Music Printing: An Update

Music printing was the major focus of the 1986 *Directory*. The main approaches to computer-based music printing were examined, and two dozen examples from diverse systems were presented. The continued growth of interest in this field has encouraged us to present a new series of examples this year; for an overview of the field, readers should consult the previous volume. The majority of music printing contributions in the current *Directory* are either from systems that have not been represented before or have increased their capabilities since they were last shown.

We have separated contributions into four categories: (1) proprietary systems, (2) commercial systems, (3) software for printing music, and (4) user contributions. All examples in the first three categories were contributed by system developers, whose names are given in parentheses. User contributions may not show off a system's capabilities to best advantage, in that the hardware used may be quite basic; conversely, patient users sometimes extract mileage from particular systems with which they have become highly familiar that developers have failed to display. Proprietary systems are not available for sale. Commercial systems are for sale but require the purchase of dedicated hardware as well as software. The software category represents programs specifically devoted to music printing that run on widely available microcomputers. Potential users should check with developers (whose addresses are listed in the back of this volume) to determine what specific hardware configurations (including memory requirements, graphics cards, interfaces, etc.) may be necessary for their programs.

To facilitate comparison of systems, we distributed a set of musical examples to all the software developers on our mailing list. These examples -- a Bach chorale, the opening bars of a Bach harpsichord prelude, and excerpts from Mozart's clarinet quintet -- were selected to elicit information both about music printing capabilities and about music representation and file structures. The original examples are represented by the first three pages of music shown (Toppan Scan-Note System). For music printing, some particular areas of interest were text underlay and basso continuo figuration (Ex. 1), subtleties of part differentiation, slurs, and fingering (Ex. 2), and accurate representation of transposing parts and ornamentation (Ex. 3). A fourth example was one with no notable printing complexities and has not been reproduced in the printing section. Several developers contributed their versions of all four examples; we have tried to select those examples that best illustrate the range of capabilities of individual systems. We have also reproduced examples of other repertories and material related to special capabilities or personalities of individual systems. Other developers preferred to submit examples of their own choosing. All examples have been reduced 20% from the versions we received, unless otherwise indicated. Material that was still too wide to be shown horizontally has been rotated 90 degrees in preference to reducing it further. The order is random.

Comparisons can be deceptive, since no two products used exactly the same hardware. Stephen Dydo graciously provided printouts of the Bach chorale from both a dot matrix and a laser printer to illustrate how spacing control is affected by hardware capabilities and restraints (both versions were produced from the same data, the same program, and the same music font). The Byrd/Stickney examples illustrate the more subtle differences between a typesetter (Linotronics) and a laser printer (Apple), again using the same data,

the same program, and the commercially available Adobe 'Sonata' font. The printing devices used range in price from under $500 to as much as $50,000. Program prices range from under $100 to nearly $1,000. The range of prices for complete systems is from around $10,000 to well above $50,000.

Comparison of the output from similar printers driven by different programs ignores the important question of input methods, which was the main subject of the 1985 *Directory*. Alphanumeric code is the usual method for IBM PC and compatible computers, including the Hewlett Packard, Tandy, and Texas Instruments microcomputers represented in the illustrations. Apple Macintosh and Atari ST systems tend to use MIDI (electronic keyboard) data with graphic icons. The division between code-intensive and sound-and-graphics oriented systems is less distinct than it was a year ago in that some cross-over technology is beginnning to appear: Apple and IBM products or features may be combined in systems designed especially for musical purposes.

Still at issue is the tradeoff between memory requirements and speed of processing. Systems of long standing tend to encode as much information as possible in as little space as possible. Dal Molin's Music Writer, written in assembly language to deal with a hexadecimal code generated by hardware specially designed for the purpose, uses less than 16K of memory. Programs of more recent vintage produce their own decisions on spacing, beaming, stem direction and so forth. This lengthens programs written in high level languages (some for the IBM PC exceed 256K) but reduces the bulk of the data. (As points of reference, one user submitted a single page of a Renaissance chanson that had consumed more than 32K of memory with a commercial music printing program, while DARMS users maintain that enough data to print a symphony can be encoded on one floppy disc. Since 1981, hard disc prices have dropped from $100 per megabyte to $10 per megabyte, and disc size has increased proportionally.) The underlying rationale of play-in systems is quite different: they capture pitch and duration data but may require extensive editing to produce a printed score.

Almost all software developers regard their current versions as incomplete. Some are still implementing such features as slurs, ornaments, and other performance-related refinements. Some are adapting mainframe or dedicated hardware systems to microcomputers. Many are seeking to broaden their hardware base to support a larger number of both microcomputers and printing devices. Some are working on user interfaces (programs to relieve users of the need to become computer experts in order to run programs). Some are adapting existing programs to make use of commercially available fonts, such as Adobe Systems' 'Sonata' font, while others are devising custom fonts. Some are developing libraries of special symbols to handle the markedly different needs of notationally unusual repertories, such as music from the later Middle Ages and the later twentieth century. Some are building provisions into their systems to enable users to devise their own list of recallable symbols.

Cumulative List of Music Encoding and Printing Systems and Products

The following list of music printing and related encoding systems is in alphabetical order, with references to previous descriptions and illustrations. The quantity of information provided here is greater for systems that have not previously been listed but

should not be used as a gauge of merit. The systems marked with an asterisk accept work on a contractual basis.

Commercial products that either do not currently support printing of classical music or which have not made samples available for reproduction are not included in this listing, but the Center would like to acknowledge with gratitude the information about such systems that their developers from time to time submit.

ALMA. See **Plaine and Easie.**

ALPHA/TIMES. Commercially available system by Christoph Schnell of input, indexing, storage, and retrieval for Apple microcomputers. ALPHA is a database system originally designed for the Apple ///. TIMES-DB (previously called IRMA), an adaptation for the Macintosh, is a kernel of TIMES (Total Integrated Musicological Editing System), which combines a graphic editor, a text processor, a font editor, and a professional music editor for conventional notation. Input by voice recognition device generates DARMS code. Printing capability for standard, early and recent repertories (in conjunction with Professional Composer, using Apple dot matrix and laser printers). Description, **1986.** Illustrations, **1986, 1987** [#45].

AMADEUS MUSIC SOFTWARE.* Kurt Maas of Munich has made his originally proprietary music printing system commercially available. It is based on a DEC PDP-11 computer, accepts MIDI input, and supports dot matrix printers, plotters, and laser printers and phototypesetters. The programs require a UNIX (or IDRIS) operating system. The user must pay license fees in addition to the purchase price of the system. Amadeus prepares scores for publication by such enterprises as B. Schotts Söhne.

A-R Editions, Inc.* Proprietary system for music printing developed by Thomas Hall using a Data General mainframe, with a Versatec plotter for preliminary drafts and a Mergenthaler Linotron 202 typesetter for finished copy. The music is encoded in a DARMS dialect. Besides producing its own editions, which have been computer-generated for ten years, A-R sets musical examples for numerous journals including that of the American Musicological Society. Illustrations, **1987** [#13, #14].

CCARH. In-house system originally designed for the HP 1000 with an IBYCUS operating system (description **1985**; illustrations **1985** and **1986**). Experimental musical character cartridge for the HP LaserJet; downloadable characters for the LaserJet Plus and LaserJet II. Research on font design in progress.

CODEX. Printing program (Macintosh) for white mensural notation. Reported in **1986.**

(The) Copyist. Software product for the Atari ST sold by Dr. T's. There is also an IBM PC version. This is a synthesizer-oriented product. Illustrations (dot matrix), **1987** [#27, #28]. Laser printing (HP LaserJet Plus), plotter output (HP-GL plotter); HP InkJet also supported. Epson printer compatibility.

Dal Molin. Armando Dal Molin has devoted a lifetime to the challenge of automating music printing. Inventor of the first musical typewriter, he has devised a series of systems that have generally been used under proprietary labels and in production-oriented

environments. His **Musicomp** terminal, a custom product with separate keypads for pitch (6 octaves) and other aspects of notation as well as text (128 redefinable characters), in conjunction with an Omnitech laser printer, has been producing roughly 1,000 pages of music a month for almost a decade. Belwin Mills Publishing Corp., a subsidiary of Columbia Pictures, is an active user of this technology. A photograph of the Musicomp terminal appears in *The New Grove Dictionary of Music and Musicians* (1980), **15**, 258. It is described in "A Terminal for Music Manuscript Input," *Computers and the Humanities*, **12**, 287-9. More recent developments and a description of his "pitch-character-space" code are given in a paper he presented in Zurich in October 1986 (copies available from the author). Illustrations, **1987**.

