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University Computer Program

SEARCH: A COMPUTER PROGRAM FOR LEGAL PROBLEM SOLVING

ROBERT HELLAWELL*

INTRODUCTION

THIS ARTICLE describes a computer program called SEARCH which is designed to assist a lawyer in legal analysis.¹ SEARCH deals with a single subject in corporate taxation, but its approach can be used for a variety of legal problems. SEARCH's subject is the attribution rules of section 318 of the Internal Revenue Code (hereinafter Code).² These rules, heartily disliked by many, are seemingly complex and often both difficult and time consuming to apply. Essentially, the attribution rules provide that a taxpayer, in certain cases, will be considered to own corporate shares that he does not actually own. Such shares are said to be attributed to taxpayer and taxpayer is said to own such shares constructively. The attribution rules apply to individuals, corporations, trusts, partnerships and estates.

In cases where the attribution rules apply, an individual will constructively own all shares owned by her spouse, children, grandchildren and parents.³ Corporations, trusts, partnerships and estates (hereinafter entities), as well as individuals, will constructively own a proportionate number of the shares owned by other entities in which they have an interest.⁴ For example, a trust will own that percentage of the shares of a corporation owned by a partnership that is equal to the percentage interest that the trust holds in the partnership. If the partnership owns one hundred shares of Corporation A, and the trust owns ten percent of the partnership, then the trust will constructively own ten shares of Corporation A. Additional rules attribute shares held by beneficiaries, partners and shareholders (under specified conditions) to their estates, trusts, partnerships and corporations.⁵

Shares constructively owned by application of the attribution rules are, with certain exceptions,⁶ considered to be actually owned for purposes of reapplying the attribution rules.⁷ This has far reaching consequences; shares

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¹ SEARCH was written in the language BASIC-PLUS-2 on the DECSYSTEM-20 at Columbia University.

² I.R.C. § 318 (1976).

³ *Id.* § 318(a)(1).

⁴ *Id.* § 318(a)(2).

⁵ *Id.* § 318(a)(3).

⁶ *Id.* § 318(a)(5)(B) & (C).

⁷ *Id.* § 318(a)(5)(A).

can be attributed from entity to entity and finally to taxpayer through a network of interlocking ownership of any length and complexity. Moreover, the same shares, or some part of them, may be able to be attributed to taxpayer by two or more different routes. In such cases shares must be counted only once, but the attribution route chosen must be that which yields the highest total attribution.⁸

SEARCH's job is to find all legal attribution routes in a given fact pattern and to calculate the attribution amounts.

I. SEARCH'S CONTEXT

SEARCH is designed as the attribution component of an overall program that concerns section 304 of the Code.⁹ An understanding of SEARCH does not require any knowledge of section 304, but a brief description of it and of how the attribution rules relate to it may be useful. Section 304 concerns cases where a person in control of two corporations sells shares of one of the corporations to the other.¹⁰ Normally a sale of shares results in capital gain (or loss) treatment,¹¹ In a sale of stock under section 304, however, this may not (and should not) necessarily be the case. Suppose, for example, an individual taxpayer (hereinafter TP) owns all of the shares of both Corporation A and Corporation B. If TP sells some A shares to B, nothing of consequence has happened except that funds of B have been transferred to TP; as a practical matter TP still owns one hundred percent of both A and B. This is a clear case for treating the proceeds of the sale as a dividend rather than as a capital gain (or loss). On the other hand, if TP owns less than all the stock of both A and B and if the number of A shares sold is such that his interest in A is substantially diminished, then perhaps capital (rather than dividend) treatment is warranted. Section 304, together with section 302, sets the rules for deciding between capital and dividend treatment in such cases.

Section 304 comes into play when TP owns at least fifty percent (by value) of each of the two corporations involved.¹² If so the sale will be treated as a redemption and the rules of section 302 will determine whether taxpayer's interest has been sufficiently diminished by the sale to qualify for capital treatment.¹³ The role of the attribution rules in the section 304 process is important: they must be used to determine if the fifty percent ownership requirement has been met and if the requisite diminution of interest has occurred.

The attribution rules of section 318 are used in conjunction with several

⁸ Treas. Reg. § 1.318-1(b)(2) (1960).

⁹ I.R.C. § 304 (1976).

¹⁰ *Id.*

¹¹ *Id.* § 1221 (1976).

¹² *Id.* § 304(c)(1).

¹³ *Id.* § 302(b)(2).

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sections of the Code¹⁴ in addition to section 304. In their various applications, however, the standard section 318 rules are sometimes modified and SEARCH, of course, uses the modifications mandated by section 304.¹⁵ In the complete section 304 program, the user needs to determine an individual taxpayer's (TP's) total direct and constructive interest in some particular corporation. Before the SEARCH module starts, the user will have already entered the name of that corporation as well as the ownership in it of TP and TP's family. Consequently, to run SEARCH as an independent unit, an arbitrary name is supplied for that corporation — FOCUS CORP. SEARCH's job is to find TP's total (direct and constructive) interest in the entities (hereinafter primes), if any, that own shares of FOCUS CORP.

After SEARCH has determined TP's total (direct and constructive) interest in the entities that own shares in FOCUS CORP (primes), another part of the 304 program translates SEARCH's results into TP ownership of FOCUS CORP, a relatively simple job, and then adds the direct interest of TP and TP's family in FOCUS CORP to produce TP's total ownership in FOCUS CORP.

II. THE SEARCH PROGRAM

SEARCH has three major parts: first, collecting the user's fact situation as data; second, finding all legal attribution routes; and third, calculating the attribution percentage and displaying the results. Each of these parts will be described, but SEARCH's main interest lies in the second, finding the legal attribution routes. The program takes its name from that part.

