OTHER AIDS TO COMPUTATION

COMPARISON OF AMERICAN ELECTRIC DESK CALCULATORS

The following list of advantages and disadvantages of the three American electric desk calculators is intended to be an impartial survey of non-debatable facts concerning the use of the machines for statistical and technical problems.

Anything common to all three machines—on either side of the ledger—is excluded. To save space, each item is entered for the odd machine, that is, an advantage for two of them is entered as a disadvantage of the third.

No attempt is made to assess ruggedness, service, or length of life.

All three machines have features which, though unique, do not clearly belong on one side of the ledger or the other. Examples:

1. Monroe claims "velvet touch," which refers to all the keys having the same pressure to operate.
2. Marchant features higher cycling speed and continuous mesh mechanism in driving the counter wheels. These two almost exactly compensate each other.
3. Friden offers the possibility of adjusting each wheel of the accumulating counter individually.

The comparison is made between the latest models as of the end of 1952, and for each the most complete machine, for which the current prices are $775 for Monroe and Friden and $815 for Marchant. The Marchant has complete carry-over on all models; the Monroe has it as a standard item only on the full size (automatic) machine; for the Friden it is not standard on any model. It should be pointed out that if the work to be done does not call for a full size machine, the prices differ sharply. In all cases, it pays to examine the range of models of all three before purchasing. No one of the machines stands out for all-purpose operation.

No comparison is made between these machines and other calculators, such as the Olivetti and Remington Rand printing calculators, the Curta 8-ounce hand operated machine, and the Swedish Facit (the latter formerly made here by R. C. Allen).

Both Monroe and Marchant offer octal calculators in their line. Monroe and Friden are about to bring forth electronic machines in team with IBM. Friden has a square root model available ($1300).

It is not possible, without exhaustive research, to evaluate the machines in terms of hourly production of written answers. It is probably true that for a variety of work (typical in technical applications) the difference in production speed is slight.

Friden advantages:

1. Zero keys can be raised to lock (positively) any single column.
2. Rounding (reset to 5) is available in six positions of the accumulating dial.
3. Dials can be cleared manually when locked.
4. Readily continues a halted division.

5. Positive lock for entire keyboard. (When locked, dividend entry is suppressed.)
6. Has a bell.
7. Automatic transfer from accumulating to counting dial.

Friden disadvantages:

1. Dividend tab key always produces long carriage travel.
2. Divide keys are arranged so that *both* must be depressed for normal (positive) division.
3. Plus and minus bars are located outside the shift keys.
4. The machine is not always ready to use as an adding machine.
5. Unless some dividend tab key is down, dividend will not enter.

Monroe advantages:

1. Lightweight, small, and portable.
2. Smaller models can be built into a full size machine.
3. Smaller models (non-automatic multiplication) have a single key to zero the entire machine.
4. Drive shaft is available for hand cranking or minor unjamming.
5. Factor is entered only once for squaring.
6. Rounding available (one position only).
7. Has back transfer from the accumulating dial to the multiplier unit.
8. A unit counter is available (optional) to tally the number of operations.
9. Single digits of a constant multiplier can be corrected or changed.
10. Zeros in the multiplier are not entered by key depression.
11. Has automatic carriage return to selected position after multiplication.

Monroe disadvantages:

1. Possible runaway on division (lacks divisor lineup feature).
2. Lacks positive keyboard lock.
3. Very easy to depress two keys in one bank at once.

Marchant advantages:

1. Automatic return of carriage after division and instant dividend/divisor entry.
2. Visible keyboard entry dials.
3. Multiplication can be left to right or right to left.
4. Multiplication takes place as the multiplier digits are entered; the product is available just after the last digit of the multiplier is entered.
5. Repeat addition or subtraction takes place if the plus bar is depressed simultaneously with a multiplier key.
6. Can have just one key per bank down at a time.
7. Allows a certain amount of touch control in multiplication with varying concavities of the multiplier keys.

Marchant disadvantages:

1. Lacks auto dividend entry, but see No. 1 advantage. Generally has to be set up for the initial division, but subsequent divisions are programmed faster.

2. Lacks non-entry of the multiplier.
3. Lacks provision for constant multiplier.
4. Lacks dial locks. This makes sums of quotients rather difficult and prevents all operations which depend on split dial locks, such as decimal accumulation.
5. Lacks positive keyboard lock.
6. Algebraic sums of products involves changing controls when the sign changes. (Friden and Monroe have a negative accumulative multiplication key).
7. Lacks automatic dial clearance at the start of a multiplication.

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1048. N. L. FRITZ, "Analog computers for coordinate transformation," *Rev. Sci. Instruments*, v. 23, 1952, p. 667–671.

This is a device for forming a linear combination $a_1b_1 + a_2b_2 + a_3b_3$ by means of an a.c. voltage source and ten turn potentiometers. The answer is obtained by a servo balancer. The effect of load is discussed.

F. J. M.

1049. G. W. SWENSON & T. J. HIGGINS, "Direct current network analyzer for solving wave equation boundary value problems," *Jn. Applied Physics*, v. 23, 1952, p. 126–131.

The two dimensional wave equation $\nabla^2\varphi + (\omega/c)^2\varphi = 0$ is solved for its least characteristic frequency by means of an electrical network. The corresponding difference equations lead to a square lattice network with boundary points at zero potential and with interior points connected to ground through "negative resistors." These "negative resistors" involve an adjusttable current source and a galvanometer in a Wheatstone bridge circuit. They are current generators which are adjusted until the output current equals in absolute value the current that would have flowed in a certain resistance connected to ground. However this generated current is opposite in direction to the last mentioned current. In each solution, all these negative resistances are readjusted until all the galvanometers read zero. In order to get a non-zero solution a forcing current is introduced at one point in the network and a solution for the difference equation for the above differential equation obtained. The frequency ω is given an increasing sequence of values starting with zero and the amount of forcing current is noted. As ω approaches the first characteristic frequency, the forcing current approaches zero for a given amplitude for the solution. Convergence of the iteration process occurs past the first characteristic frequency to a point "just below the first antiresonant frequency" and no further. The device will also solve problems in forced vibrations. Various vibration problems are illustrated and the possibility of generalizing the boundary conditions is discussed.

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