Under the name **The Music Writer**, Dal Molin is currently adapting his system to run on an IBM PC and other 8088 or 80286 microcomputers. Currently, his program provides access to one music and one text font; he plans for two music and four text fonts in the completed product. This directory shows examples of a finished product from his main system [#15] and work in progress towards an adaptation for microcomputers [#37, #38].

DARMS. This is an encoding system, not a printing product (descriptions, **1985** and **1986**), once known as the Ford-Columbia music representation language, after its original benefactor and university setting. First used on IBM mainframes, DARMS code has been used for dedicated printing purposes by Lincoln and Morehen (illustrations, **1986**). Subsets of DARMS code have been used by many others for diverse purposes. DARMS manual (1976) available from Raymond Erickson; revision by McLean planned. Completion of microcomputer software for three-dimensional representation (DARMS 'cube') of formal ('canonical') DARMS by McLean intended for August 1987. DARMS code is used by Stephen Dydo in his printing program, **The Note Processor.**

Deluxe Music Construction Set. Software product for the Macintosh (alternative versions for other microcomputers) developed by Geoff Brown. Illustrations, **1986** (Apple LaserWriter and Linotronics typesetter) and **1987** (Linotronics typesetter; #39, #40).

ETH. The Eidgenössische Technische Hochschule [Swiss Federal Institute of Technology] has under development at its Institut für Informatik in Zurich a research prototype for an interactive editor of complex musical notation. This effort involves the use of an abstract representation of certain features of musical notation. The system is implemented in Modula-2 and runs on a LILITH workstation. Giovanni Müller is the principal investigator. Illustration, **1987** [#44].

FASTCODE. An encoding language (middle and late '70's) derived from the still earlier IML-MIR (early 1970's); both versions originated at Princeton University. Printing capability for white mensural notation partially developed by Thomas Hall. A modified version of the code is currently used by Leeman Perkins (Columbia University) for the Busnois edition. The proprietary system used by A-R Editions* is indebted in a general way, through the work of Thomas Hall, to this system. Descriptions, **1985** and **1986**; illustration, **1985**.

Grawemeyer Industries.* Current users of the system previously developed by **MusiGraph.**

GUIDO. A music learning system oriented toward classroom use for music theory, ear training, and music appreciation. There are Macintosh and IBM PC versions, although the development work was done on the PLATO system. A series of video discs is now available. No music printing capability has been reported. Description, **1986.**

Graphic Notes. Commercial software from Australia for Macintosh-based music printing. Release expected in the last quarter of 1987. The developer is Trevor Richards.

Gregory's Scribe. Printing program for Gregorian chant for the Apple //; hardware component no longer in manufacture. Description, **1985**; also in the *Computer Music Journal* VII/1 (1983).

H-Score. Software from Hybrid Arts for the IBM PC. Synthesizer-oriented. User-created examples submitted but not reproduced.

High Score. Music printing software for the Macintosh, using the PostScript 'Sonata' font. Still under development. Described, **1986 Supplement,** and in the popular press as a joint venture by Kimball Stickney and Don Byrd doing business as Advanced Music Notation Systems. Illustrations, **1987** [#41, #42].

The partnership is now dissolved. Stickney retains the product name; his version will be released by Southworth Music Systems. Byrd retains the company name and is working on a user interface for his product, which will be called **Nightingale** and is designed to work in a number of graphics environments. The program is a derivative of SMUT (see **MUSTRAN**).

IML-MIR. Linked encoding (Intermediary Musical Language) and query (Music Information Retrieved) languages developed at Princeton. See **FASTCODE.**

IMS (Interactive Music System). A PLATO-based system developed over many years at the University of Illinois. Broad capabilities for transcription, screen editing, playback, and printing. Input by alphanumeric code or from synthesizer. Adaptations of the printing system for use with NEC, IBM, and Macintosh microcomputers, the Toshiba P1350 dot matrix printer, and the HP LaserJet series are currently in progress. An associated program, LIME, is a graphic screen editor. OPAL is a language for music description and algorithmic manipulation of scores. Stand-alone version for the Apple Macintosh with a large screen and a MIDI keyboard under development. Descriptions **1985** and **1986**; illustrations **1985, 1986, 1987** [#46]. Revised manual (January 1987) by Lippold Haken and Valerie Schmid; article by Carla Scaletti in the *Computer Music Journal* 9/1 (1985). [For other work at Illinois, see also **NEWNOTE** and **OLDNOTE.**]

IRMA (Information Retrieval for Multiple Musicological Applications). See **ALPHA/TIMES.**

Laffangraff. See **The Music Editor.**

Lasergraphics. Proprietary system. See **Dal Molin.**

LIME. See **IMS.**

McLeyvier. David McLey's McLeyvier system was oriented towards the needs of composers. Its sophisticated graphics were said to be comparable with those of the Mockingbird system. The system is now the property of Syntronics in Toronto and is not in active use for music typography.

MEG (Music Editing and Graphics). Developed in Rome, originally for the Apple //, later adapted to the IBM PC. Some scores published by Universal Edition in Vienna. Description, illustration **1986.** See *ICMC Proceedings 1984.*

Mockingbird. An interactive editor and printing system for musical notation (primarily keyboard music) developed in 1980 at the Palo Alto Research Center (supported by the Xerox Corp). Experimental in nature, the programs (in Mesa) ran on the Xerox 1132 computer and accepted keyboard input. No commercial versions have been made available. Description, **1985.**

music. A music preprocessor for the **troff** typesetting system; operates in a UNIX environment. Under development at Nottingham University (U.K.) by Eric Foxley. Custom language for description of musical scores; custom music fonts work with Chelgraph laser printer. Documentation from the author. Listed, **1986.**

(The) Music Editor. Music printing program by John Laffan for the IBM PC. Description, **1985**; illustrations, **1985** and **1986.**

(The) Music Factory*. Service using software for the IBM PC by Stephen Dydo. (See description for **The Note Processor.**) Listed, **1986.** Forthcoming publications with musical examples from The Music Factory include two Schirmer books, Kerala Snyder's *Buxtehude: Organist at Lübeck* and Glenn Watkins' *Soundings: Music in the Twentieth Century.*

(The) Music Processor. Program by Etienne Darbellay for the Texas Instruments Professional and Business Pro computers. Handles numerous special notations (ligatures, black and white mensural notation), piano reductions, and three sizes of symbols; permits user-defined graphics. Conversion for the IBM PC underway. Descriptions, **1985, 1986**; illustrations, **1985, 1986, 1987** [#21-#23].

(The) Music Writer. IBM PC version of Dal Molin's system for entering and printing music. See **Dal Molin.**

MUSICA. A language for musical encoding used at the University of Padua. Alphanumeric system completed in 1981. Described in *Interface* 11/1, 1-27.

MUSICODE and MUSICODE/A. Fred T. Hofstetter developed MUSICODE as part of his M.A. thesis at Ohio State University in 1970. It is an alphanumeric encoding system. A revised version by Ann Blombach is called MUSICODE/A.

Musicomp Terminal. See **Dal Molin.**

Musicprinter. Program by Jack Jarrett for printing music with the Apple //+. Illustration, **1986.**

Musicsys 3600. A proprietary system for editing and sound with a music printing capability. Based on the Symbolics 3600, a LISP-based machine; designed by Bernard S. Greenberg. Description, illustration, **1985.**

MusiGraph. A proprietary system for music printing originally developed by William Watkins. The system is now owned by Grawemeyer Industries* in Lexington, KY. The original MusiGraph system generated notational descriptions from a Tandy TRS-80 microcomputer and printed them on a typesetter; beams and slurs were added by hand. The system provides musical examples for the *Journal of Musicology* and scores for a number of music publishers including C. F. Peters (New York).

MusPrint. Music printing program by Keith Hamel for the Macintosh. Illustration, **1986.**

MusScript. Successor to MusPrint. It uses the Postcript 'Sonata' font. Illustration, **1987** [#32].

MUSTRAN. An encoding language originated by Jerome Wenker at Indiana University in the 1960's. Original focus on ethnomusicology. Used as a basis for the development of analytical and instructional capabilities, especially by Dorothy Gross and Gary Wittlich, and for music printing by Donald Byrd. MUSTRAN programs have been run on the IBM PC. SMUT, a plotter notation program in FORTRAN by Byrd, ran on some Indiana University mainframes. No MUSTRAN-based printing capability for microcomputers has been reported.

Byrd's current commercial interest is in developing sophisticated music editing capabilities for Macintosh computers and for Sun and Apollo workstations. He is also taking a position at Princeton University in the autumn of 1987 that entails developing a music printing capability for twentieth-century music using the 'C' language in a UNIX environment.