A. *Input of the User's Facts*

This part of the program is interactive. SEARCH asks a question, the user answers,¹⁶ then SEARCH chooses its next question or action on the basis of the user's answers so far. SEARCH assumes a general familiarity with the law involved and, therefore, no introductory description of it is provided.¹⁷ There are, however, notes on trust attribution, partnership attribution, family attribution and estate attribution which contain legal information that a user with a good general knowledge of the law might need. Any one or more of these notes can be called by the user at appropriate

¹⁴ These include I.R.C. §§ 302 (redemption of stock), 306(b)(1)(A) (disposition of 306 stock), 334(b)(3)(C) (basis of property in certain liquidations), 382(2)(3) (limitations on loss carryovers), 958(b) (controlled foreign corporations), 856(d) (real estate investment trusts), 6038(d)(1) (information regarding certain foreign corporations).

¹⁵ Section 304 modifies the standard § 318 rules by allowing proportionate attribution of shares owned by a corporation to a shareholder of that corporation no matter how small a percentage of the corporation the shareholder owns. The normal § 318 rule allows attribution from a corporation only to a shareholder that owns fifty percent more (by value) of the corporation. See I.R.C. §§ 318(a)(2)(C), 304 (b)(1), 304(c)(1).

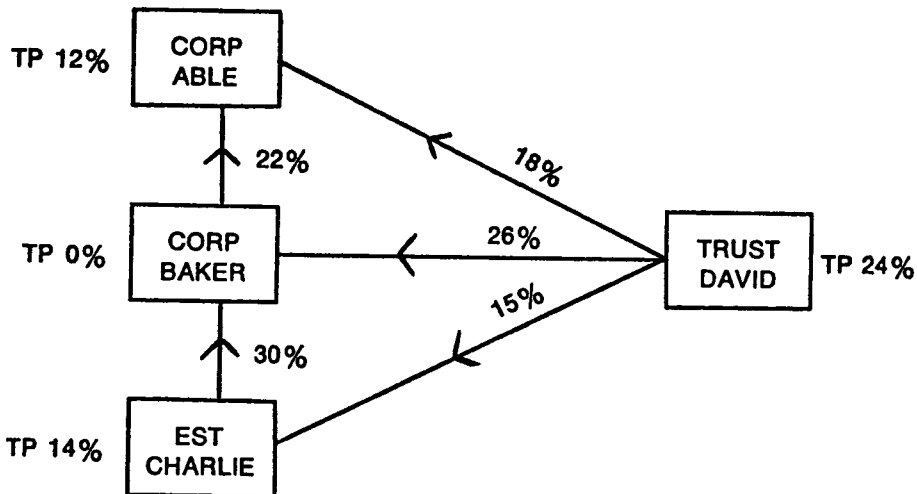
¹⁶ The user may also ask for information or other help.

¹⁷ Such a description would be easy to provide if needed.

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points throughout the work session.¹⁸ In addition there is an introduction to SEARCH and a set of general instructions. The general instructions consist largely of non-legal information about operating the program, typing in answers and the like and are intended to give a person with no prior knowledge of computers all the information needed to run SEARCH. The general instructions also contain a small amount of legal material. All of this legal and mechanical information is included in the program in order to make SEARCH a self-contained unit. None of the material appears unless called and, therefore, need not slow down an experienced user.

The following example of SEARCH's operation uses the fact pattern set out in the diagram below. CORP ABLE is a prime and the problem is to find TP's total ownership in CORP ABLE. Arrows in the diagram point away from the owner and toward the ownee. Thus, for example, CORP BAKER owns 22% of CORP ABLE. TP's direct ownership in each entity is shown next to that entity.



As the SEARCH module begins, the following appears on the screen:¹⁹

WELCOME TO SEARCH. WOULD YOU LIKE SOME INFORMATION ABOUT SEARCH BEFORE WE START. TYPE YES OR NO (Y/N) AND THEN PRESS CARRIAGE RETURN.

? Y

TYPE THE NUMBER OF THE ITEM YOU WANT (THEN PRESS CARRIAGE RETURN)

- 0 NOTHING THANKS. LET'S GET ON WITH IT.
- 1 INTRODUCTION TO SEARCH.
- 2 GENERAL INSTRUCTIONS.
- 3 NOTE ON FAMILY ATTRIBUTION.

¹⁸ These notes appear in Appendix 2 *infra*.

¹⁹ The "?" is a cue printed by the computer to indicate that the user should type something. Underlined material indicates information typed by the user.

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- 4 NOTE ON TRUST ATTRIBUTION.
 5 NOTE ON TRUST ATTRIBUTION.
 6 NOTE ON PARTNERSHIP ATTRIBUTION.

? 2

GENERAL INSTRUCTIONS

(1) EACH TIME YOU GIVE AN ANSWER YOU MUST PRESS THE CARRIAGE RETURN TO REGISTER THE ANSWER WITH THE PROGRAM. BEFORE PRESSING THE CARRIAGE RETURN YOU MAY CHANGE YOUR ANSWER BY USING THE DELETE KEY ON YOUR TERMINAL.

(2) YOU WILL FREQUENTLY BE ASKED TO ANSWER YES OR NO. FOR YES, YOU MAY ANSWER: Y, YES, Yes, yes, OR y. FOR NO, YOU MAY ANSWER: N, NO, No, no, OR n.

(3) USE NUMERALS FOR NUMERICAL ANSWERS. PRESS NUMBER 1 FOR 1, NOT THE LETTER L. PRESS 0 FOR ZERO, NOT THE LETTER O. DO NOT USE COMMAS IN NUMBERS: TEN THOUSAND IS 10000.

