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An Interpolation Program for Texas Instruments 58/59 Series Programmable Calculators with Application to Contour Maps

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Introduction

This program was developed to aid geologists hand-contouring various types of maps. It is most useful when the number of shots between drill holes or sample sites is large and when the relief between them is great. The main value of the program is to eliminate the need to tediously calculate the position of each contour line manually.

To successfully use the program, three things must be kept in mind. (1) The variables A, B, and C must be used as defined below, and must be entered into the calculator using the corresponding A, B, and C keys. The order in which they are entered is not important. (2) The same unit of measurement must be used to measure the results as was used to determine variable B for any single series of calculations. (3) The lower of the two values for any given pair of points must be used when determining variable C and when plotting the positions of the contour lines.

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[1]Use of trade names in this paper is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.

Definitions

Three variables are used when contouring and they are as defined as follows (see fig. 1).

Variable A. This is the arithmetic difference between values being contoured. For example, it could be the difference between formation top elevations or formation thicknesses in adjacent drill holes.

Variable B. This is the horizontal map distance between points (drill holes, sample sites, etc.) measured directly off the base map. Any convenient unit can be used when measuring. However, it must be remembered that the values computed will be in the same units.

Variable C. This is the arithmetic difference between the smaller of the two values being contoured and the value of the next highest contour line. The contour line value will always be the larger of the two numbers. For example, assume that formation thicknesses in adjacent drill holes are 7 meters and 21 meters, and that you want to contour between them at 5 meter intervals. The smaller of the two values being contoured is 7 m and the next highest contour line is 10 m, which results in a value of 3 m for variable C.

Example and explanation

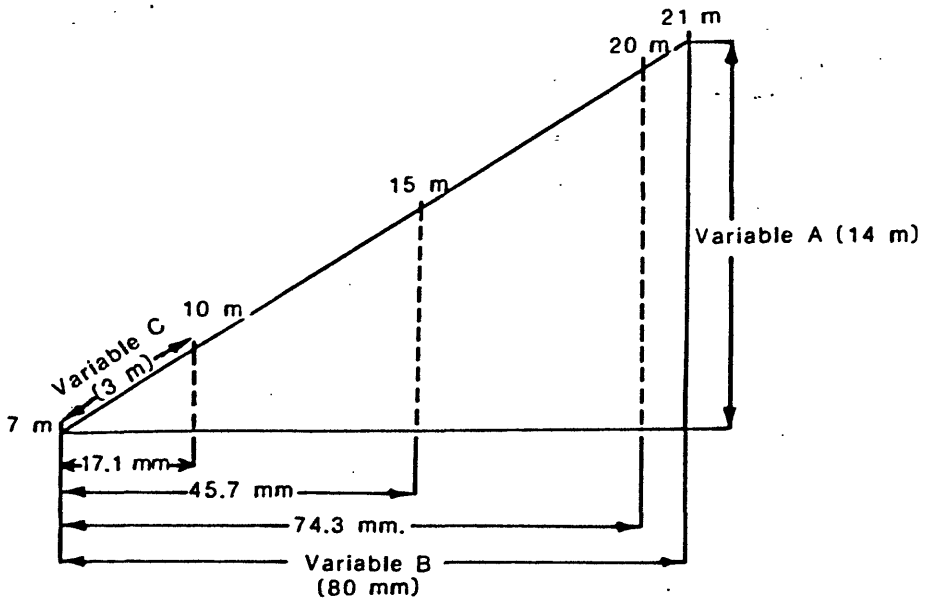

Figure 1.--Cross-sectional view of locations of contour lines.

In this example we will continue with the conditions in the previous example. Namely, that we have formation thicknesses of 7 m and 21 m in adjacent drill holes. We want to interpolate the positions of the 10-, 15-, and 20-m contour lines that pass between them.

Variable A is defined as the arithmetic difference between the two endpoints; in this example, 21 minus 7 = 14 m.

Variable B is the horizontal distance between the two endpoints (map distance, not real distance); in this example, 80 mm.

Variable C is the difference between the lowest value being contoured and the next highest contour line; in this example, 10 minus 7 = 3 m.

To compute where to place the contour lines, the 36-step program must first be entered into the calculator.

Next, the variables need to be stored. This is accomplished by first entering variable A (14 m) on the display and pressing the A key on the calculator. Do the same for variables B and C in turn, by first entering the numbers on the display and then pressing the appropriate letter key.

To compute the distance (in millimeters) from the lowest value (7) to the first contour line (10) press label D. This gives us a value of 17.1428. Generally only one decimal place is needed for these measurements. By pressing the keys 2nd - Fix - 1, the number (17.1428) is rounded to 17.1.

To find the distance to the 15-m contour line press the R/S key; the value is 45.7. Likewise, the distance to the 20-m line is found to be 74.3 by again pressing the R/S key.

By starting at the 7-m endpoint and measuring off 17.1, 45.7, and 74.3 mm along a line to the 21-m endpoint, you can accurately interpolate where the contour lines should cross.

There is no upper limit for the number of contour-line positions that can be interpolated for any three variables. Our example might have used endpoints of 7 m and 50 m just as easily. In that case, variable A would change to 43, but the other variables would remain the same. The result would be to calculate the position of the contour lines much closer together to represent the greater amount of relief.

When doing calculations between other pairs of points, you have to recalculate variables A, B, and C and enter them as described. If variables A or B should happen to remain the same on consecutive shots they need not be re-entered. However, variable C must be re-entered at its original lowest value, because it is constantly being increased automatically in increments of the contour interval, by means of the segment labelled E.

[Note: This program has been specifically designed for the TI Programmable 58/59 series calculators. Users more familiar with other TI programmable calculators may easily make adjustments in the program by studying the function of each segment and making any alterations necessary to accommodate their particular calculator.]

PROGRAM

Location	Key Code	Key Sequence	Comments
		LRN	
000	76	2nd Lbl	Stores variable A
001	11	A	
002	42	STO	
003	01	1	
004	91	R/S	
005	76	2nd Lbl	Stores variable B
006	12	B	
007	42	STO	
008	02	2	
009	91	R/S	
010	76	2nd Lbl	Stores variable C
011	13	C	
012	42	STO	
013	03	3	
014	91	R/S	
015	76	2nd Lbl	Recalls the variables
016	14	D	and uses them to
017	43	RCL	calculate positions of
018	02	2	contour lines
019	65	X	
020	43	RCL	
021	03	3	
022	55	÷	
023	43	RCL	
024	01	1	
025	95	=	
026	91	R/S	
027	76	2nd Lbl	Increases variable C by
028	15	E	the contour interval;
029	*	*	loops back to segment D
030	*	*	
031	44	SUM	
032	03	3	
033	61	GTO	
034	14	D	
035	91	R/S	
		LRN	

*Enter the contour interval to be used at this point, using one digit for each step. For example, the number 20 would appear as 029 02, the number 5 would be 029 00.
030 00
030 05