NEWNOTE and **OLDNOTE.** Programs developed by L. Rumery at the University of Illinois in *c.* 1980 to encode and print sixteenth-century vocal music in both modern and mensural notation. Designed for the PLATO system (see also **IMS**).

Nightingale. Macintosh-based program for music printing, under development by Donald Byrd. See **High Score, MUSTRAN.**

(The) Note Processor. IBM PC-based program for printing music by Stephen Dydo. Input by DARMS code or mouse. The program runs on IBM PC and compatible microcomputers and supports Toshiba, Epson, and NEC dot matrix printers as well as the HP LaserJet II. Illustrations, **1986, 1987** [#24-#26]. See also **The Music Factory.**

Notepro. A system of encoding used at the University of Illinois by James Beauchamp and others. Synthesis-oriented. Reference manual.

Noteprocessor. Music printing program for the Apple //. Developed by Piero de Berardinis, one of the first to devise a way of playing music directly into a microcomputer (1983); also the founder of the Italian review *Informatica musicale* (1982--). Illustration, **1987** [#30].

Oberon Systems. Oberon's System I* was developed in 1981 and is based on the Hewlett Packard 1000 microcomputer. Oberon offers a fully tested package of current hardware and software tools (for approximately $10,000) that more or less duplicates its own capabilities. It also offers typesetting services and data storage backup. Its System II music font for the HP Vectra and other IBM PC compatibles can be used with any screen editor that allows keying of characters in the font and control characters in the text. Musical files can be excerpted and merged with text files (created with such programs as Memomaker, Wordperfect, and MS Word). Oberon professes a commitment to keeping upgrades compatible with existing products. It is currently engaged in efforts to improve its software for choral music. Illustrations, **1987** [#35, #36].

OLDNOTE. See **NEWNOTE.**

OPAL. See **IMS.**

ORPHEUS. See **IMS.**

Oxford Music Processor. IBM PC-based program for printing music announced by Oxford University Press; not yet released. Input involves redefinition of the keyboard. Supports both dot matrix and plotter output. Derived from a mainframe program by Richard Vendome,* the original version of the OMP has been in active use for setting recent performing editions by OUP and musical examples for Oxford journals such as *Early Music* and *Music and Letters*. Description, **1986**; illustrations, **1986, 1987** [#43].

Personal Composer. IBM PC-based music printing program by Jim Miller. Synthesizer-based. PostScript 'Sonata' font for the Apple LaserWriter. Illustrations, **1986, 1987** [#29].

Plaine and Easie. Plaine and Easie is a melodic input code developed by Barry Brook and Murray Gould in the late 1960's. It has been especially widely used for thematic indexing and has also been central to the manuscript cataloguing efforts of RISM Series A projects. ALMA, an extension by Gould, accepts chordal notation. Programs for plotter output of musical notation were developed in the 1970's by Norbert Böker-Heil. Description, **1985, 1986.** Illustration, **1986.**

Professional Composer. Screen editing and printing program for the Macintosh. Synthesizer-based. Currently in use for the preparation of musical editions by Garland Press. Illustrations, **1986, 1987** [#31].

SCAN-NOTE System. This proprietary system for printing music was designed by Mogens Kjaer and developed in the late 1970's by Dataland ApS in Aarhus, Denmark. It was subsequently sold"to the Japanese firm Toppan and has undergone further development. See **Toppan.**

SCORE. Music printing program for the IBM PC and compatibles derived from **SCORE/MS.** SCORE was scheduled for release by Passport Designs in June 1987. Several sublibraries of symbols for special repertories and accommodation of user-defined symbols are provided. An Apple LaserWriter is currently supported and versions compatible with other printers are currently under development. Illustrations, **1987** [#18-#20].

SCORE/MS. A music printing system developed (in FORTRAN) at Stanford University for the PDP-10 computer and a Versatec plotter in the early '70's by Leland Smith. Many special capabilities for early and recent music as well as standard repertories. Descriptions and illustrations, **1985, 1986.**

SCRIBE. A system for transcribing, editing, and analysis of early music (through the Renaissance) under development on a DEC VAX at La Trobe University in Australia. Facsimiles in neume or pitch notation use a Houston plotter. Description, **1986.**

Synclavier. A music printing option for the well-known synthesizer called a Synclavier has been offered by New England Digital Corporation since 1982. Three versions have appeared; the third of these, supporting laser printing, has been available for a year. To print music a user needs a Synclavier system, a graphics terminal, proprietary software, and one of seven printers that the system supports. These include a 300-dots-per-inch Dataproducts printer, the Apple LaserWriter, and the Linotronics 100 and 300 (2540 dots per inch). Illustration, **1987** [#16].

The Synclavier music printing option is used by a number of professonal music copying services, including that of Ted Petrosky [#17], whose Symphony Reproductions, Inc., is "engraving" the complete works of Gordon Getty.

TAUMUS. Original name of **TELETAU.**

TELETAU. An integrated system combining a repository of musical data and software for management, analysis, and telecommunications. Initially developed at CNUCE in Pisa and now maintained jointly with the Florence Conservatory. Active research program. No musical printing at present. Library of 800 encoded pieces. Manual available from Pietro Grossi (CNUCE) and Lelio Camilleri (CNUCE; Florence Conservatory). Description, **1986.** Electronic addresses: *MUSIC3@ICNUCEVM* and *CHERU@IFIIDG* [both *BITNET*].

THEME: The Music Editor. IBM PC-based software by Mark Lambert for music printing. Input involves redefinition of QWERTY (standard typewriter) keyboard. Permits mensural notation. Version 3.0 for Epson-compatible dot matrix printers supports incorporation of musical examples in text using PC-Write. Illustrations, **1987** [#33, #34].

TIMES. See **ALPHA/TIMES.**

Toppan Scan-Note System.* A highly evolved system for quality music "engraving" serving the Japanese and European markets since 1983. It uses the **Scan-Note** system originally developed in Denmark. In its current configuration, the system uses a CRT terminal for entering layout information and lyrics, a piano keyboard for entering pitch, and a laser phototypesetter. Toppan Printing Co., Ltd., contracts with major music publishers, such as Bärenreiter Verlag, for whom it prepared a recent volume of the *Neue Mozart Ausgabe* -- the *Divertimenti und Serenaden für Blasinstrumente* (Ser. VII, N. 17). Illustrations, **1987** [#8-#12].

troff. See **music.**

Waseda University. See **Log: Facilities - Toyko.**

Illustration 8

Proprietary Systems -- 1a
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard
Software: custom, in 'C'
Printing device: unidentified laser phototypesetter