(4) AT THE END OF A PROGRAM QUESTION YOU MAY SEE ONE OR MORE OF THE FOLLOWING: (FAM HELP —1) (CORP HELP —2) (INFO —3). TYPE —1 FOR HELP IN FIGURING FAMILY ATTRIBUTION TOTALS. TYPE —2 FOR HELP IN FIGURING PERCENTAGE INTEREST (BY VALUE) IN A CORPORATION. TYPE —3 FOR THE INFORMATION MENU THAT YOU HAVE ALREADY SEEN.

The complete general instructions which comprise ten paragraphs and a note on the option rules are reproduced in Appendix 2. After displaying the full general instructions SEARCH asks:

DO YOU WANT TO READ ANOTHER ITEM (Y/N).

? N

The program now moves to a substantive question. If the user had not wanted any preliminary information, typing a single N to the first question would have brought him to this point immediately. It is important to remember that SEARCH is the main attribution segment of an overall program about section 304. SEARCH starts with the name of the subject corporation — here FOCUS CORP — and with the direct interest of taxpayer's family in FOCUS CORP also entered. SEARCH's work is to compute TP's ownership in the entities that have an ownership interest in FOCUS CORP, in this case, CORP ABLE. SEARCH continues:

I NOW WANT TO ASK YOU ABOUT ATTRIBUTION THROUGH RELATED ENTITIES. HEREAFTER PARTNERSHIPS, ESTATES, TRUSTS AND CORPORATIONS WILL COMMONLY AND COLLECTIVELY BE REFERRED TO AS ENTITIES. BY A 'RELATED' ENTITY, I MEAN AN ENTITY IN WHICH TP OR FAMILY HAVE EITHER A DIRECT INTEREST OR A CONSTRUCTIVE INTEREST THROUGH ONE OR MORE OTHER ENTITIES.

DOES A RELATED ENTITY OWN ANY SHARES OF FOCUS CORP? IF YOU WANT MORE EXPLANATION, TYPE- H

? H

AS MENTIONED EARLIER, BY A RELATED ENTITY I MEAN AN ENTITY IN

WHICH TP OR FAMILY HAS EITHER A DIRECT INTEREST OR A 'CONSTRUCTIVE' INTEREST.

TP AND FAMILY WILL HAVE A 'CONSTRUCTIVE' INTEREST IN ENTITY X IF ANY ONE OF THEM OWNS AN INTEREST IN ANY ENTITY THAT IN TURN OWNS AN INTEREST IN ENTITY X — OR IF ANY ONE OF THEM OWNS AN INTEREST IN ANY ENTITY THAT OWNS AN INTEREST IN ANY ENTITY THAT (ETC. ETC.) IN TURN OWNS AN INTEREST IN ENTITY X. THERE IS NO THEORETICAL LIMIT TO THE NUMBER OF LINKS IN THE OWNERSHIP CHAIN. THERE IS, HOWEVER, A LIMIT TO THE NUMBER OF ENTITIES THE PROGRAM IS DESIGNED TO HANDLE (SEE INTRODUCTION).

IF YOU WANT AN EXPLANATION OF 'FAMILY' TYPE 1, ELSE TYPE SOME OTHER NUMBER.

? 4

Now, having provided all information requested, SEARCH repeats the question:

DOES A RELATED ENTITY OWN ANY SHARES OF FOCUS CORP? IF YOU WANT MORE EXPLANATION, TYPE - H

? Y

WHAT IS THE NAME OF THE ENTITY. IF MORE THAN ONE, TYPE ANY ONE YOU WANT.

? CORP ABLE

PLEASE STATE THE TOTAL DIRECT INTEREST OF TP AND FAMILY IN CORP ABLE AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 FAM HELP —1)

? -1

Here SEARCH offers two types of help in answering the question. By typing —1 the user chooses FAM HELP. The signals used here to call for help (—1, —2) are handy in cases like this where a help routine is offered at the same time a question is asked. A minus number cannot possibly be a proper answer to the question and, therefore, can never create confusion. Here is the FAM HELP routine:

STATE THE DIRECT PERCENTAGE INTEREST IN CORP ABLE OF -

- TP - ? 4
- SPOUSE - ? 6
- PARENTS - ? 2
- CHILDREN ? 0
- GRANDCHILDREN ? 0

THE TOTAL OWNED BY TP AND FAMILY IS - 12

FAM HELP provides two kinds of help: arithmetic, adding up the individual interests and legal, reminding the user of the family members whose interests will be attributed to taxpayer. SEARCH then continues:

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN CORP ABLE.

? Y

WHAT IS THE NAME OF THE ENTITY. IF MORE THAN ONE, TYPE ANY ONE YOU WANT.

? CORP BAKER

PLEASE STATE THE TOTAL DIRECT INTEREST OF TP AND FAMILY IN CORP BAKER AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 FAM HELP —1)

? 0

STATE THE INTEREST OF CORP BAKER IN CORP ABLE AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 CORP HELP —2 INFO —3).

? -2

The user has requested CORP HELP by typing “—2.” CORP HELP will be of substantial use in many instances. In the case of corporations, the information needed for application of the attribution rules is the decimal or percentage interest *by value* owned by taxpayer or other relevant entity in the corporation (here CORP ABLE). With several classes of stock this can be a nuisance to calculate by hand. CORP HELP proceeds as follows:

HOW MANY CLASSES OF STOCK DOES CORP ABLE HAVE.

? 2

HOW MANY SHARES OF CLASS 1 ARE OUTSTANDING.

? 1000

HOW MANY SHARES DOES CORP BAKER OWN.

? 220

WHAT IS THE FAIR MARKET VALUE PER SHARE OF THE CLASS 1 STOCK.

? 34.56

HOW MANY SHARES OF CLASS 2 ARE OUTSTANDING.

? 500

HOW MANY SHARES DOES CORP BAKER OWN.

? 110

WHAT IS THE FAIR MARKET VALUE PER SHARE OF THE CLASS 2 STOCK.

