February 25, 1976

26 FEB 76 9: 02

W. D. Royall

Did you see this? Please return.

B. Grad

We had not, thanks for calling it to our attention.

Bill

3/1

2/26/76

Burt,

We had not--thanks for calling it to our attention.

W. D. Royall

Aleksa per our conversation. BG 3/1. Call to

March 2, 1976

Mr. S. A. A[illegible]ka MAR 3 9 15 AM '76

Per our conversation.
Please return.

B. Grad

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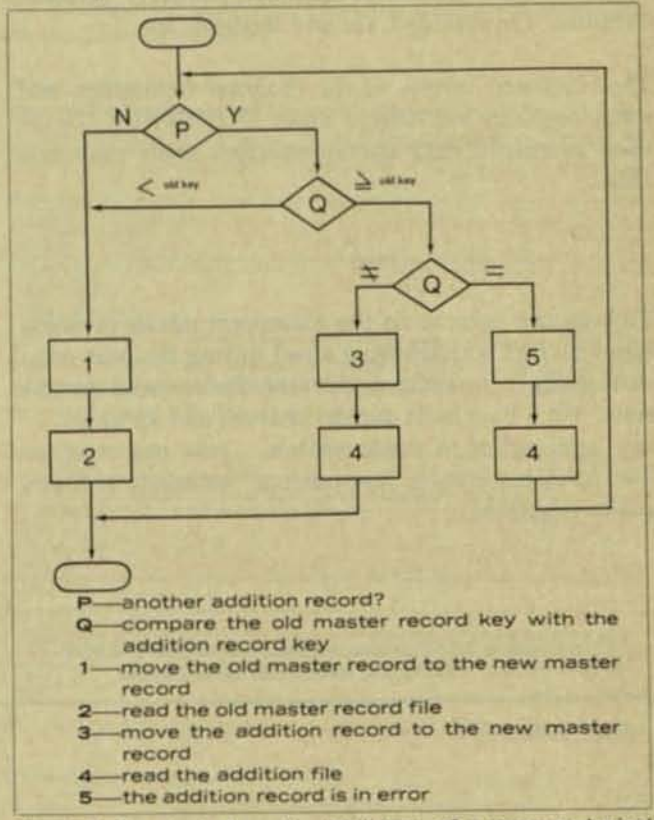
The Dark Side of Structured Programming

Many positive things have been said about structured programming. Maybe the time has come to be somewhat negative.

The proximate cause of this article was a reading of IBM's Independent Study Program on Structured Programming [ed. note: A review appeared in the October issue, p. 27]. In it we learn that the flowcharting decision box is now a predicate node; the connector is a collector node; and the process box, a process node. We also learn that to convert our spaghetti-bowl flowchart thinking to structured thinking, we must master the techniques of interchange, transposition, combination, resolution, and substitution. With help like this, we may have nothing to worry about—structured programming may not survive.

Perhaps we should begin again. Let's try it with a not-so-



P—another addition record?
Q—compare the old master record key with the addition record key
1—move the old master record to the new master record
2—read the old master record file
3—move the addition record to the new master record
4—read the addition file
5—the addition record is in error

Fig. 1. A flowchart done the "old" way, of a common logical situation: merging additions to a master file.

	1	2	3	4
P ?	Y	Y	Y	N
Q (LESS THAN CASE) ?	Y	N	N	—
Q (EQUAL CASE) ?	—	Y	N	—
1	X	—	—	X
2	X	—	—	X
3	—	—	X	—
5	—	X	—	—
4	—	X	X	—

Fig. 2. The same situation as Fig. 1 presented in a decision table.

new remark: From a general point of view, structured programming isn't a new thing. It's just another way of saying that you should organize and localize your code. However, don't think that by this remark, I mean to run down the structured programming concept. I don't. It shows how to organize and localize code in a methodical way, and that's to the good, since it allows us to minimize art and maximize procedure.

However, it's hard to overcome a strong sense of déjà vu, and with good reason, because we decision table devotees have been here before. The fact is that if you use decision tables to organize your program logic and adhere to one simple rule, you've organized your logic according to structured programming principles. The simple little rule is: No GO TO's in the action stub. Actually, there's one important exception to this rule, but rather than bother you with it here, I've buried it at the end.

Now, how do decision table and structured programming logic differ? The answer is shown in a nutshell in Fig. 1, which represents a common logical situation. The key at the bottom of Fig. 1 substitutes values for variables to transform the general case shown into a familiar specific one—the merging of additions into a master file.