Unreduced

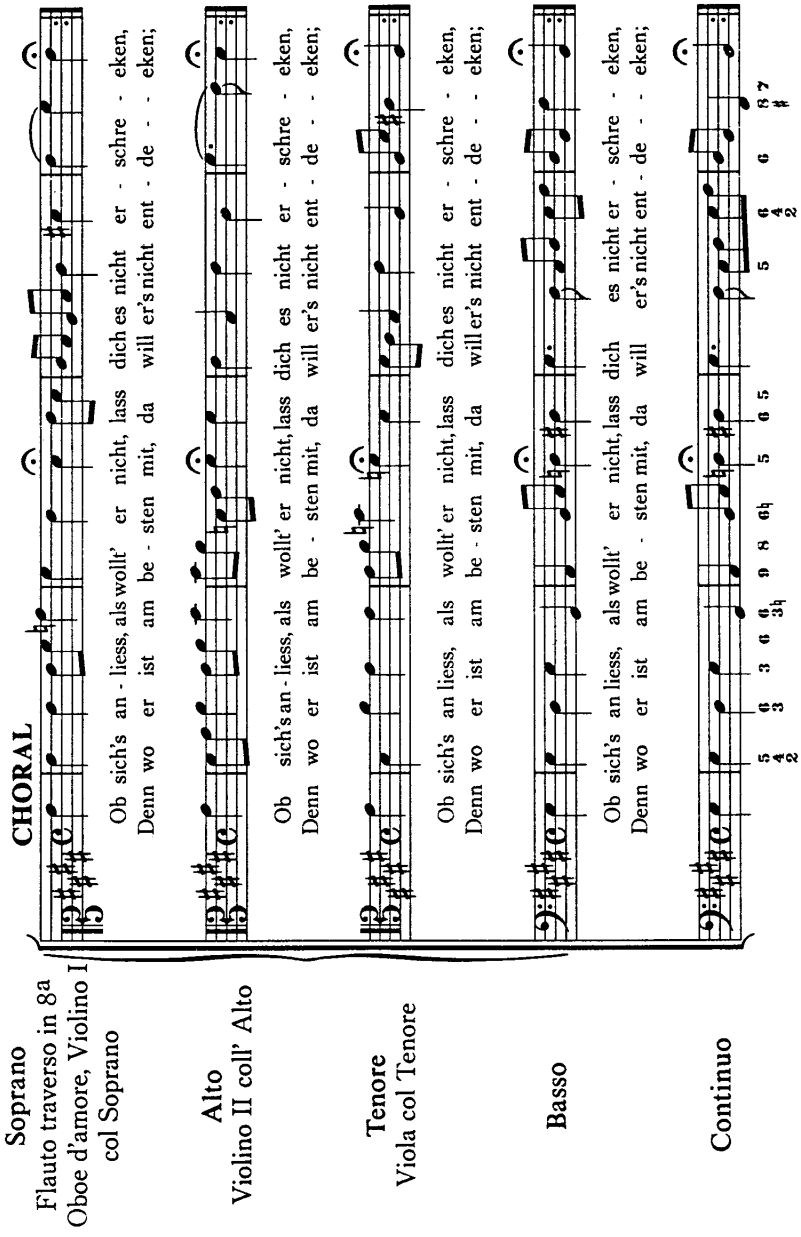


Illustration 9

Proprietary Systems -- 1b
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard
Software: custom, in 'C'
Printing device: unidentified laser phototypesetter

Unreduced

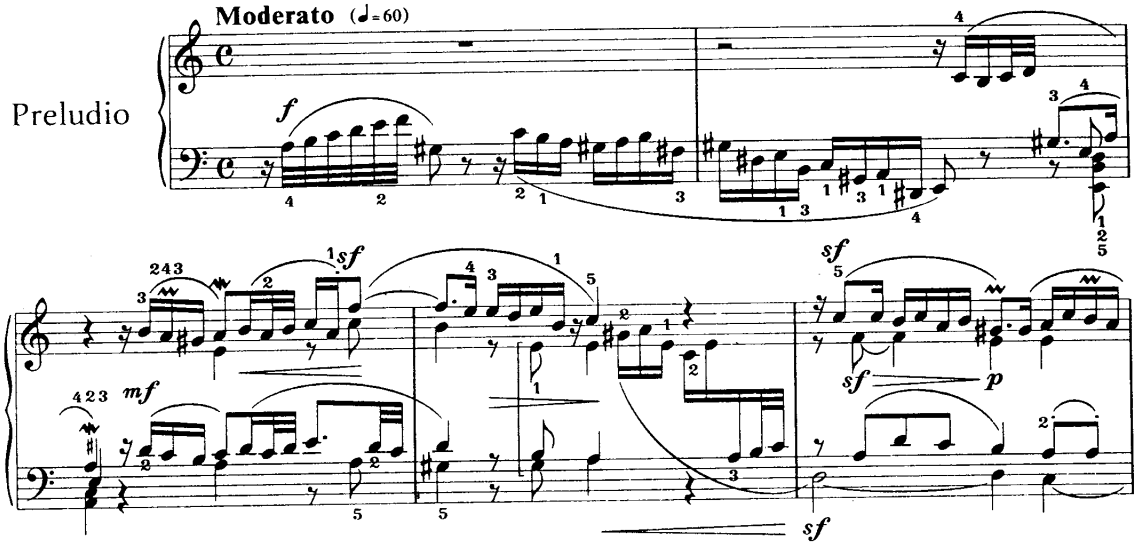


Illustration 10

Proprietary Systems -- 1c
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard
Software: custom, in 'C'
Printing device: unidentified laser phototypesetter

Unreduced

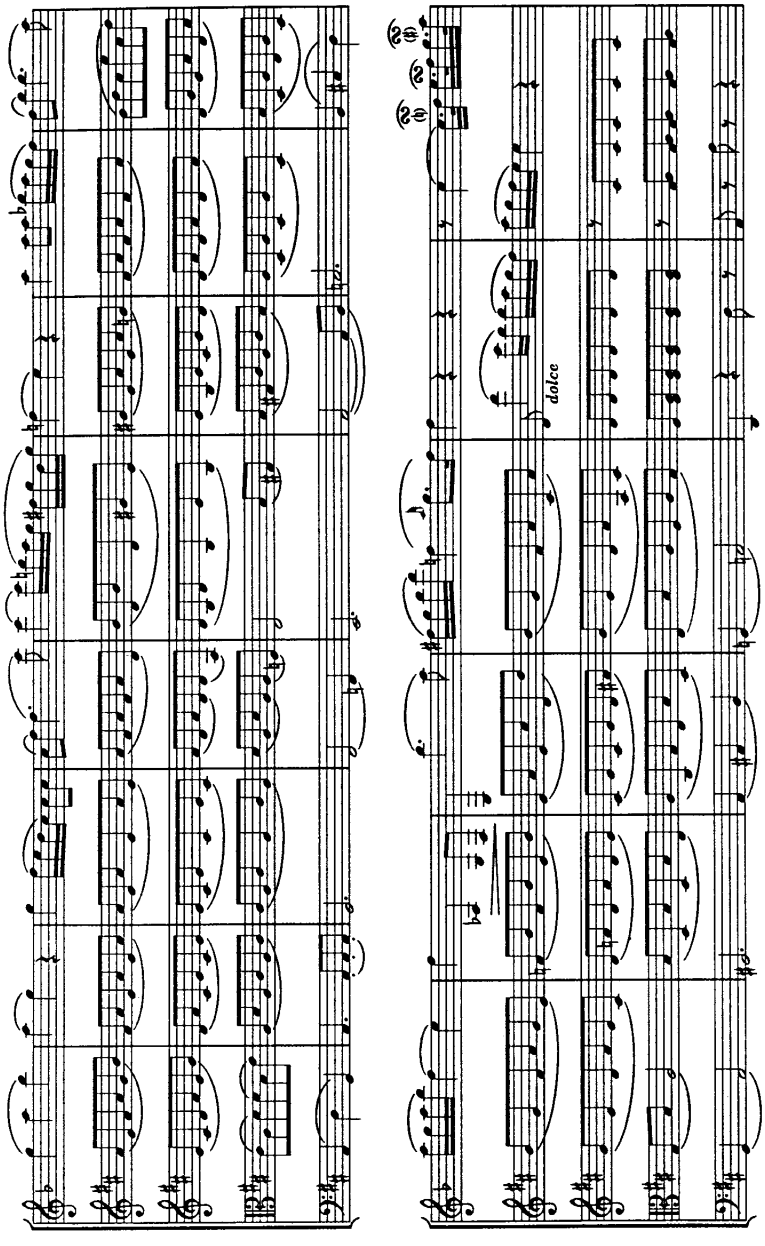


Illustration 11

Proprietary Systems -- 1d
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard
Software: custom, in 'C'
Printing device: unidentified laser phototypesetter