? 14.25

CORP ABLE

SHARES OUTSTANDING

	NUMBER SHARES	SHARE VALUE	TOTAL VALUE
CLASS 1	1,000.00	\$34.56	\$34,560.00
CLASS 2	500.00	\$14.25	\$7,125.00
TOTAL VALUE			\$41,685.00

SHARES OWNED BY CORP BAKER

	NUMBER SHARES	SHARE VALUE	TOTAL VALUE
CLASS 1	220.00	\$34.56	\$7,603.20
CLASS 2	110.00	\$14.25	\$1,567.50
TOTAL VALUE OWNED -			\$9,170.70

CORP BAKER HAS A 22% DIRECT INTEREST, BY VALUE, IN CORP ABLE.

Having completed CORP HELP, SEARCH continues gathering data:

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN CORP BAKER.

? Y

WHAT IS THE NAME OF THE ENTITY. IF MORE THAN ONE, TYPE ANY ONE

YOU WANT.

? EST CHARLEY

PLEASE STATE THE TOTAL DIRECT INTEREST OF TP AND FAMILY IN EST CHARLEY AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 FAM HELP —1)

? 14

STATE THE INTEREST OF EST CHARLEY IN CORP BAKER AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 INFO —3).

? 30

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN EST CHARLEY.

? Y

WHAT IS THE NAME OF THE ENTITY. IF MORE THAN ONE, TYPE ANY ONE YOU WANT.

? TRUST DAVID

PLEASE STATE THE TOTAL DIRECT INTEREST OF TP AND FAMILY IN TRUST DAVID AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 FAM HELP —1).

? 24

STATE THE INTEREST OF TRUST DAVID IN EST CHARLEY AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 INFO —3).

? 15

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN TRUST DAVID.

? N

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN CORP BAKER.

? Y

WHAT IS THE NAME OF THE ENTITY. IF MORE THAN ONE, TYPE ANY ONE YOU WANT.

? TRUST DAVID

I KNOW TRUST DAVID AND HAVE ALL THE INFORMATION ON ITS OWNERSHIP THAT I NEED.

STATE THE INTEREST OF TRUST DAVID IN CORP BAKER AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 INFO —3).

? 26

Notice above that SEARCH indicates that it knows TRUST DAVID. The message is given whenever the same entity comes up again in the course of the dialogue and is intended to reassure the user that things are going along all right. Here SEARCH already has all the information it needs on the ownership of TRUST DAVID and so advises the user. If that were not the case it would say so. SEARCH continues:

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN CORP BAKER.

? N

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN EST CHARLEY.

? Y

WHAT IS THE NAME OF THE ENTITY. IF MORE THAN ONE, TYPE ANY ONE YOU WANT.

? TRUST DAVID

YOU HAVE ALREADY GIVEN ME THAT INFORMATION. NO APOLOGY NEEDED.

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN EST CHARLEY.
? N

The above is a very easy error to make and it demonstrates one of the error messages in SEARCH's repertory.²⁰

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN CORP ABLE.
? Y

WHAT IS THE NAME OF THE ENTITY. IF MORE THAN ONE, TYPE ANY ONE YOU WANT.

? TRUST DAVID

I KNOW TRUST DAVID AND HAVE ALL THE INFORMATION ON ITS OWNERSHIP THAT I NEED.

STATE THE INTEREST OF TRUST DAVID IN CORP ABLE AS A PERCENTAGE (AND OMIT % SIGN) E.G. 24.635 (CORP HELP —2 INFO —3).

? 18

DOES ANOTHER RELATED ENTITY OWN AN INTEREST IN CORP ABLE.

? N

DOES ANOTHER RELATED ENTITY OWN ANY SHARES OF FOCUS CORP? IF YOU WANT MORE EXPLANATION, TYPE- H

? N

THANK YOU. I NOW HAVE ALL THE INFORMATION I NEED.

SEARCH can handle ownership patterns of great complexity, including chains of ownership that loop back on themselves with circular or reciprocal ownership.²¹ Moreover, there is no fundamental size limitation in SEARCH's design: theoretically it can accommodate an ownership network of any size. The capacity of the computer used is the ultimate limitation. At present, however, SEARCH is set up to accommodate (in addition to taxpayer and family members, who may own interests in any or all corporations, estates, trusts and partnerships involved) nine direct owners of the subject corporation (here FOCUS CORP), nine indirect owners and two hundred attribution routes.²²

The data input always follows the same pattern. The user is first asked about an entity that owns an interest in FOCUS CORP, a "prime." If there is more than one prime, the user can start with any of them. Next the user is asked about an owner of the prime (hereinafter "sub"), then about a second sub owning the first sub, then about a third sub owning the second sub, and so forth until the chain ends.²³ Then the user is asked if there is *another* sub that owns the first sub and, if so, if there is another sub that owns that sub and so forth until that chain ends. SEARCH then again returns

²⁰ Other situations which produce error messages and give the user an opportunity to answer again include giving an ownership percentage of more than 100, inputting an O for a zero (or an L for a 1) and giving something other than an appropriate answer to a Yes/No question.

²¹ Such ownership chains are discussed in Appendix 1 *infra*.

²² The meaning of the term attribution route is discussed in Part B *infra*.

²³ Or until the ownership chain loops. See Appendix 1 *infra*.

to ask if another sub owns the first sub and at the end of each chain continues to return to ask about ownership of the first sub until the answer is received that there are no more owners of the first sub. It then goes to the second sub mentioned and does the same thing. Then to the next sub and so forth until eventually the user has answered for all subs mentioned that there are no other related entities that own interests in them. SEARCH then asks if there is another prime. If so, the entire routine starts over again. The end of input is reached when the user answers that there are no more primes. Throughout the input the same corporation, trust or other entity may appear several times. It may first appear as a prime, then as a sub owning a prime, then as a sub owning another sub. Each time an entity is named by the user, SEARCH checks to see if the name has been used earlier and, if so, what data it has on it, particularly whether it is open or closed: that is, whether the user has already given the final "No" stating that it has no further related owners. SEARCH then arranges its questions accordingly.

