TD: An Automated Tournament Director

A Creative Project
and System Support Document

by

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Ball State University
Muncie, Indiana
May 22, 1986

Spring Quarter 1986
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INTRODUCTION

Hofstadter's Law: It always takes longer than you expect, even when you take into account Hofstadter's Law.

Douglas Hofstadter
Gödel, Escher, Bach
(page 152)
PROSPECTUS

Doug Hofstadter's wonderfully recursive quotation on the previous page captures so well the essence of nearly any academic endeavor--especially an ambitious one involving the modeling of a complex thought process. Three months ago, when I began laying the groundwork for this project, I wrote a prospectus that contained the following:

...some computer scientists have focused their attentions on the development of software that could adequately perform the Swiss method of tournaments that is commonly employed in chess tournaments world-wide. The "Swiss System" has proven to be equally difficult to master, due primarily to the complex manipulation of data that characterizes this highly intuitive process. For my senior honors project ....

and so on. I will not amuse you with the rest of that miserable text here. (Copies are, however, available upon request.) Though what I said therein was largely true, the ideal picture it painted in no way revealed the colder truth about desires and the limitations of time. Instead, I will now present the relevant introductory material about my efforts this quarter from a more seasoned perspective.

For my "creative honors project," I chose to create a software system to perform the duties of a tournament director (TD) for an officially sanctioned United States Chess Federation (USCF) tournament. The primary challenge of this assignment lay in automating the Swiss System of
tournament pairings. The principles of the system are given in the *Official Rules of Chess* (pp. 85-101), published periodically by the USCF. Any mention in this document of "Rule #X" refers to the corresponding rule in the USCF text. The output of this project is twofold: (1) the executable software system and (2) a complete documentation package (this manual). Dr. Frank Owens, a professor of computer science and an avid chessplayer, has supervised the course of my work.

**NATURE OF THIS DOCUMENT**

This document represents something of a compromise between the requirements of structured analysis/design and the realities of a small, experimental project. I have not abandoned the professionalism of Software Engineering so much as I have tailored this text to the narrow audience for which it is intended-- of which I am a prominent member. The motives of my thesis advisor, the director of the Honors College, and this author are certainly different than those of an end user! I hope that my informal combination of the user, programming, operations, and system manuals provides for easy readability and answers any questions the reader might have. As a "special bonus" I have included occasional informal commentary so that the reader might also have some insight into how this project developed its final form.
USE OF THIS SYSTEM

I must stress the introductory nature of the software I have created this quarter. Though I would certainly have liked to create a package that was ready for the World Open (a major chess tournament) this summer, my experience as a software engineer and the constraints of a single quarter precluded the achievement of any such dreams. This system is meant to be studied and then built upon, as one might erect a building on top of a solid foundation. Now, one can use the system as it currently stands and have a pretty solid TD; but, for all the situations one would encounter in even a medium-sized tournament, changes need to be made. With that said, the reader is ready to delve into the system proper ...
The user's manual will be the most frequently consulted manual .... Care must be taken to make it concise, clear, and easy to follow .... It must be assumed that the average reader has little or no knowledge of computers.

William F. Brown
Standards Manual for Software Engineering II (CS 498)
(page 9)
GENERAL HARDWARE AND SOFTWARE INFORMATION

The target users of this system are Dr. Owens, the author, and other computer science students interested in the automation of a process such as the Swiss System. Thus, many of the "user-friendly" features that one might expect in a software system of this size have been bypassed. I hope that the system will eventually be modified for use on a microcomputer so that other less "computer literate" users can have access to TD, conveniently at their various tournament sites.

Before running TD, the user must verify the existence of certain files. Only the asynchronous control trap, written in Fortran, has been compiled externally; all other system procedures, written in Pascal, are copied into the main module as internal procedures at the time of compilation. As such, the number of source files is greater than the number of all other files. Required modules are enumerated below.

SOURCE : All modules listed in the Module Index.
OBJECT : TD.Obj, 11.Obj
EXECUTABLE : TD.Exe
AUXILIARY : Roster.Fdl, Prt.Com

All other files are created by the system during the course of execution.