Unreduced

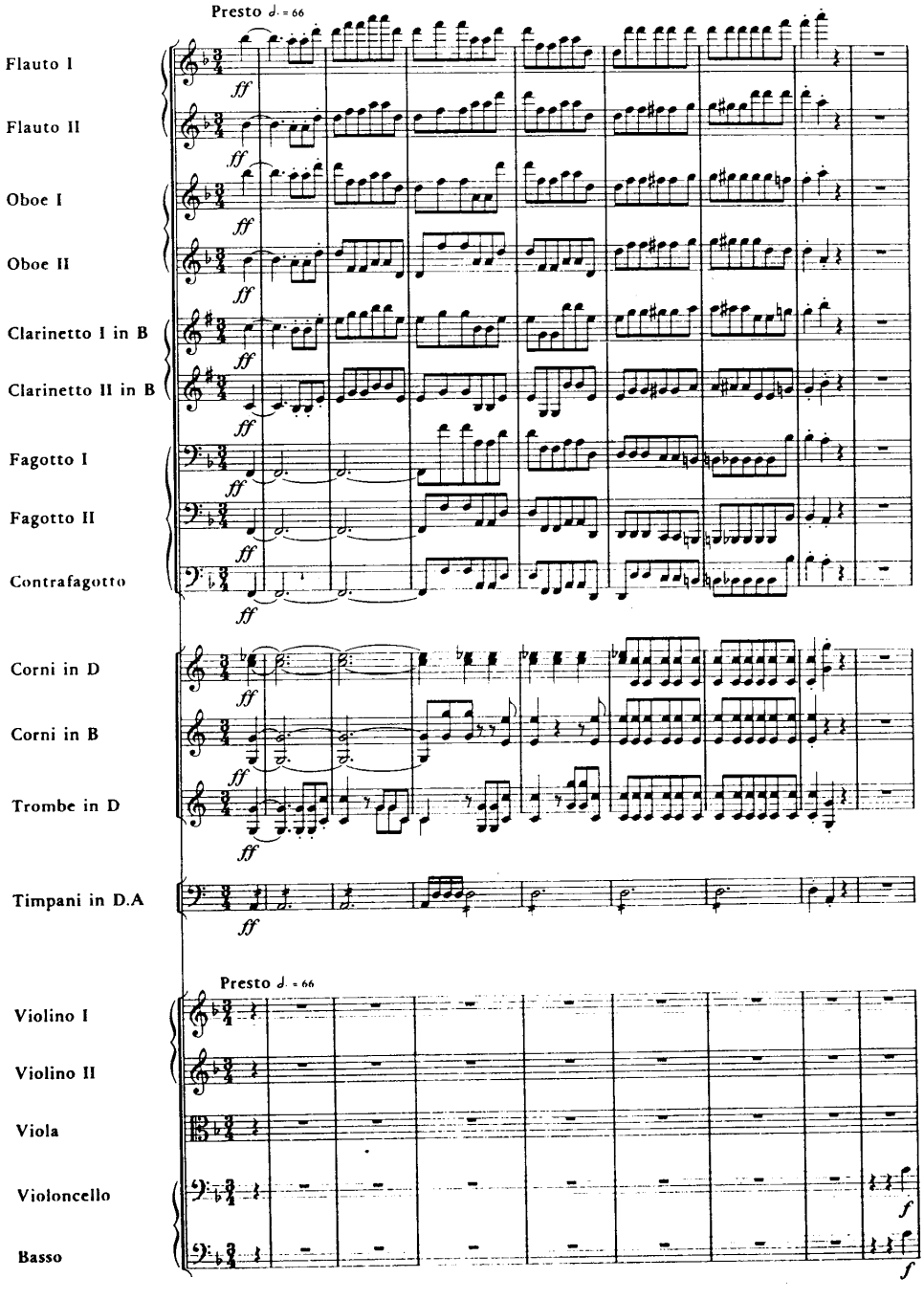


Illustration 12

Proprietary Systems -- 1e
Toppan Scan-Note System

Hardware: unidentified host computer, CRT, and electronic keyboard
Software: custom, in 'C'
Printing device: unidentified laser phototypesetter

Unreduced

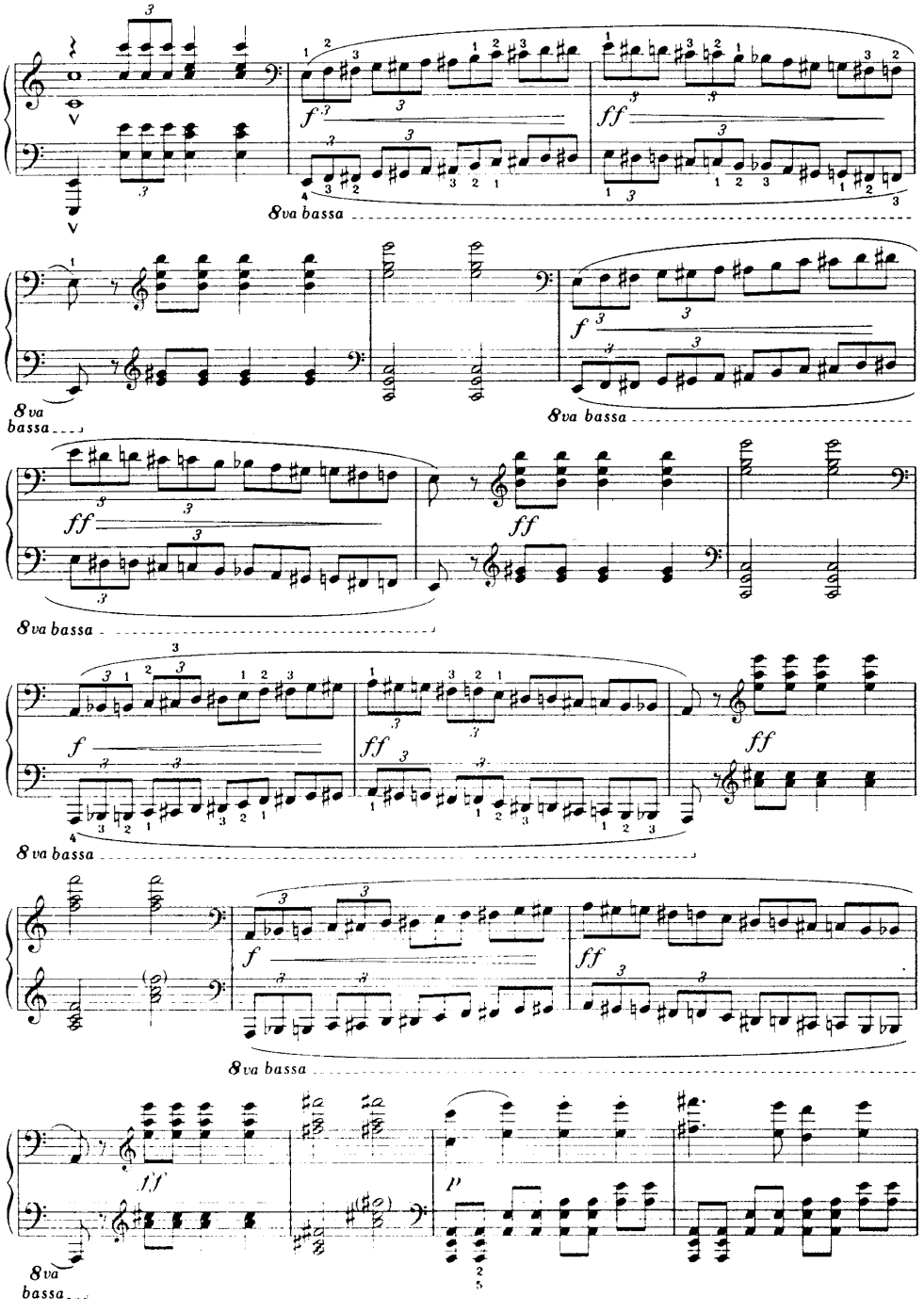
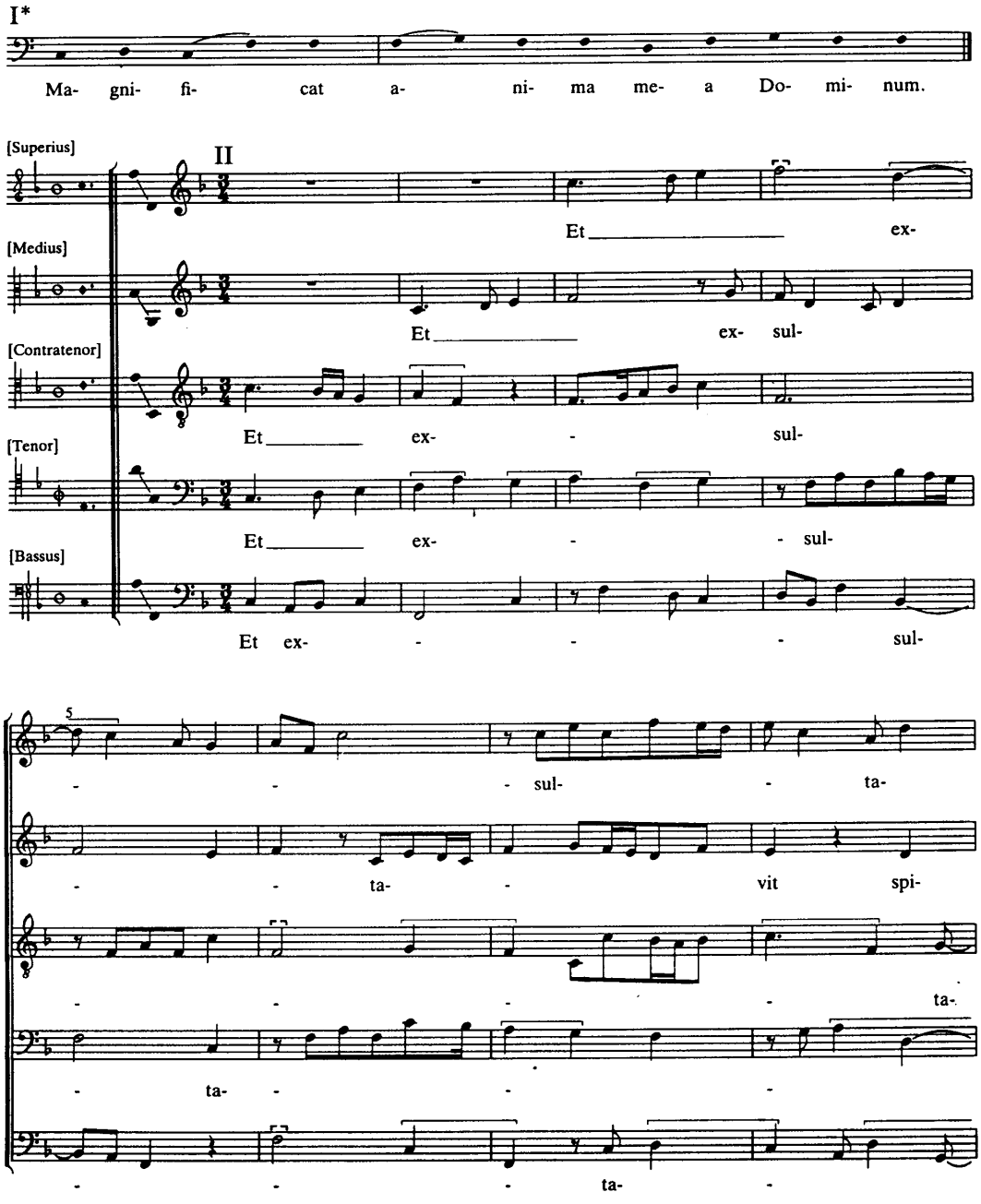