Initially my idea was to set up the attribution routes and make the attribution calculations as the user entered the data. Such an approach would allow the computer to use and then immediately discard large parts of the data. Eventually, it became evident that this was impossible (or maybe just too difficult) to do with some fact patterns. In such patterns it is impossible to be sure what data must be saved until all the data is in. Accordingly, the input section of SEARCH is just that, input. At its conclusion SEARCH has stored the raw facts of ownership. Nothing else.

B. *The Search for Attribution Routes*

The search for attribution routes is the central and most interesting part of the program. After input, SEARCH has a collection of entity names and ownership which forms a network linked together by such information as "EST CHARLEY owns 30% of CORP BAKER." SEARCH tracks through these linkages looking for legal attribution routes which end with a prime. As noted earlier, SEARCH is designed only to determine TP's actual and constructive ownership in the primes — that is, entities which are owners of the subject corporation. Using that information, another part of the final program will determine TP's actual and constructive ownership in the subject corporation, a relatively simple operation in comparison to SEARCH.

In an earlier paper, I explained that the computer is a limited and literal machine, able to carry out only the most simple and unambiguous instructions.²⁴ In describing the program CORPTAX, I noted that it did nothing that I had not thought through in full detail. That still holds with

²⁴ Hellawell, *A Computer Program for Legal Planning and Analysis: Taxation of Stock Redemptions*, 80 COLUM. L. REV. 1363, 1365 (1980).

SEARCH but to a lesser extent. In CORPTAX certain fixed attribution routes were provided for, e.g., from a trust to another trust to taxpayer and/or family. A large number of such routes were provided and only a most unusual situation would not fit one of them. Nevertheless, CORPTAX was limited to prearranged routes or patterns. SEARCH was written primarily to see if that limitation could be avoided.

The core idea in SEARCH comes from artificial intelligence, a branch of computer science which has long used search routines. Artificial intelligence programs search through networks of data and possibilities to find the best route for a traveling salesman or a telephone connection or to find the best move in a chess game.²⁵ SEARCH uses a similar approach. It looks through the stored network of ownership, seeking legal attribution routes which end in a prime.²⁶ I will illustrate this with the relatively simple fact pattern whose input was related above. CORP ABLE is here the only prime.

SEARCH starts with the first non-prime entity given to it — CORP BAKER — and checks to see if CORP BAKER owns a prime. It finds that CORP BAKER does own a prime, registers the route as scoring and closes the route so that it cannot be counted twice. The first scoring route therefore is CORP BAKER - CORP ABLE. SEARCH now looks to find other routes starting with CORP BAKER and checks the data to see if CORP BAKER owns either another prime or a sub. Since neither is the case, SEARCH closes CORP BAKER; CORP BAKER cannot thereafter be used to start any new route. SEARCH now turns to the next sub — EST CHARLEY — and checks to see if it owns a prime (No) and then if it owns another sub (Yes, CORP BAKER). SEARCH then makes EST CHARLEY - CORP BAKER the route under consideration and again checks to see if CORP BAKER owns a prime. It does; SEARCH registers a score and closes the route: EST CHARLEY - CORP BAKER - CORP ABLE. SEARCH then rechecks, finds that CORP BAKER owns no other entity and then closes all routes beginning EST CHARLEY - CORP BAKER. Next SEARCH checks whether EST CHARLEY owns another sub, finds that it does not and closes all routes starting with EST CHARLEY. SEARCH then takes up TRUST DAVID and follows the same routine as with EST CHARLEY and CORP BAKER. It finds a score with TRUST DAVID - CORP ABLE, finds another score with TRUST DAVID - CORP BAKER - CORP ABLE, closes TRUST DAVID - CORP BAKER, finds a score with TRUST DAVID - EST CHARLEY - CORP BAKER - CORP ABLE, closes TRUST DAVID - EST CHARLEY - CORP BAKER, closes TRUST DAVID - EST CHARLEY, closes TRUST DAVID and, with all entities closed, completes the search.

²⁵ P. WINSTON, *ARTIFICIAL INTELLIGENCE*, Chapter 4 (1977).

²⁶ As noted above, a prime is an entity which in turn owns the subject corporation.

C. Calculation and Output

The final part of SEARCH calculates the attribution amounts and prints the results. With one exception, described in Appendix 1, it is relatively simple. SEARCH calculates TP's interest in each prime, route by route, and then totals the amounts. Any route where TP or family has no interest in the initial sub (such as the route CORP BAKER - CORP ABLE) can result in no attribution to TP and is eliminated at this stage. For the route EST CHARLEY - CORP BAKER - CORP ABLE the relevant ownership amounts are:

CORP BAKER - CORP ABLE:	22%
EST CHARLEY - CORP BAKER:	30%
TP - EST CHARLEY	14%

SEARCH multiplies 22% by 30% by 14% and gets .924%. The concluding printout looks like this.

ATTRIBUTION ROUTES ARE:

- 1 EST CHARLEY - CORP BAKER - CORP ABLE
TP INT IN CORP ABLE - 0.924%.
- 2 TRUST DAVID - CORP ABLE
TP INT IN CORP ABLE - 4.32%.
- 3 TRUST DAVID - CORP BAKER - CORP ABLE
TP INT IN CORP ABLE - 1.3728%.
- 4 TRUST DAVID - EST CHARLEY - CORP BAKER - CORP ABLE
TP INT IN CORP ABLE - 0.2376%.

