UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, APRIL 2001

Third Year - Program AELMEBASC

MMS 301S - Mineral Processing

Examination Type B

Examiner - G. E. Agar

ANSWER ALL QUESTIONS

Four pieces of graph paper, one linear, two semi logarithmic and one log-log are supplied. A graph of C_D versus N_R is also included.

Marks

15 1) A spherical particle 0.05 cm diameter settles freely in water. Calculate the terminal free settling velocity.

Specific gravity of quartz = 2.65
Specific gravity of water = 1.0
$g = 980$ cm/sec^2
Viscosity of water (μ) = 0.01 g/cm-sec

$$R = C_D * A * v^2 * \rho_l / 2$$
$$N_R = v * d * \rho_l / \mu$$

10 2) In the following table the assays of feed and products from an operating concentrator are given. Calculate the best fit material balance from this data and the distribution of elements into the products.

	Assays (%)		
	Cu	Pb	Zn
Feed	2.65	0.15	3.71
Cu Conc	27.55	0.66	2.68
Zn Conc	0.54	0.46	53.66
Tails	0.12	0.07	0.54

15 3) The flowsheet for a concentrator is as follows: a rougher followed by a scavenger on the rougher tails. The scavenger tails are the final tails. The scavenger concentrate joins the feed to the rougher stage. The rougher concentrate is subjected to three cleaning stages operated counter currently. The 1st cleaner tails become part of the rougher feed. Prepare a connection matrix to describe this circuit and calculate the minimum number of streams that must be sampled in order to calculate a complete material balance.

20 4) Batch laboratory grinding tests were done on charges of a single size fraction of ore. The tests were done for specifies time periods then the charge was screened. The following data was collected.

Time(sec)	0	30	60	90	120
Size (mm)	Weight fraction retained				
+1.2	1	0.56	0.31	0.17	0.10
1.2/0.84		0.12	0.16	0.15	0.12
0.84/0.6		0.06	0.08	0.09	0.08
0.6/0.42		0.05	0.08	0.09	0.10
0.42/0.3		0.04	0.07	0.08	0.09
-0.3		0.17	0.30	0.42	0.51

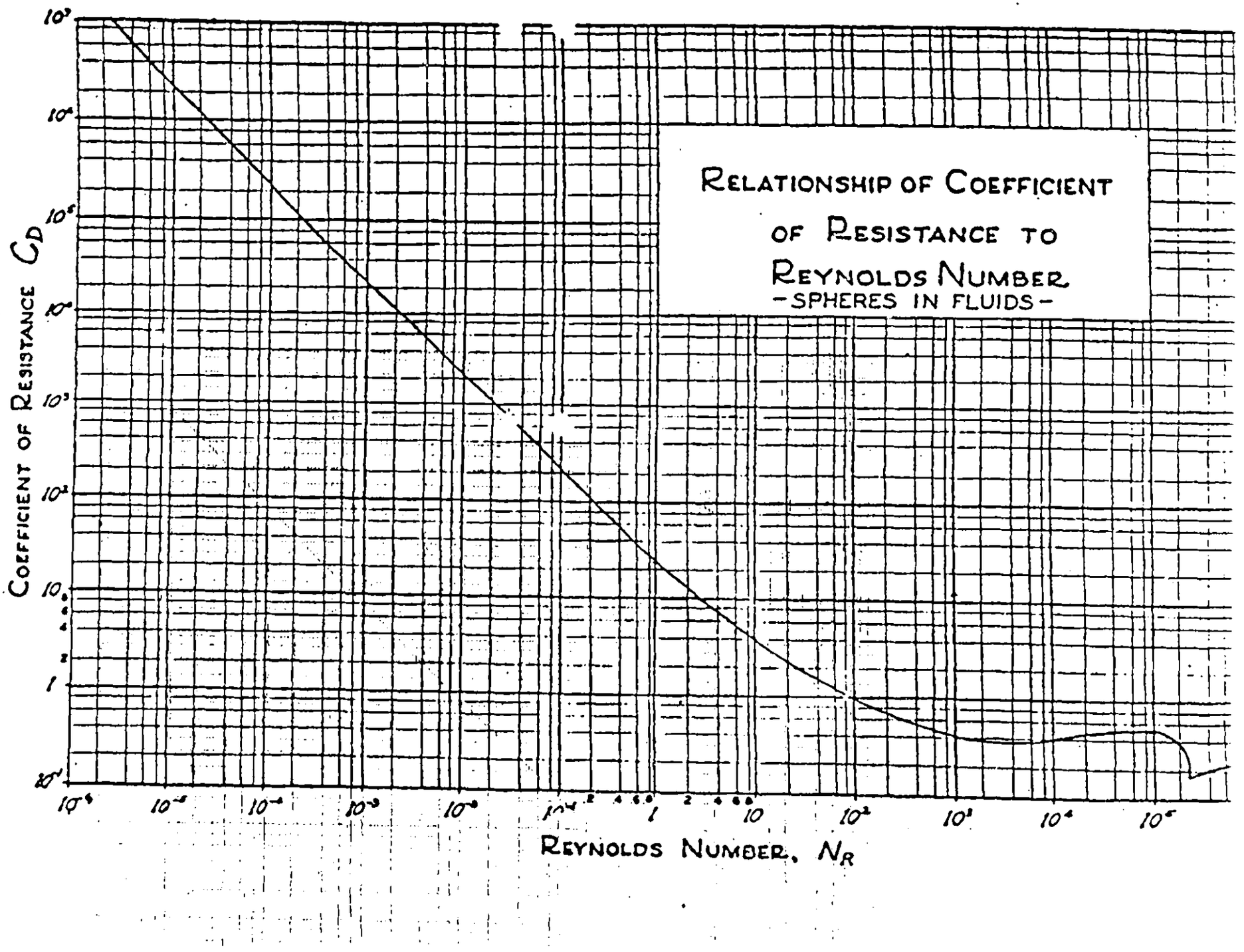
Calculate the first order rate constant for the disappearance of the two coarsest by two different methods.