As a menu-driven system, actual use of TD is rather simple (assuming that one knows how to direct a tournament
with a minimum of proficiency). To start the tournament director, type "RUN TD"; to stop the system, merely select option 5, "Terminate the tournament director," in the main menu. As mentioned earlier, I have not yet included many of the niceties that should be part of any system for use by the general public. Though the program is very easy to use with respect to the flow of directing activity, the user must--at this point in time--reach a level of moderate competence before trying to use the TD in a real-life situation. The incompetent user will become very frustrated very quickly!

FUNCTIONS AND RESTRICTIONS (The "wills and won'ts")

The TD system currently performs the essential tasks of a Swiss System tournament director. One may enter all necessary tournament information, enter each new player as he registers, perform the basic Swiss System pairing method, enter round results as they arrive, and create/print up-to-the-minute crosstables, both by wallchart order and by game-score order. The necessary tournament data includes the selection of all official variations of the System, as given by the USCF. Provisions for the use of each have been made, but as of yet only the bye-scoring variation has actually been implemented.

The limitations of the system may be divided into two classes: user limitations and performance limitations. Though control-Y and control-C characters are trapped at the keyboard, many other key combinations can cause an untimely end to TD execution. The advice I give to the user is this:
Hit only the numeric and alphabetic keys located on the main keyboard. Do not hit the escape key, the control key, or any of those exotic function keys that you see on various parts of your different keyboards. Invalid entries on the menu screens are trapped, and the user will always be given a chance to reject the screen of data that he has just typed. Unusual key combinations, though, can cause unexpected results; rather than trying to list them all, I will trust the beforementioned users to heed my warnings and to avoid these uncertainties.

Performance limitations are of an entirely different nature, since they involve the subtleties of the Swiss System, and tournament direction in general, that have not yet been coded into TD. A full list of future improvements and additions is given in Section III, Part 4, under technical support; but I will outline a few of the more important here. The first involves the inadvertent loss of data. What happens if execution is stopped during a tournament (whether accidentally or intentionally)? All the pairing card data is lost! In my wisdom, I choice to maintain that information in dynamically-allocated linked lists rather than in a relative file. Only later did I realize that this method made data recovery impossible. Other limitations include the inability to enter a player late, to withdraw a player early, or to restrict early-round pairings on the basis of player requests. Provisions have been made for these elements, but they still need to be coded, integrated, and tested. TD does, though, perform the basic functions
of tournament direction quite well and, for this reason, serves as a useful foundation for my current users.

For user convenience, the following pages include a copy of each screen that exists in the system. One may refer to these pages to see examples of correct data entry or to verify the selection of options from the various menus.
(1) Enter tournament information
(2) Record a game result
(3) Pair players for the round
(4) Prepare a current crosstable
(5) Terminate the tournament director

Enter your selection:
(1) Enter specific tournament data
(2) Enter a new player
(3) Prepare for round one
(4) Return to the main menu

Enter your selection:
**ENTER TOURNAMENT DETAILS**

<table>
<thead>
<tr>
<th>Tournament name</th>
<th>Eastern Indiana Open</th>
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<tbody>
<tr>
<td>Sponsor</td>
<td>Ball State Chess Club</td>
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<tr>
<td>Tournament Director</td>
<td>Eugene Wallingford</td>
</tr>
<tr>
<td>Site</td>
<td>Muncie, Indiana</td>
</tr>
<tr>
<td>Starting date</td>
<td>May 10, 1986</td>
</tr>
<tr>
<td>Ending date</td>
<td>May 11, 1986</td>
</tr>
<tr>
<td>Number of rounds</td>
<td>5</td>
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<tr>
<td>Select variations ?</td>
<td>y</td>
</tr>
<tr>
<td>Scoring byes</td>
<td>0</td>
</tr>
<tr>
<td>Ranking unrated players</td>
<td>0</td>
</tr>
<tr>
<td>Scoring unfinished games</td>
<td>0</td>
</tr>
<tr>
<td>Pairing odd men</td>
<td>0</td>
</tr>
<tr>
<td>Alternation of colors</td>
<td>0</td>
</tr>
</tbody>
</table>

Is all the information on this screen OK? (Y or N) : y
Name : Eugene Wallingford
Rating : 1555
USCF ID number : 12057870

Is all the information on this screen OK? (Y or N) : y
Enter your selection: 3

Preparing files and pairing cards for round one.

SELECTION 1.3
*** ENTER A ROUND RESULT ***

Result (W or D) : w
Pairing # of winner : 010
Pairing # of loser : 020

Is all the information on this screen OK? (Y or N) : y
Pairing players for round
Preparing for the pairings.

