.28	2.701	2	0.055	97.72
1.79	2.87	2.1	0.045	98.21
1.39	3.055	2.2	0.036	98.61

2.1. Normal distribution case

$$F(z) = \int_{-\infty}^z \frac{1}{\sigma\sqrt{2\pi}} e^{-t^2/2} dt$$

$$t((x_c)) = F((x_c - \mu)/\sigma)$$

$$x_-(x_c) = \mu + \sigma e^{(-1/2((x_c - \mu)/\sigma)^2)} / (\sqrt{2\pi} F((x_c - \mu)/\sigma))$$

$$x_-(x_c) = \mu + \sigma\omega$$

$$\omega = \frac{e^{(-1/2((x_c - \mu)/\sigma)^2)}}{(\sqrt{2\pi} F((x_c - \mu)/\sigma))}$$

$$z = (x_c - \mu)/\sigma = (0.5 - 1.4)/\sqrt{0.36} = -1.5$$

$$F(-1.5) = 1 - F(1.5) = 6.7$$

$$20 \times 0.9332 = 18.664 \approx 18.66$$

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$$\omega = 0/138$$

$$\bar{x}((x_c)) = \mu + \sigma\omega = 1.4 + 0.138 \times \sqrt{.036} = 1.483$$

3. Probability, mean grade and tonnage of ore reserve calculation using MATLAB programming language

3.1. description of calculating the probability of normal distribution via MATLAB programming language

3.2. description of calculating the probability, tonnage of ore reserve and mean grade of normal distribution via MATLAB programming language

ω

3.3. Main program

4. Conclusion

References

Principles of Mineral Exploration

Exploration Data Analysis

*Applied Statistics,
Geostatistical Ore Reserve Estimation
Songun Porphyry Copper Evaluation*

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