Illustration 13

Proprietary Systems -- 2a
A-R Editions, Inc. (Thomas Hall)

Computer: Data General mainframe
Printing device: Mergenthaler (Linotron) 202 typesetter

Magnificat *"Regale"*



*Plainsong on Tone VIII for the odd-numbered verses has been supplied from the Sarum Tonale in *The Use of Sarum*, ed. Walter H. Frere (1901), Appendix, ii.

Illustration 14

Proprietary Systems -- 2b
A-R Editions, Inc. (Thomas Hall)

Computer: Data General mainframe
Printing device: Mergenthaler (Linotron) 202 typesetter

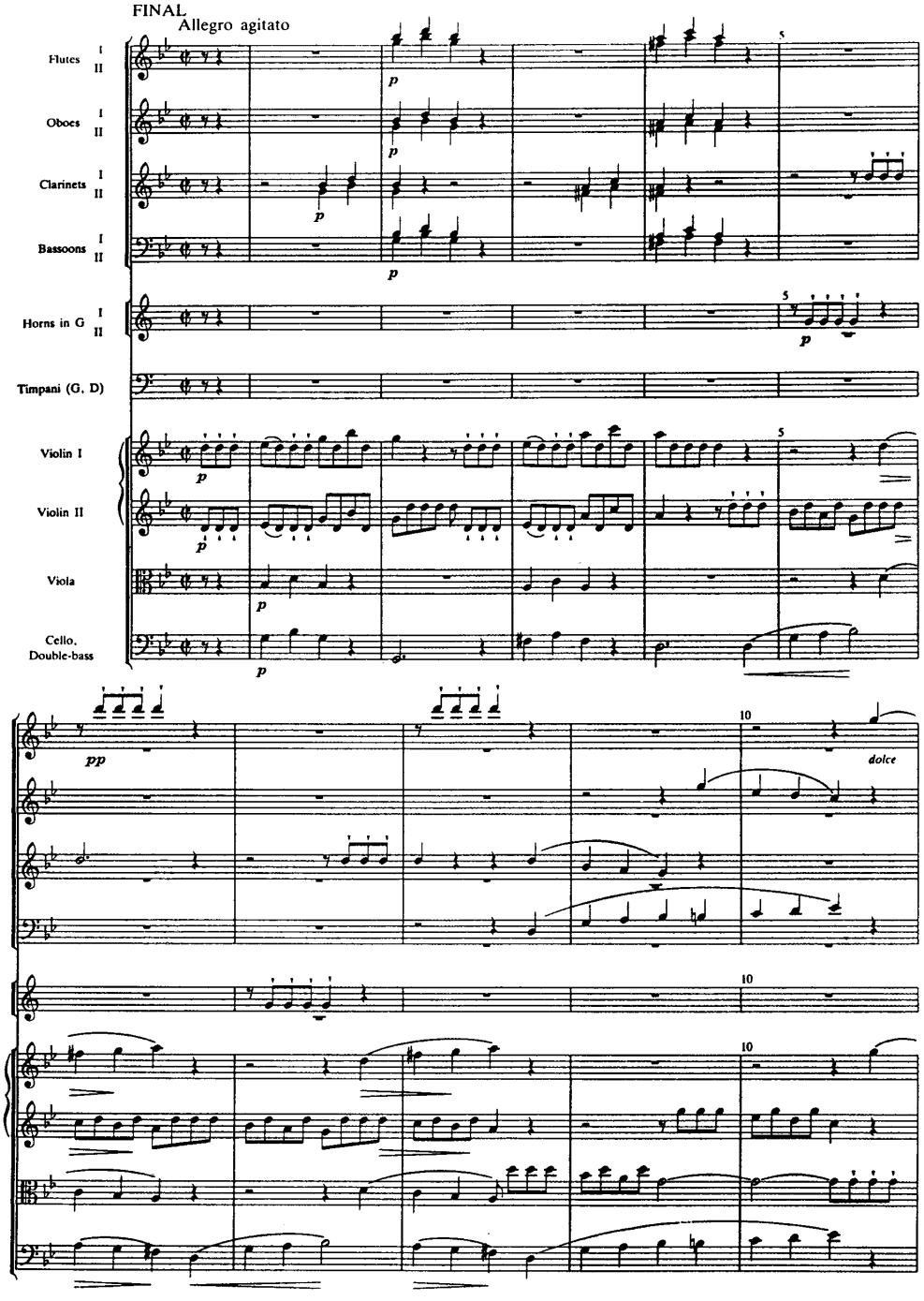


Illustration 15

Proprietary Systems -- 3
Lasergraphics (Armando Dal Molin)

Input device: PCS-500 Musicomp terminal
Printing device: Omnitech laser printer
[This system is currently in use by Belwin Mills, a subsidiary of Columbia Pictures]