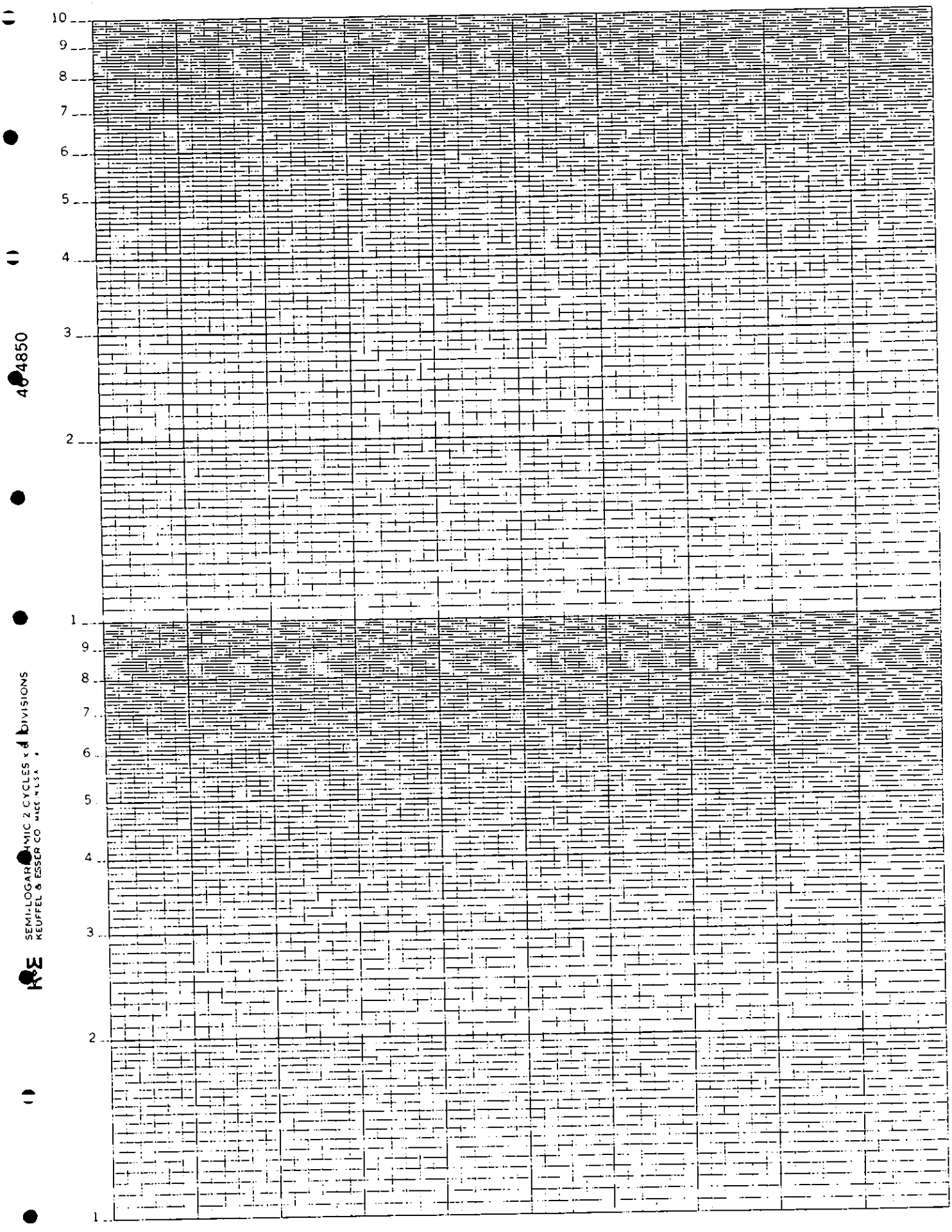
15 5) A batch flotation test was done in order to collect rate data for the separation of two minerals. The data is given below. Fit this data to an equation of the form $R = Rl\ (\ 1 - \mathbf{exp(-k}(t + \phi)))$