Creating a score group.
Pairing_odd_men.
Pairing score group.
Preparing pairing list file.
PAIR PLAYERS FOR THE ROUND

(1) Print pairing list to attached printer
(2) Print pairing list on selected queue
(3) Return to main menu

Enter your selection:

SELECTION 3 - SCREEN 2
PAIR PLAYERS FOR THE ROUND

Updating the pairing_cards
Pairings completed for round 1

Hit <RETURN> to continue . . .

SELECTION 3 - SCREEN 3
PREPARE A CURRENT CROSSTABLE

(1) Create a new crosstable
(2) Output the most recent crosstable
(3) Return to the main menu

Enter your selection:

SELECTION 4
PREPARE A CURRENT CROSSTABLE

(1) Crosstable in wallchart order
(2) Crosstable in game-score order
(3) Crosstable in tiebreak order
(4) Return to the main menu

Enter your selection:

SELECTION  4.1 - SCREEN  1
PREPARE A CURRENT CROSSTABLE

Writing header items to the Crosstable file . . .
Writing detail lines to the Crosstable file . . .
Hit <RETURN> :
PREPARE A CURRENT CROSSTABLE

(1) Print to attached printer
(2) Print crosstable on selected queue
(3) Return to main menu

Enter your selection : 2

SELECTION  4.2 - SCREEN  1
PREPARE A CURRENT CROSSTABLE

(1) Print to attached printer
(2) Print crosstable on selected queue
(3) Return to main menu

Enter desired queue : rb355

Job CROSSTABLE (queue PRINTRB355, entry 1056) started on PRINTRB355

Hit <RETURN> to continue:

SELECTION 4.2 - SCREEN 2
Nothing ever becomes real till it is experienced-- even a proverb is no proverb to you till your life has illustrated it.

John Keats
INTRODUCTION

The TD software system is written in Pascal for Ball State's Vax-11/785 cluster. (Note: The control character asynchronous trap is written in Fortran and is externally compiled.) I hope that someone will eventually modify the system for use in an MS-DOS environment, so that tournament directors will be able to use the programs conveniently on-site. I have made a great effort to maintain the portability of the code to different hardware and software systems. Only ANSI-standard Pascal is employed, with a minimum of reliance placed on Vax-dependent features (like FDL, DCL, and the Run-Time Library). Overall, no major programming changes should be anticipated with respect to environmental alterations.

This section does require a couple of explanatory notes. First, the Data Flow Diagrams presented here do not conform strictly to guidelines of CS 497. Often, simple descriptive terms or dummy processes were used to represent more subtle operations such as linked-list attrition and construction. To conform too closely to DeMarco's dicta would have presented an inaccurate picture of the data flows. Second, the structure chart shows only the "external" procedures that are copied into each module at compilation. Small or
informal procedures written for the sake of a module's clarity and coded into the module are not included. The notch located in the upper righthand corner of a cell on the structure chart denotes that this module has not yet been coded or integrated into the TD system.
### Adjudicated-score

**COMPOSITION**... Round-result

### Crosstable

**COMPOSITION**... Tournament-statistics +
{ Player-record }

### Entrant-identification

**COMPOSITION**... Name + Rating + USCF-ID

### Error-notification

**COMPOSITION**... "I am unable to find a legal pairing combination for the " + Score. +
" score group. The following tentative pairings were used: " + Tentative-pairings

**NOTE**............ This error message is produced any time the program is unable to generate a set of Legal-pairings. The human director must then resolve the deadlock.

### Late-pairing-card

**COMPOSITION**... Pairing-card
Legal-pairings

CCMPOSITION ... { Pairing }

NCTE ............ The two players that compose each repetition of Pairing have not yet played each other.

Odd-man

CCMPOSITION ... Pairing-card

Optimized-pairing

CCMPOSITION ... Pairing

NCTE ............ This flow consists of one valid and preferred pairing, derived from a special-case pairing.

Optimized-pairing-list

CCMPOSITION ... { Optimized-pairing }

NCTE ............ All the score groups, as well as all odd men and the player with a bye (if necessary), are assembled into one pairing list.