Decision tables have no trouble with the logic shown. (See Fig. 2.) However, this common logic situation is the nemesis of structured programming—to express this logic in structured form requires the introduction of a flag (F), as shown in Fig. 3. So, yes, decision tables and structured programming do, on some occasions, produce different logical structures for the same situation, but in those in-

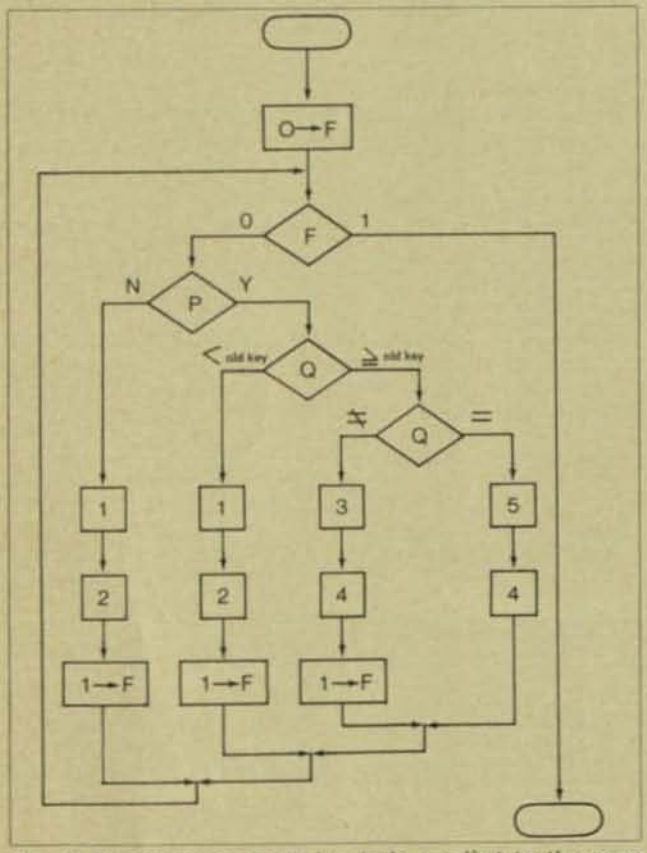


Fig. 3. Structured programming logic, applied to the same situation as Figs. 1 and 2, requires flags and increases in complexity.

stances where they differ, who needs the contortions of structured programming?

It could be contended that logic such as that shown in Fig. 1 should be allowed, and that otherwise, structured programming principles are to be followed. But now the door is ajar and who knows what other spaghetti bowls may creep in? Decision tables aren't hampered with the need for

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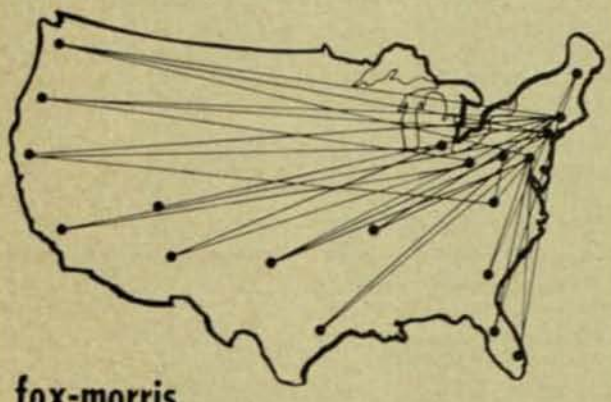

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any such compromises.

Decision tables have another advantage over structured programming. When you're finished with your decision tables, you can just turn them over to a preprocessor, and out comes your code. With a structured flowcart, you must still write all that COBOL code. And if you thought writing COBOL code made your hand hurt, wait until you write COBOL code in structured format. All those duplicate operations create a real temptation to slip in a few nice, simple GO TO's to avoid writer's cramp.

Preprocessed spaghetti

Now, it's possible to contend that while decision tables organize logic well, preprocessors turn out spaghetti bowls. True enough, but this is the same as saying that even if you avoid GO TO's in your COBOL code, the compiler is going to generate a lot of branches, which is true. The point is that you maintain programs at the level at which you write them, and with the use of preprocessors, you maintain your programs at the decision table level.

There's also the fact that with decision tables, there are automatic procedures which can be built into the preprocessor to:

1. guarantee that all possible combinations of conditions have been considered
2. eliminate all redundancy
3. detect all contradictions.

No flowcharting technique, including structured flowcharts, can claim to do all three.

That one exception

Here's the buried exception part mentioned earlier. Consider the situation in Fig. 4. Now, suppose that condition B depends on the outcome of action D. The situation then has

TABLE—X	1	2	3	4
CONDITION A	Y	Y	N	N
CONDITION B	Y	N	Y	N
ACTION C	X	X	—	—
ACTION D	X	X	X	X
GO AGAIN	X	—	X	—
EXIT	—	X	—	X

Fig. 4. The one case where the simple decision table like this presents difficulties without a GO TO is when condition B depends on the outcome of action D.

TABLE—X	1	2
CONDITION A	Y	N
ACTION C	X	—
ACTION D	X	X
PERFORM TABLE—Y	X	X
EXIT	X	X

TABLE—Y	1	2
CONDITION B	Y	N
GO TO TABLE—X	X	—
EXIT	—	X

Fig. 5. The situation of Fig. 4 with a GO TO in the action stub.

to be described as shown in Fig. 5. This is the only type of situation in which a GO TO action should appear in the action stub.

. . . once again

Going back to the starting point, if you use decision tables, you don't need to know anything about predicate nodes, collector nodes, process nodes, interchange, transposition, combination, resolution, and substitution. That alone should be enough to sell you on decision tables.

—Thomas R. Gildersleeve

Previously with Univac for 14 years, for the past six years Mr. Gildersleeve has been a consultant specializing in organization studies, and in developing project management procedures and system development standards.