Time(sec)	Sp	Py
0	0	0
15	0.2027	0.0249
30	0.3622	0.0474
60	0.5863	0.0857
120	0.8107	0.1421
180	0.8967	0.1791
300	0.9422	0.2194
480	0.9496	0.2413

15 6) Batch flotation tests are often done during the development of a separation process for new ore bodies. Amongst other things the time for each separation stage is determined in the batch tests; however, the flotation process is usually carried out in a continuous manner. Show algebraically how you would relate the batch flotation time to the mean residence time in a continuous circuit.

10 7) Gravity separations are still common in the mineral industry. Describe the generic types of gravity separators and indicate the mechanism by which they function. Be quantitative wherever possible.


RELATIONSHIP OF COEFFICIENT
OF RESISTANCE TO
REYNOLDS NUMBER
-SPHERES IN FLUIDS-
COEFFICIENT OF RESISTANCE C_D
REYNOLDS NUMBER, N_R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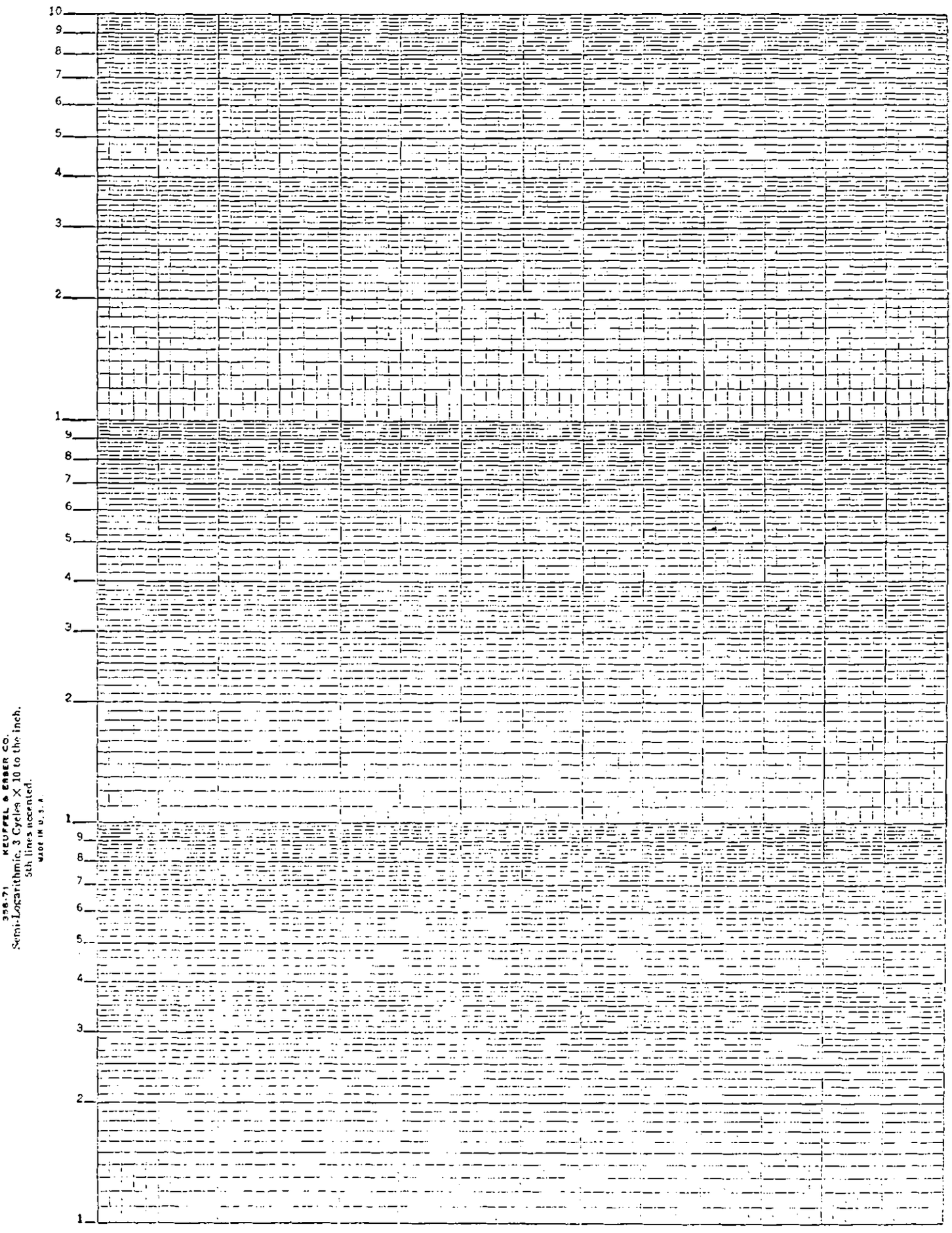
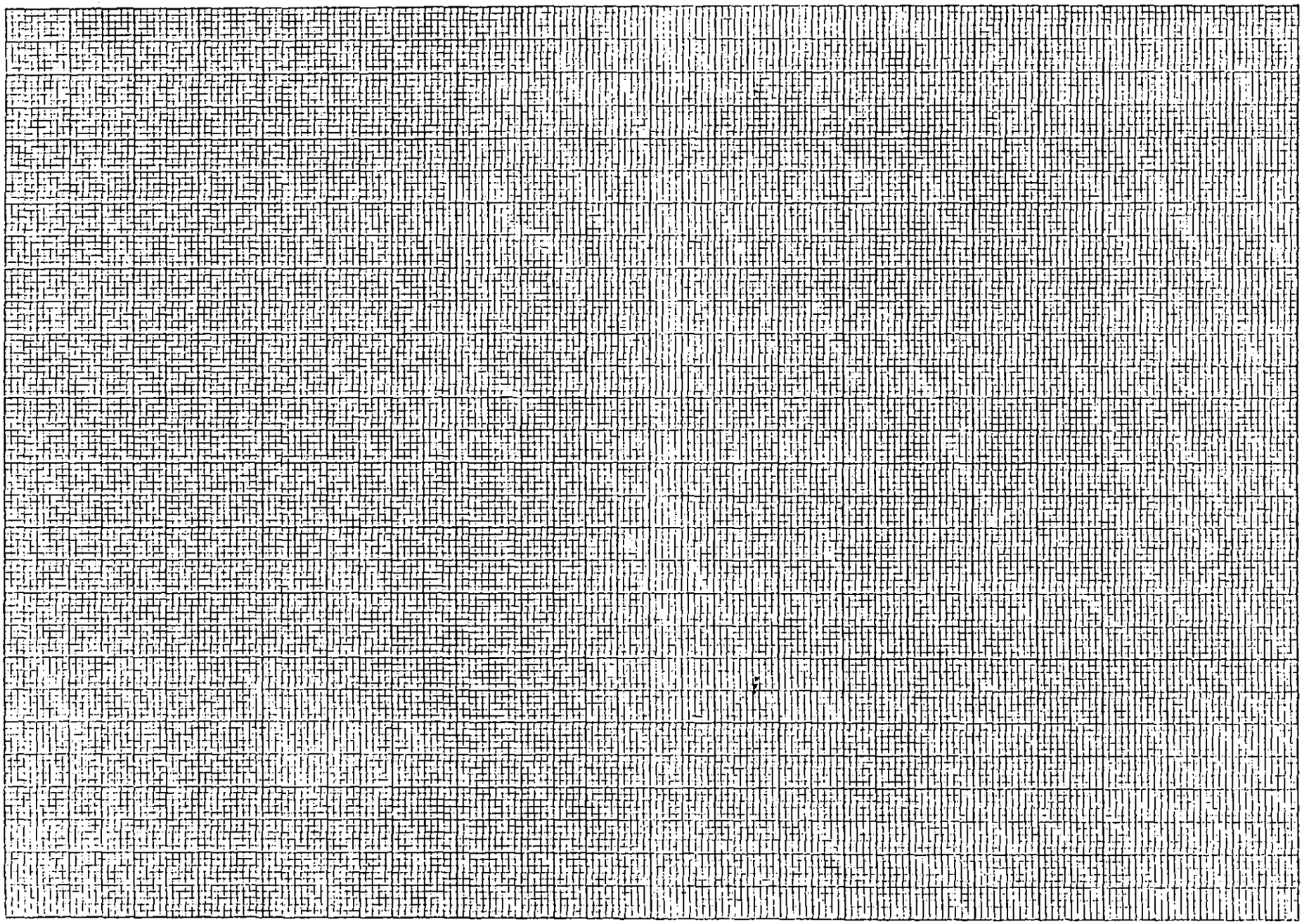
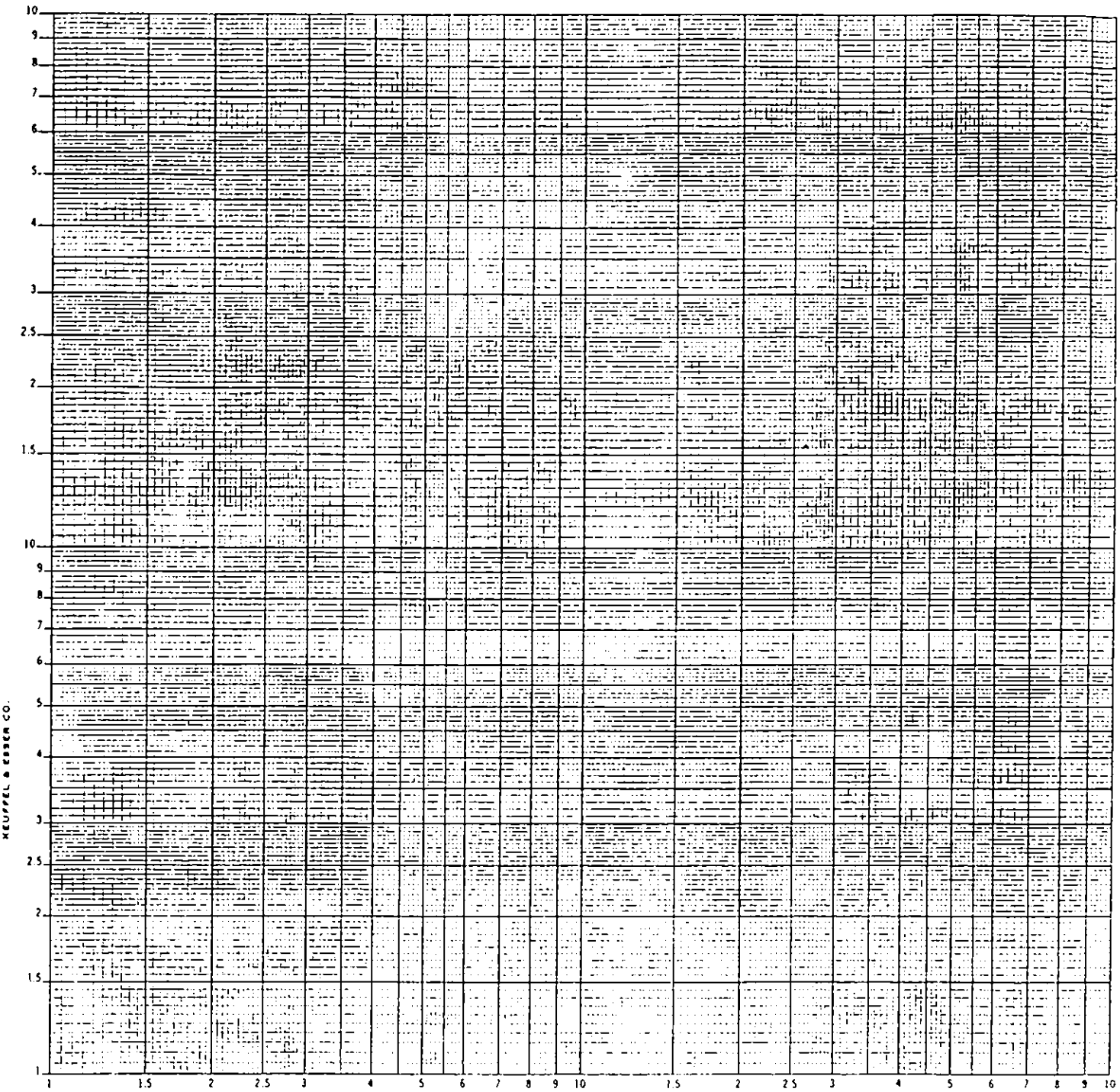


358-71 KEUFFEL & ESSER CO.
Semi-Logarithmic, 3 Cycles X 10 to the inch.
5th lines accented.
MADE IN U. S. A.

358-11 KEUFFEL & ESSER CO.
10 × 10 to the ½ Inch, 5th lines accented.
MADE IN U. S. A.

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