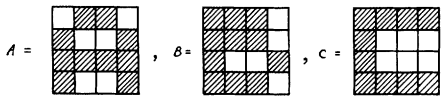
Example III: Separate vowels from consonants as they are displayed on a four-by-four matrix.



Each matrix is converted to a column representation corresponding to the numbered squares below, and each resulting column is placed in a test matrix as in the previous examples.

1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	−	+	+	+	−	+	+	+	−	+	+	+	+	+	−	+	+	+	+	+	−	+	+	+	+	+
1	+	+	+	+	−	+	+	+	+	−	+	+	+	+	+	+	−	+	+	+	−	+	+	+	+	+
2	−	+	+	+	−	+	+	+	+	−	+	+	+	+	−	+	+	+	+	−	−	+	+	−	−	−
3	−	+	+	+	−	+	+	+	+	+	+	+	+	+	−	+	+	+	−	−	−	−	+	−	−	−
4	−	+	+	+	−	+	+	+	+	+	+	+	+	+	+	+	−	+	+	−	+	−	+	+	−	+
5	−	+	+	+	−	+	+	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	+
6	+	+	−	−	−	+	−	+	−	−	−	−	+	+	+	−	−	−	+	+	+	−	−	+	+	−
7	−	−	−	−	+	−	−	+	−	−	+	−	−	−	+	+	−	+	−	+	+	+	+	+	+	+
8	+	+	+	+	−	−	+	−	−	+	−	+	−	−	−	−	+	−	+	+	−	+	−	−	+	+
9	−	+	+	+	−	+	+	−	+	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	+
10	+	+	−	−	−	+	−	+	+	−	+	−	+	−	+	−	−	−	+	−	+	−	−	+	+	+
11	−	−	−	−	+	−	+	+	−	−	−	−	−	+	+	+	+	+	−	−	+	+	+	+	−	−
12	+	+	+	+	−	−	+	−	+	+	−	+	−	−	−	−	+	−	+	−	−	+	−	−	−	+
13	+	−	+	−	−	+	+	+	+	+	+	−	+	+	+	−	−	−	+	+	−	+	+	+	+	+
14	−	−	−	+	+	−	−	+	+	+	−	−	+	+	−	+	+	+	−	−	−	+	+	−	−	−
15	−	+	−	+	+	−	+	+	+	+	+	−	+	+	−	−	+	−	+	−	−	−	+	−	−	−
16	−	−	+	−	−	−	+	+	+	+	+	+	+	+	+	−	+	+	−	−	+	−	+	+	−	+

Since it is not obvious which combinations will produce non-negative (or non-positive) rows, reduction of the matrix is initiated by making linear combinations to produce as many zeroes as possible at the beginning of each row.

The table below shows the two-row combinations which were tried before a non-positive row was produced:

Operation	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0−2:	0	0	0	0	0	0	0	0	−	+	0	0	0	0	0	0	0	0	0	+	0	0	0	+	+	+
1+7:	0	0	0	0	0	0	0	+	0	−	+	0	0	0	+	+	−	+	0	+	0	+	+	+	+	+
2−3:	0	0	0	0	0	0	0	0	0	−	0	0	0	0	0	0	0	0	+	0	0	+	0	0	0	0
3−4:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	−	0	+	0	−	0	−	0	0	−	0	−
4−5:	0	0	0	0	0	0	0	+	+	+	+	+	+	+	+	0	−	0	0	−	0	0	+	+	0	0
5−9:	0	0	0	0	0	0	0	0	−	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Delete column I as a result of the (5−9) combination. Now the (0−2) combination has only + and 0 signs, so delete columns J, T, X, Y and Z. Next delete columns S and V as a result of the (2−3) combination. Each of the rows involved may also be deleted because the information in the remaining columns is duplicated in another row. The remainder of the partial matrix is now recopied and the combinations are continued:

Operation	A	B	C	D	E	F	G	H	K	L	M	N	O	P	Q	R	U	W
1+7:	0	0	0	0	0	0	0	+	+	0	0	0	+	+	−	+	0	+
3−4:	0	0	0	0	0	0	0	0	0	0	0	0	−	0	+	0	−	0
4−5:	0	0	0	0	0	0	0	+	+	+	+	+	+	0	−	0	0	+
6−10:	0	0	0	0	0	0	0	0	−	0	0	+	0	0	0	0	0	0
7−11:	0	0	0	0	0	0	−	0	+	0	0	−	0	0	−	0	0	0
(4−5)−(7−11):	0	0	0	0	0	0	+	+	0	+	+	+2	+	0	0	0	0	+

As a result of this double combination, colums G, H, L, M, N, O and W may be deleted. Row (4−5) may be deleted, as well. Next, column K and row (6−10) may be eliminated. Row (7−11) now reveals that column Q may be eliminated, and consequently column U may be deleted because of row (3−4), and columns P and R may also be deleted as shown by row (1+7). Only columns A through F remain to be checked:

	A	B	C	D	E	F	
8−16:	+	+	0	+	0	0	∴ delete columns A, B, and D,
9−10:			+		0	0	∴ delete column C,
12:					−	−	∴ delete columns E and F.