TP TOTAL INTEREST IN -

CORP ABLE 18.8544%.

SO LONG, I'VE ENJOYED IT. LET'S WORK TOGETHER AGAIN.

CONCLUSION

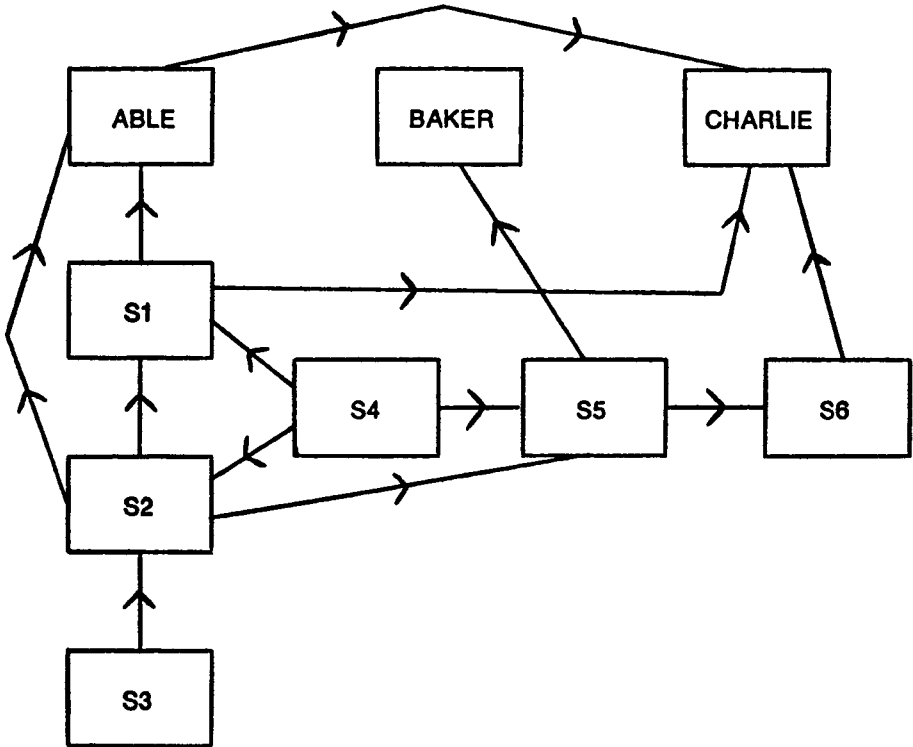
SEARCH performs three functions for the user: legal research, calculation and figuring out the routes.

The first of these, legal research, is not especially apparent in SEARCH,²⁷ but it is important. There are probably very few lawyers who could (or would) analyze a section 304 fact situation like the one SEARCH just considered without at least reading the code provisions very carefully and giving a good deal of thought to how the attribution should be routed under the section 318 rules, as modified by section 304. In fact, those rules allow a rather simple attribution plan but it takes time for someone to figure that out.

²⁷ The legal research function is much more apparent in two earlier programs: CORPTAX (described in Hellawell, *A Computer Program for Legal Planning and Analysis: Taxation of Stock Redemptions*, 80 COLUM. L. REV. 1363 (1980) and CHOOSE (described in Hellawell, *CHOOSE: A Computer Program for Legal Planning and Analysis*, 19 COLUM. J. TRANSNAT'L L. 339 (1981)).

The second function, calculation, is the most obviously useful. It takes only a moderately complex set of facts for the user to benefit substantially from SEARCH's calculations.

The third function, route finding, is not of much use in simple cases but can be helpful in complex ones. Consider the following fact pattern which is of moderate complexity but far from the limits of SEARCH's capacity. Ownership percentages are omitted from the diagram for simplicity. ABLE, BAKER AND CHARLEY are primes.



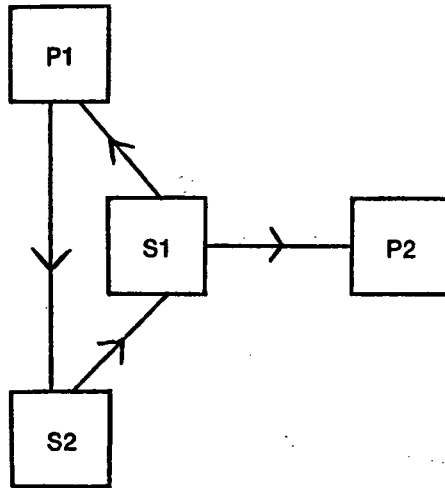
There is nothing tricky or difficult about this pattern, but it is easy to make a mistake in picking out the routes. Assuming TP or family has an interest in all relevant entities, how many scoring routes are there?²⁸ A printout of the results (based on ownership in all links of exactly 20%) is given in Appendix 3.

The route finding function, although not so patently useful as the other functions, is the most significant part of SEARCH because it frees the program from pre-specified fact patterns. In tracking through ownership paths SEARCH suggests many possibilities. Programs may search through an accumulation of data looking for a wide variety of legal analogies, con-

²⁸ Is there an illegal loop in any of the routes? See Appendix 1 *infra*.

nections and relationships. To say the least, it is not immediately obvious how to write such programs or what their constraints, their limits and their usefulness will be. But that is only to be expected. As simple as the use of a search technique on the instant problem now seems, it took time to think of it and to work it out. Certainly search and other computer science techniques can be applied to legal problems and analysis in far more subtle and complex ways than they are used in SEARCH. A world of possibilities awaits exploration.