Optimized-pairings

CCMPOSITION ... { Optimized-pairing }

Ordered-tournament-roster

CCMPOSITION ... { Pairing-number }

NOTE ............ This list of Pairing-card's is sorted on Score and is used to maintain the Pairing-card deck for all directing purposes.
Pairing

CCMPOSITION ... \{ Pairing-card \} 2

Pairing-card

CCMPOSITION ... Pairing-number + Score +
Odd-man-status + Color-due-status +
Unfinished-game-status +
Bye-given-status +
\{ Opponent \}

NOTE .......... See also Odd-man

Pairing-limitations

CCMPOSITION ... Pairing-number +
\{ Opponent \}

NOTE .......... Pairing-limitations is a list whose
first entry identifies a player and
whose other elements represent all
players with whom the identified
player is not to be paired.

Pairing-list

CCMPOSITION ... Round-number +
\{ \{ Pairing-number \} 2 \}

Player-record

CCMPOSITION ... Pairing-number +
Entrant-identification +
\{ Opponent + Color + Result \} +
Score

Remaining-cards-of-score-group

CCMPOSITION ... \{ Pairing-card \}

NOTE .......... This data flow exists after the
elimination of all Odd-man pairing
cards.
Remaining-pairing-cards

COMPOSITION ... { Pairing-card }

NCTE .......... This data flow consists of all Pairing-card's except that of the player assigned a bye.

Round-result

COMPOSITION ... { Pairing-number + Score } 2

NOTE .......... See also Adjudicated-result

Score-group

COMPOSITION ... { Pairing-card }

NCTE .......... For all pairing cards in a score group, Score will be the same.

Tentative-pairings

COMPOSITION ... { Pairing }

NCTE .......... This flow represents the initial attempt to pair a Score-group, without regard for the basic Swiss laws.

Tiebroken-ordered-tournament-roster

COMPOSITION ... Ordered-tournament-roster + 
[ [ Tiebreak-values ] ]

NOTE .......... This list of Pairing-card's is sorted first on Score and then on a tiebreak value assigned on the basis of opposition strength.
Tournament-identification

COMPOSITION ...
Tournament-name + Sponsor +
Director + Site +
Starting-date + Ending-date +
Number-of-rounds +
Ranking-unrated-players +
Scoring-byes +
Scoring-unfinished-games +
Pairing-odd-men +
Alternating-colors

Updated-pairing-cards

CCMPOSITION ... { Pairing-card }
Alternating-colors

**DEFINITION** Code denoting how alternation of colors is to be implemented

**TYPE/LENGTH** Character / 1

**EXPLANATION** The possible values are:

'-0' :: transpositions, interchanges are allowed

'-1' :: transpositions, interchanges not allowed

Bye-given-status

**DEFINITION** Code denoting whether a player has been given a bye

**TYPE/LENGTH** Character / 1

**EXPLANATION** The possible values are:

Y :: yes

N :: no

Color

**DEFINITION** Code denoting whether player had white or black in a game

**TYPE/LENGTH** Character / 1

**EXPLANATION** The possible values are:

W :: white

B :: black
Color-due-status

**DEFINITION** ..... Code denoting how color may be allocated to a player

**TYPE/LENGTH** ..... Integer

**EXPLANATION** ..... The possible values are:

- **+3**: colors are equal but must have black
- **+2**: must have black
- **+1**: is due for black
- **0**: colors are equal
- **-1**: is due for white
- **-2**: must have white
- **-3**: colors are equal but must have white

**Director**

**DEFINITION** ..... Name of official tournament director

**EXPLANATION** ..... See Name for field specification.

**Ending-date**

**DEFINITION** ..... Date on which tournament is to end

**TYPE/LENGTH** ..... Character / 8

**EXPLANATION** ..... In the form "MM/DD/YY".
See Starting-date.

**Name**

**DEFINITION** ..... Entrant's name

**TYPE/LENGTH** ..... Character / 30
Odd-man-status

**DEFINITION** .... Code denoting whether the player has been paired up or down in previous rounds.

**TYPE/LENGTH** .... Integer

**EXPLANATION** .... The possible values:

- \( +1 \): player has been PAIRED UP
- \( 0 \): player has not been used an ODD-MAN or has been PAIRED UP as many times as he has been PAIRED DOWN
- \( -1 \): player has been PAIRED DOWN

Opponent

**DEFINITION** .... Pairing-number of opposing player

**EXPLANATION** .... See Pairing-number for field specification.

Order-choice

**DEFINITION** .... Flag denoting whether tiebreak procedures are to be invoked

**TYPE/LENGTH** .... Boolean

Pairing-number

**DEFINITION** .... Symbol of rank for pairing purposes

**TYPE/LENGTH** .... Character / 3

**EXPLANATION** .... Pairing-number will be assigned in order of rating, with late entrants being assigned a value one-half of the way between the players immediately above and below him.
Pairing-odd-men

DEFINITION .... Flag describing how odd men are to be paired.