All 26 columns have been deleted, so the desired separation is shown possible.

When no further advantageous row operations are apparent, nonrealizability is indicated. Proof of nonrealizability, however, requires proving that no further operations will produce non-negative, nonzero (or non-positive, nonzero) rows, or else finding a set of nonzero weights which satisfies the equations.

One particular advantage of this procedure is that if nonrealizability is indicated, it is relatively obvious what coding changes will produce a realizable separation.

For a slightly different and more thorough approach to this problem, see the work by Singleton [2]. He also considers the problem of determining the weighting function for realizing a realizable separation.

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References

[1] C. K. Chow, "Boolean functions realizable with single threshold devices," Proc. IRE, vol. 49, p. 370; January, 1961.
The only reference consulted in the preparation of this paper was [1]. For further information, see the following:
[2] R. C. Singleton, "A Test for Linear Separability as Applied to Self-Organizing Machines," in "Self-Organizing Systems 1962," M. C. Youits, G. T. Jacobi and G. D. Goldstein, Eds., Spartan Press, Washington, D. C.; 1962.
[3] K. Fan, "On systems of linear inequalities," in "Annals of Mathematics Studies, Number 38," H. W. Kuhn and A. W. Tucker, Eds., Princeton University Press, Princeton, N. J.; 1956.
[4] C. C. Elgot, "Truth Functions Realizable by Single-Threshold Organs," presented at the AIEE Fall General Meeting, Chicago, Ill.; October 9–14, 1960.
[5] C. C. Elgot and J. D. Rutledge, "Operations of finite automata," *Proc. Second Annual Symp. on Switching Circuit Theory and Logical Design*, AIEE Publ. No. S-134; October, 1961.

Data for Character Recognition Studies*

A few years ago during my initial work in the problem of pattern and character recognition, I reduced several samples of hand printing and machine printing to matrix form. I later used this data to obtain experimental results which appeared in two papers.[1,2] My intent in reducing this data

* Received February 7, 1963.
[1] W. H. Highleyman, "An analog method for character recognition," IRE Trans. on Electronic Computers, vol. EC-10, pp. 502–512; September, 1961.
[2] W. H. Highleyman, "Linear decision functions, with application to pattern recognition," Proc. IRE, vol. 50, pp. 1501–1514; June, 1962.

to computer language was only to test my ideas in character recognition. However, several people have since requested copies of this data and there have, in fact, been several published works[3–5] in which this data was used for experimental results. This data has now been received, and is presumably beings used, by such companies and laboratories as Burroughs Corporation, Panoramic Research, Inc., Purdue University, Syracuse University, Pennsylvania State University, Argonne National Laboratories, Armour Research Laboratories and the General Electric Company. Since it appears that this data is being used commonly, it may, therefore, serve as an unintended, incomplete, yet interesting, available and temporary standard by which workers in the field may compare their results with those of others.

Because of this, I am prepared to distribute this data to anyone who requests it for the nominal charges of reproduction and shipment. The data comprises 50 samples of each of the 36 alpha numerics, hand-printed by 50 different people, and 50 samples of each of the 10 numbers taken from an IBM 407 line printer. It is on punched cards with a matrix size of 12×12. Requests for this data may be made to W. H. Highleyman, Data Trends, Inc., 1259 Rt. 46, Parsippany, N. J.

I think it valuable to have a standard for comparison of character recognition results since many published works tend to be ambiguous as to the quality or source of their data. However, I strongly feel that any such standard should be well thought out and certainly more complete than this data of mine. Until such a standard exists, I am happy to make this data available, and hope that many will find it of use.

W. H. Highleyman
Data Trends, Inc.
1259 Rt. 46
Parsippany, N. J.

[3] W. H. Highleyman, and L. A. Kamentsky, "Comments on a character recognition method of Bledsoe and Browning," IRE Trans. on Electronic Computers (*Correspondence*), vol. EC-9, p. 263; June, 1960.
[4] W. W. Bledsoe, "Further results onthe N-tuple pattern recognition method," IRE Trans. on Electronic Computers, vol. EC-10, p. 96; March, 1961.
[5] C. K. Chow, "A recognition method using neighbor dependence," IRE Trans. on Electronic Computers, vol. EC-11, pp. 683–690; October, 1962.