APPENDIX I
LOOPED OWNERSHIP: A COMPLICATION



P1 and P2 are primes. S1 and S2 are subs. The scoring routes to P1 are S1 - P1 and S2 - S1 - P1. P1 has an interest in S2 but it would be double counting to allow a third route P1 - S2 - S1 - P1 or S1 - P1 - S2 - S1 - P1. Therefore, whenever SEARCH adds another entity to the route it checks to see if the route contains any entity twice. If so, it closes the route and marks it as a looped route. At the end of the program, after the printout of the scoring routes SEARCH checks to see if there are any looped routes. If so, it identifies them as such and prints them. However, it does not calculate any attribution amounts through them. SEARCH prints them because the user may believe that ownership should be attributed through some types of looped routes or that such routes should affect the calculation in other ways. In the instant example SEARCH would print and calculate for five routes.

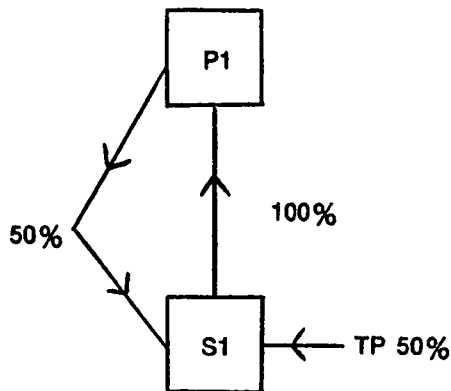
- S1 - P1
- S1 - P2
- S2 - S1 - P1
- S2 - S1 - P2
- P1 - S2 - S1 - P2

It would then print:

THE FOLLOWING ATTRIBUTION ROUTES WERE DISREGARDED
BECAUSE THEY LOOPED THROUGH THE SAME ENTITY TWICE.

- S1 - P1 - S2 - S1
- S2 - S1 - P1 - S2
- P1 - S2 - S1 - P1

In this case it is unlikely that the user would want to count any of the looped routes. But consider the following case:



Here taxpayer nominally owns 50% of S1 but, as a practical matter, taxpayer might be considered to own 100% of S1. In reporting the loop SEARCH calls this to the user's attention. The user must then make the legal judgment. SEARCH could (but presently does not) provide advice on the matter.

APPENDIX 2 TRUST ATTRIBUTION

Stock owned (directly or indirectly) by a trust is attributed to the trust beneficiaries in proportion to their actuarial interests. The factors and methods used in ascertaining the value of an interest in property (e.g., life estate) for estate tax purposes are used in determining a beneficiary's actuarial interest in a trust for purposes of the constructive ownership rules. Code Sec. 318(a)(2)(B). The Estate Tax Regulations appear at Sec. 20.2031-7.

An exception to the general rule is a tax exempt employees trust (Sec. 401(a)), whose holdings are not attributed to its beneficiaries. And all of the holdings of a "grantor" trust (e.g., a trust where the grantor has retained a beneficial interest, or the power to alter, amend or revoke the trust) are attributed to the "owner." For further information see Cavitch, *Tax Planning for Corporations and Shareholders*, Sec. 7.03[3][iv] (1974).

PARTNERSHIP ATTRIBUTION

Stock owned (directly or indirectly) by a partnership is attributed to the partners in proportion to their interests. Where a partner's interest in

earnings differs from his interest in capital or where there are different classes of partners with different rights to profits it may be unclear what the proportionate interest is.

FAMILY ATTRIBUTION

Throughout this program "family" means a person's spouse, children, grandchildren and parents. A spouse who is legally separated under a degree of divorce or separate maintainance is not included. A legally adopted child is treated as a child by blood.

Stock owned by TP's family is considered to be owned by TP. Moreover, stock owned by a member of TP's family through the corporate, partnership, estate and trust rules (or a combination of them) is also considered owned by TP.

ESTATE ATTRIBUTION

The beneficiaries of an estate are deemed to own shares by that estate in proportion to their interests in the estate. Reg. Sec. 1.318-3(a) provides:

. . . property of a decedent shall be considered as owned by his estate if such property is subject to administration by the executor or administrator for the purpose of paying claims against the estate and expenses of administration notwithstanding that, under local law, legal title to such property vests in the decedent's heirs, legatees or devisees immediately upon death. The term "beneficiary" includes any person entitled to receive property of a decedent pursuant to a will or pursuant to laws of descent and distribution. A person shall no longer be considered a beneficiary of an estate when all the property to which he is entitled has been received by him, when he no longer has a claim against the estate arising out of having been a beneficiary, and when there is only a remote possibility that it will be necessary for the estate to seek the return of property or to seek payment from him by contribution or otherwise to satisfy claims against the estate or expenses of administration.

A direct present interest in the estate is required; a person who has only a remainder interest in estate property is not an estate beneficiary.

For further information see Cavitch, *Tax Planning for Corporations and Shareholders*, Sec. 7.03[3][iii] (1974).

GENERAL INSTRUCTIONS

(1) Each time you give an answer you must press the carriage return to register the answer with the program. Before pressing the carriage return you may change your answer by using the delete key on your terminal.

(2) You will frequently be asked to answer Yes or No. For Yes, you may answer: Y, YES, Yes, y, or yes. For No, you may answer: N, NO, No, no, or n.

(3) Use numerals for numerical answers. Press number 1 for 1, not the letter 1. Press 0 for zero, but not the letter O. Do not use commas in numbers: ten thousand is 10000.

(4) At the end of a program question you may see one or more of the following: (FAM HELP —1) (CORP HELP —2) (INFO —3). Type —1 for help in figuring family attribution totals. Type —2 for help in figuring percentage interest (by value) in a corporation. Type —3 for the information menu that you have already seen.

(5) When asked about ownership, actual ownership is meant. When you are questioned about constructive ownership, that is always stated.

(6) You will be asked for the names of the various trusts, estates, partnerships and corporations involved in the attribution pattern. Keep the names short, simple and distinctive. You must be accurate: if you first refer to a trust as HELEN and then later refer to it as HELENE the program will record them as two separate entities, with obviously bad results. The name must always be used EXACTLY as first given, even to the extent of capital and lower case letters: HELEN cannot later be typed Helen. Best use all caps.