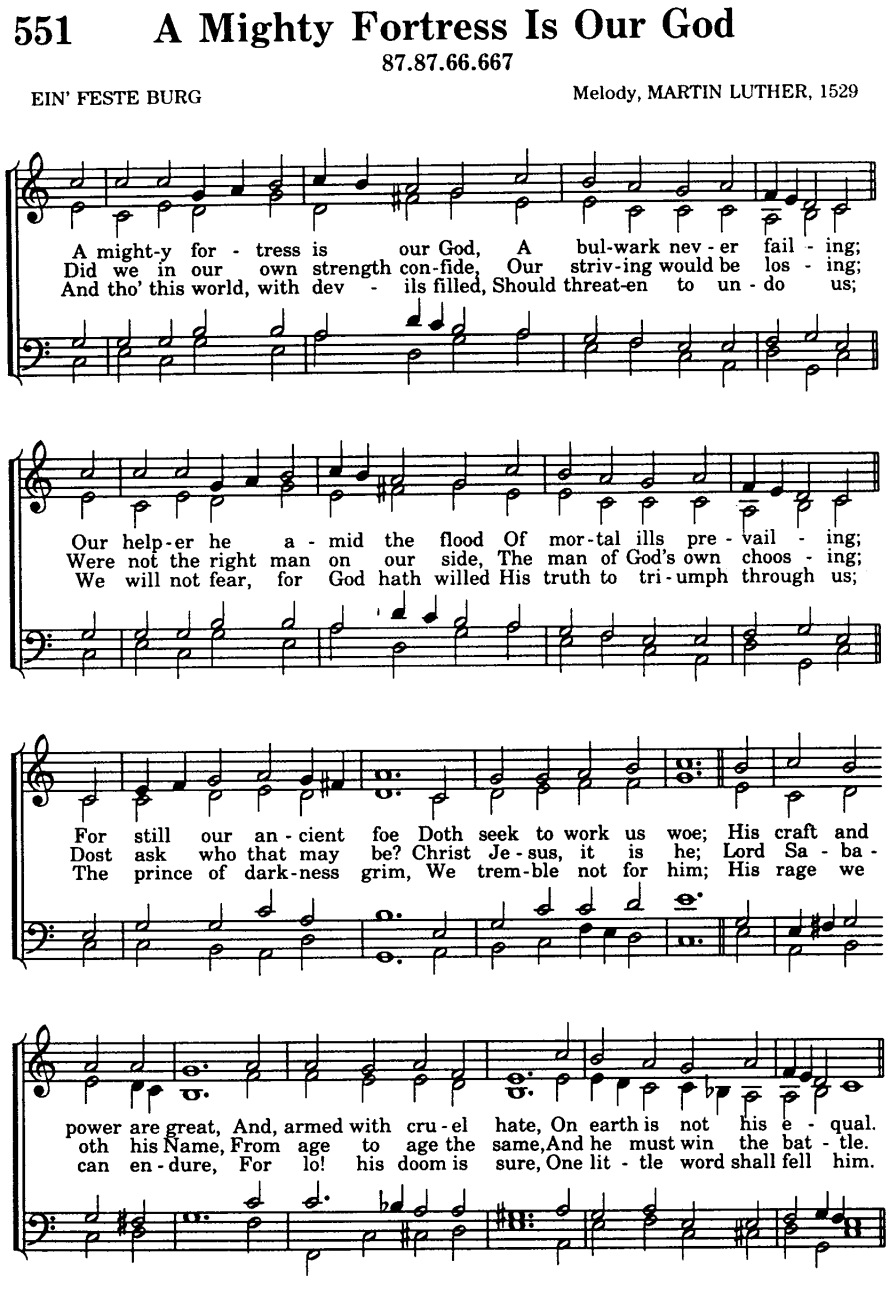
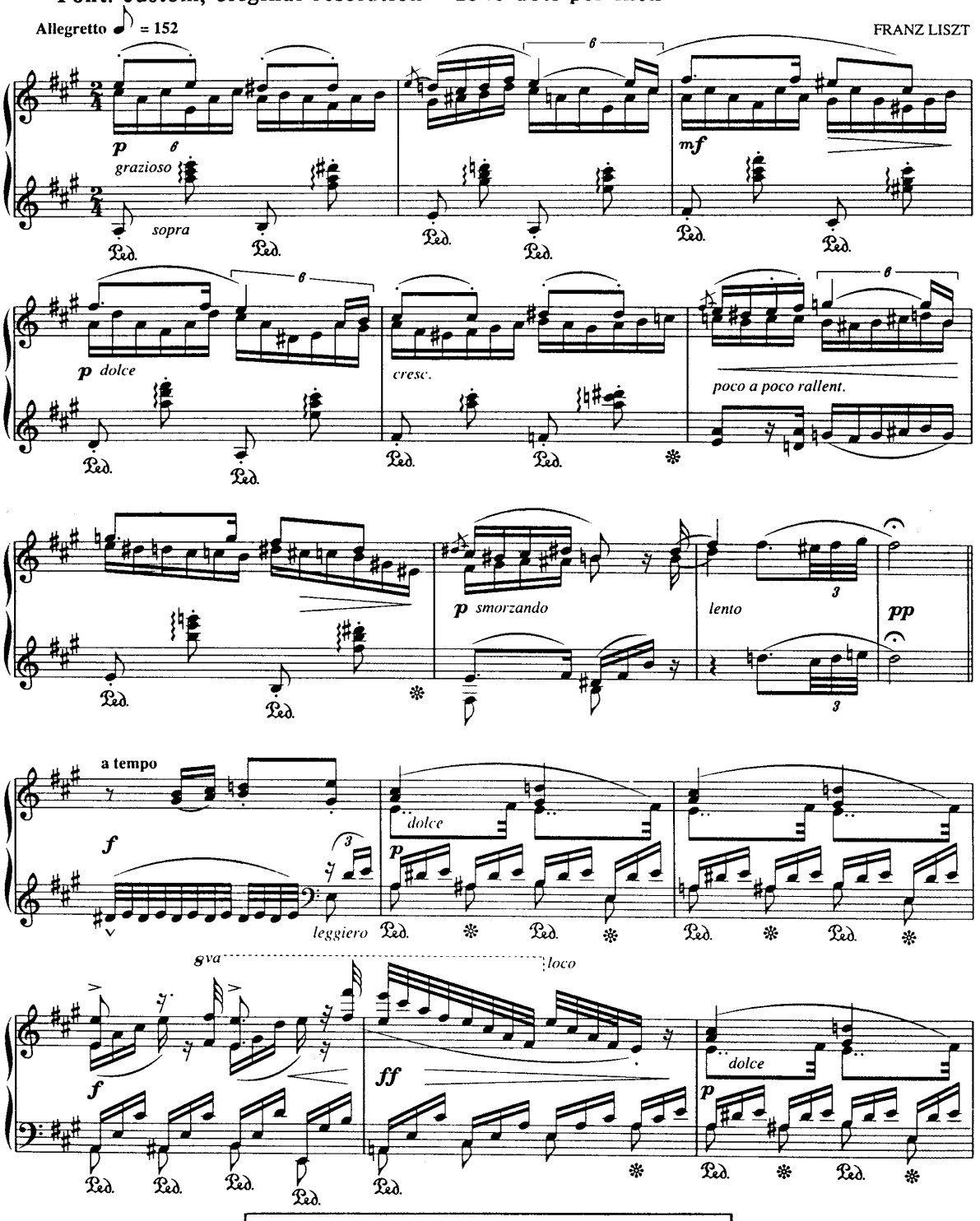


Illustration 16

Commercial Systems -- 1a
Synclavier Music Engraving System

Input device: Synclavier
Printing device: Linotype L300, driven by PostScript image processor
Font: custom; original resolution = 2540 dots per inch



This piece was engraved by the Synclavier® Music Engraving System
New England Digital Corporation • White River Jct., Vermont 05001

Illustration 17

Commercial Systems -- 1b
Synclavier Music Engraving System

Editor: Symphony Reproductions, LTD. (Ted Petrosky)

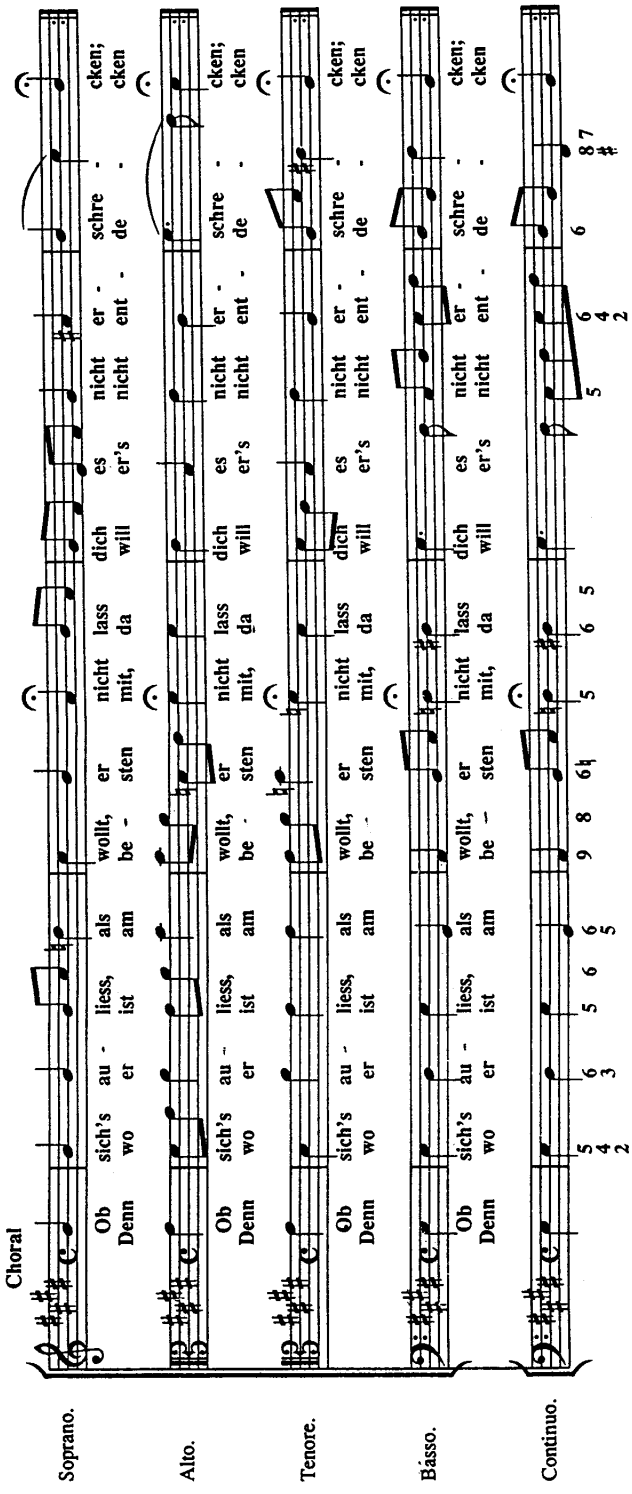


Illustration 18

Software for Printing Music -- 1a
SCORE (Leland Smith)