Renaming the PTGEC*

In this memo are recorded my views on a new name for the Professional Technical Group on Electronic Computers having a connotation broad enough to encompass the principal activities and interests of its current members but not so broad that it includes the principal activities and interests of other groups of engineers and scientists.

If our professional group were now seeking a name for itself for the first time, I suggest that a rational procedure for arriving at such a name is the following:

1) Write down a statement describing the principal activities and interests of the current members and, as far as possible, what their future activities and interests are expected to be.

2) Select from this statement the key words and expressions, and characterize these by inclusive terms and expressions or their equivalents so as to reduce their number.

3) Arrange these inclusive terms appropriately as the new name.

Let us try this procedure.

1) I believe that our members' principal activity and interest is, and will be in the foreseeable future, the theory and practice of the design, construction, test, operation, and maintenance of reliable components, circuits and equipment to be used by itself or as part of a larger system for such diverse purposes as making calculations and simulations, solving differential equations, controlling inventory, producing a payroll, predicting the weather, playing games with incomplete strategies, proving theorems, deciphering codes, translating languages, retrieving information, and carrying out other such tasks which are characterized as mental or intelligent when carried out by human beings.

2) The key inclusive terms in the above statement are *theory, practice, activity, interest, equipment, system, intellectual task.* I think most people will agree that in the name of a professional group of the IEEE, the terms *theory, practice,* or terms designating any of the activities or interests (namely, *design, construction, test, operation, maintenance*) need not appear because the charter of the parent organization implies these interests and activities. On the other hand, the terms (or acceptable equivalents) *equipment, system* and *intellectual* should appear in the name.

3) The following names, then, are candidates:

a) Professional Technical Group on Equipment Systems Used for Intellectual Tasks.

b) Professional Technical Group on Intellectronic Systems (if one takes intellectronics to mean equipment(s) used for intellectual tasks).

The present name, Professional Technical Group on Electronic Computers, is inadequate because a) we are now also interested in other than electronic components (*e.g.*, chemical), b) computing is not the only purpose to which the equipment is put and c) a *system* of which the equipment is a part is neither mentioned nor implied. The proposed name,[1] Professional Technical Group on Information Processing Systems, is inadequate because Information Processing is too broad and the term *equipment* is neither named nor implied. It is true that in performing most, if not all, of its intellectual tasks, information (sometimes data or records which may or may not yield information) is being processed, *i.e.*, signals are rearranged on a medium, or are transferred from one location to another, their codes are changed, and the equivalent of mathematical and logical operations are performed on them. It is equally true that information is processed in, or by, television equipment, radio equipment, telephone and telegraph equipment, telemetering equipment, and other such equipment systems in which our members have but peripheral interest. I think the name of our organization should feature the purpose to which the equipment system is to be put rather than the "stuff" (in this case, information) that the equipment system works on (processes). Otherwise, as indicated above, the name may be ambiguous.

A third candidate is

c) Professonal Technical Group on Automata.

The Greek derived term *automaton* (*auto* = self; *maton* = thinking) is inadequate because it connotes only the equipment itself (not as part of a system) and also because in current usage automaton connotes motion—physical activity, rather than intellectual activity.

On another occasion,[2] I have coined a single word, derived from the Greek, which by its etymology connotes a variety of substantive *systems* (*equipment* and otherwise) pooling their "*intellectual*" resources in the performance of intellectual tasks. This word is *synnoeton;* plural *synnoeta,* (*syn* = together; *noeton* = intellectual entity). Thus, another candidate is the short name,

d) Professional Technical Group on Synnoeta.

I submit, therefore, that we change our name to the *Professional Technical Group on Synnoeta.*

In connection with this, I would like to point out that publications and organizations such as ACM are interested in applications, purposes, functions and programming of synnoeta and their members, as ours, may be accurately described as engineers or scientists working in a branch of the science of Synnoetics. When the ACM and other organizations and publications get around to changing their names to more adequately describe their scope of interest and activity, I hope that this fact will be recognized and that it will be a desideratum.

From the objections to the name Professional Technical Group on Information Processing Systems, enumerated above, it will be correctly surmised that the names American Federation of Information Processing Societies (AFIPS) and its international godfather IFIPS are ill-chosen. Let's not perpetuate such mistakes with a PTGIPS. We have an opportunity to show the way in accurately characterizing the scope of our interest and activity and that of our colleagues.

Louis Fein
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Palo Alto, Calif.

* Received January 25, 1963.

[1] This memo was originally written in response to A. Cohen's suggestion that the name of the PGEC be changed to PGIPS.

[2] L. Fein, "The computer-related sciences (Synnoetics) at a University in the year 1975," *Am Scientist,* vol. 44, pp. 149–168; June, 1961.