TYPE/LENGTH ... Character / 1

EXPLANATION .... The possible values:

'G' :: with the highest ranked player who he has not yet met

'I' :: with the highest ranked player who he has not yet met who is due the correct color

Ranking-unrated-players

DEFINITION .... Flag describing how unrated players are to be ranked at the outset of the tournament.

TYPE/LENGTH ... Character / 1

EXPLANATION .... The possible values:

'C' :: at the bottom of the pairing pack

'1' :: just below the average rating of the tournament

'2' :: about one-fifth of the way up from the bottom of the pairing pack

Rating

DEFINITION .... Entrant's official USCF rating.

TYPE/LENGTH ... Character / 4

EXPLANATION .... For those players with ratings of less than 1000, the rating will be right-justified for comparisons.
Result

**DEFINITION** .... Score reported from completion of a single game

**TYPE/LENGTH** ... Real

**EXPLANATION** ... The possible values are:

1.0 (for a win)
0.5 (for a draw)
0.0 (for a loss)

The sum of Result scores for one game must be 1!

Round-number

**DEFINITION** .... Number assigned to each round

**TYPE/LENGTH** ... Integer

**EXPLANATION** ... Round-number will be set at 1 upon first pairing the players and will thereafter be incremented by 1 with each successive pairing.

Score

**DEFINITION** .... Cumulative total points for a player

**TYPE/LENGTH** ... Real

**EXPLANATION** ... Score will always end in .0 or .5

Scoring-byes

**DEFINITION** .... Flag describing how byes are to be scored in this tournament

**TYPE/LENGTH** ... Character / 1

**EXPLANATION** ... The possible values:

'0' :: one point
'1' :: one-half point
Result

**DEFINITION** .... Score reported from completion of a single game

**TYPE/LENGTH** ... Real

**EXPLANATION** ... The possible values are:

- 1.0 (for a win)
- 0.5 (for a draw)
- 0.0 (for a loss)

The sum of Result scores for one game must be 1!

Round-number

**DEFINITION** .... Number assigned to each round

**TYPE/LENGTH** ... Integer

**EXPLANATION** ... Round-number will be set at 1 upon first pairing the players and will thereafter be incremented by 1 with each successive pairing.

Score

**DEFINITION** .... Cumulative total points for a player

**TYPE/LENGTH** ... Real

**EXPLANATION** ... Score will always end in .0 or .5

Scoring-byes

**DEFINITION** .... Flag describing how byes are to be scored in this tournament

**TYPE/LENGTH** ... Character / 1

**EXPLANATION** ... The possible values:

- '0' :: one point
- '1' :: one-half point
Scoring-unfinished-games

DEFINITION .... Flag describing how unfinished games are to be scored in this tournament

TYPE/LENGTH ... Character / 1

EXPLANATION ... The possible values:

'O' :: scored as a draw

'I' :: scored by adjudication

Site

DEFINITION .... Name of tournament location

TYPE/LENGTH ... Character / 40

Sponsor

DEFINITION .... Name of official tournament sponsor

TYPE/LENGTH ... Character / 40

Starting-date

DEFINITION .... Date on which tournament begins

TYPE/LENGTH ... Character / 8

EXPLANATION ... In the form "MM/DD/YY". See Ending-date.

Tiebreak-value

DEFINITION .... Score based on opposition strength

TYPE/LENGTH ... Real

Tournament-name

DEFINITION .... Official USCF title of tournament

TYPE/LENGTH ... Character / 40
**Unfinished-game-status**

**DEFINITION** .... Code denoting that a game has not finished

**TYPE/LENGTH** .... Character / 2

**EXPLANATION** ....

Character 1 :: round number
Character 2 :: pairing score

Possible values of pairing score are:

"W" :: win
"D" :: draw (default)
"L" :: loss

**USCF-ID**

**DEFINITION** .... Entrant's USCF identification number

**TYPE/LENGTH** .... Character / 8