(7) All questions on the various classes of voting stock and common stock must be answered even if TP owns no shares of one or more classes. In that case, answer 0.

(8) This program is to help determine the tax of an individual human shareholder, although that individual may constructively own shares through a trust, partnership etc. The program is not applicable to a non-human taxpayer, such as a trust.

(9) If there are other transactions that occur (or will occur) in connection with the 304 sale, this program must be used (if at all) with extreme caution. For example, if other unrelated shareholders have agreed to sell some of their stock to TP, or to have stock redeemed, at about the time of the instant transaction, the effects of that may need to be included in working out the section 304 result. A similar caution applies to any change which affects TP's interest in any corporation, trust, partnership or estate which might be interpreted to occur in conjunction with the instant transaction.

(10) The program assumes that corporations involved have at least one class of voting common stock.

A person who has an option to purchase corporate shares (even an option to purchase treasury shares or unissued shares from the corporation itself) will be considered to own such shares. The program assumes throughout, when calling for the number of shares a person actually owns, that shares under option will be included. Of course, the shares must not be

counted twice. If a son has an option on shares owned by his father the shares are attributed to the son once — through the option rule. For further information see Cavitch, *Tax Planning for Corporations and Shareholders*. Sec. 7.03(3)(vi) (1974); Note, *Attribution of Stock Ownership From Stock Options Under the Internal Revenue Code*, 44 U. Chi. L. Rev. 482 (1977).

APPENDIX 3

ATTRIBUTION ROUTES ARE:

- 1 S1 - ABLE
TP INT IN ABLE - 4%.
- 2 S1 - CHARLEY
TP INT IN CHARLEY - 4%.
- 3 S1 - ABLE - CHARLEY
TP INT IN CHARLEY - 0.8%
- 4 S2 - ABLE
TP INT IN ABLE - 4%.
- 5 S2 - S1 - ABLE
TP INT IN ABLE - 0.8%.
- 6 S2 - S1 - CHARLEY
TP INT IN CHARLEY - 0.8%.
- 7 S2 - S1 - ABLE - CHARLEY
TP INT IN CHARLEY - 0.16%.
- 8 S2 - S5 - BAKER
TP INT IN BAKER - 0.8%.
- 9 S2 - S5 - CHARLEY
TP INT IN CHARLEY - 0.8%.
- 10 S2 - S5 - S6 - CHARLEY
TP INT IN CHARLEY - 0.16%.
- 11 S2 - ABLE - CHARLEY
TP INT IN CHARLEY - 0.8%.
- 12 S3 - S2 - ABLE
TP INT IN ABLE - 0.8%.
- 13 S3 - S2 - S1 - ABLE
TP INT IN ABLE - 0.16%.
- 14 S3 - S2 - S1 - CHARLEY
TP INT IN CHARLEY - 0.16%.
- 15 S3 - S2 - S1 - ABLE - CHARLEY
TP INT IN CHARLEY - 0.032%.
- 16 S3 - S2 - S5 - BAKER
TP INT IN BAKER - 0.16%.
- 17 S3 - S2 - S5 - CHARLEY
TP INT IN CHARLEY - 0.16%.
- 18 S3 - S2 - S5 - S6 - CHARLEY
TP INT IN CHARLEY - 0.032%.
- 19 S3 - S2 - ABLE - CHARLEY
TP INT IN CHARLEY - 0.16%.
- 20 S4 - S1 - ABLE
TP INT IN ABLE - 0.8%.
- 21 S4 - S1 - CHARLEY

Hellowell: Computer Program

22 S4 - S1 - ABLE - CHARLEY
 TP INT IN CHARLEY - 0.8%.
 TP INT IN CHARLEY - 0.16%.
 23 S4 - S2 - ABLE
 TP INT IN ABLE - 0.8%.
 24 S4 - S2 - S1 - ABLE
 TP INT IN ABLE - 0.16%.
 25 S4 - S2 - S1 - CHARLEY
 TP INT IN CHARLEY - 0.16%.
 26 S4 - S2 - S1 - ABLE - CHARLEY
 TP INT IN CHARLEY - 0.032%.
 27 S4 - S2 - S5 - BAKER
 TP INT IN BAKER - 0.16%.
 28 S4 - S2 - S5 - CHARLEY
 TP INT IN CHARLEY - 0.16%.
 29 S4 - S2 - S5 - S6 - CHARLEY
 TP INT IN CHARLEY - 0.032%.
 30 S4 - S2 - ABLE - CHARLEY
 TP INT IN CHARLEY - 0.16%.
 31 S4 - S5 - BAKER
 TP INT IN BAKER - 0.8%.
 32 S4 - S5 - CHARLEY
 TP INT IN CHARLEY - 0.8%.
 33 S4 - S5 - S6 - CHARLEY
 TP INT IN CHARLEY - 0.16%.
 34 S5 - BAKER
 TP INT IN BAKER - 4%.
 35 S5 - CHARLEY
 TP INT IN CHARLEY - 4%.
 36 S5 - S6 - CHARLEY
 TP INT IN CHARLEY - 0.8%.
 37 S6 - CHARLEY
 TP INT IN CHARLEY - 4%.
 38 ABLE - CHARLEY
 TP INT IN CHARLEY - 4%.

TP TOTAL INTEREST IN -

ABLE	31.52%
BAKER	25.92%
CHARLEY	43.328%

It took me just short of twelve minutes to input the data. It took the computer 5.622 seconds to ask the appropriate questions, digest the answers, find the routes and make the calculations. During the rest of the twelve minutes it was off working for a lot of other people.