Computer: Tandy 2000 (IBM PC compatible)
Printing device: Apple LaserWriter
Software vendor: Passport Designs

Part extraction from score (or score assembly from parts) showing size differentiation

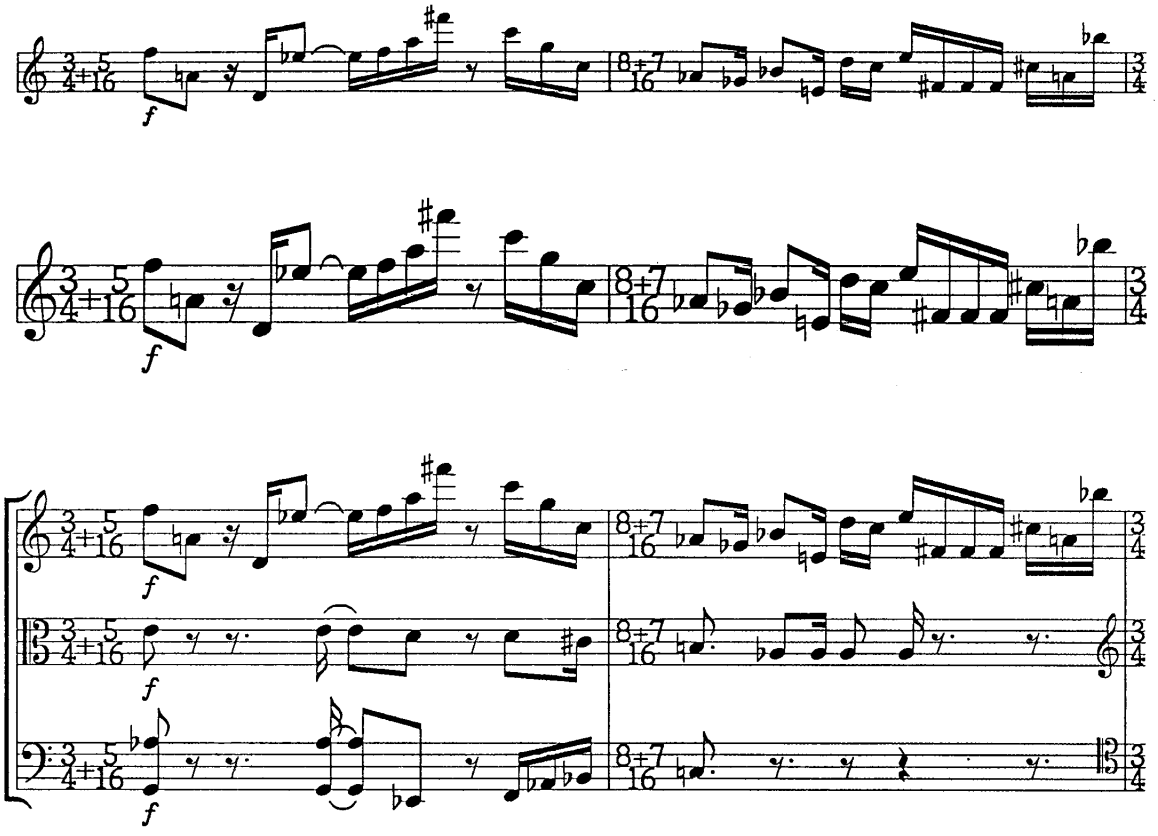
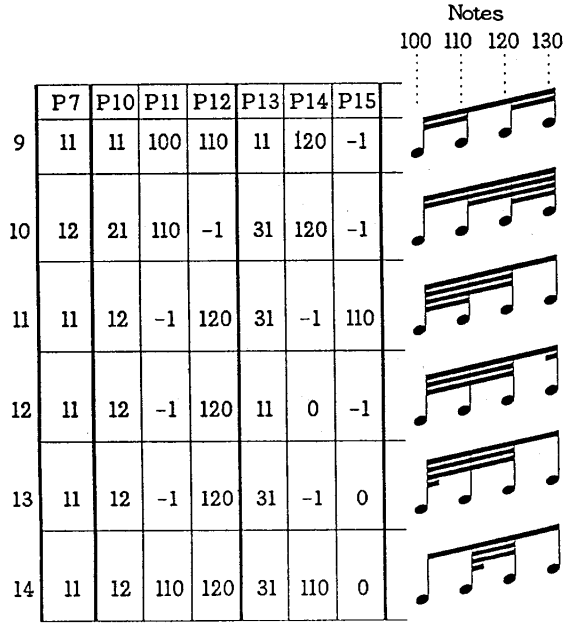


Illustration 19

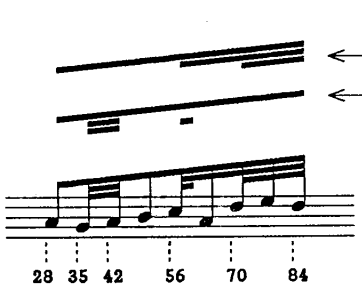
Software for Printing Music -- 1b
SCORE (Leland Smith)

Computer: Tandy 2000 (IBM PC compatible)
Printing device: Apple LaserWriter
Software vendor: Passport Designs

Parameters for contol of spacing

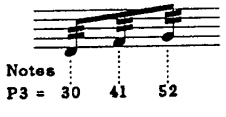


	P7	P10	P11	P12	P13	P14	P15
9	11	11	100	110	11	120	-1
10	12	21	110	-1	31	120	-1
11	11	12	-1	120	31	-1	110
12	11	12	-1	120	11	0	-1
13	11	12	-1	120	31	-1	0
14	11	12	110	120	31	110	0



P7 = 11

P10	P11	P12	P13	P14	P15
11	56	-1	21	70	-1
12	35	42	21	56	0



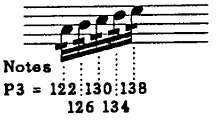
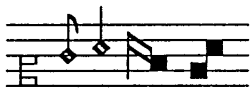


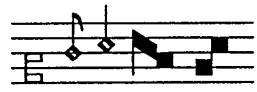
Illustration 20

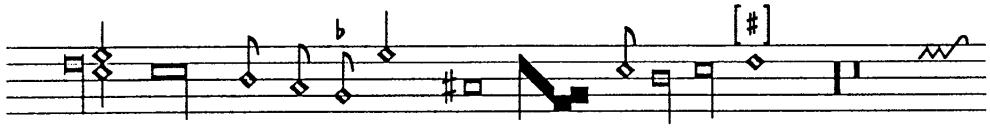
Software for Printing Music -- 1c
SCORE (Leland Smith)

Computer: Tandy 2000 (IBM PC compatible)
Printing device: Apple LaserWriter
Software vendor: Passport Designs

Special libraries for early music notation, guitar tablature, percussion





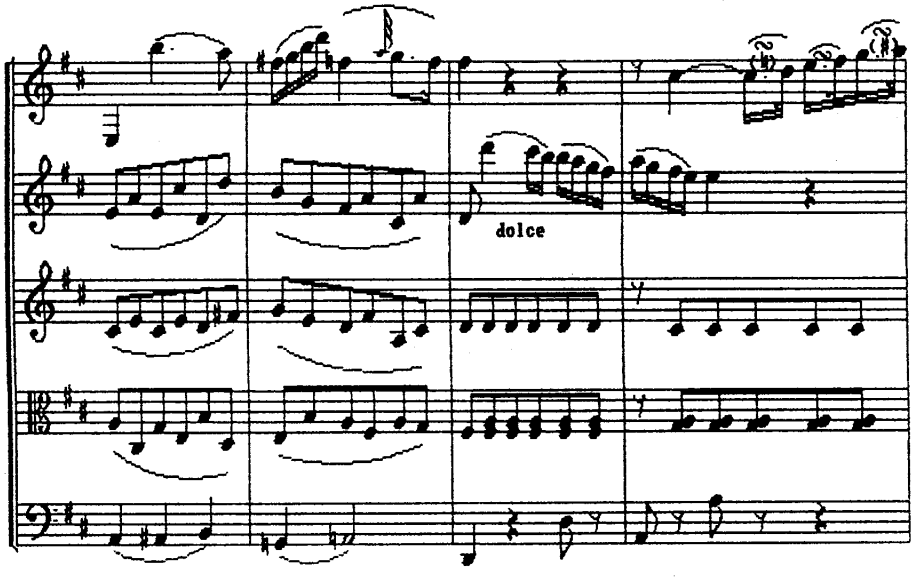


P5 = -1
P13 = 1 P13 = 11 P13 = 123 P13 = 123000 P13 = 54111 P13 = 339222 P6 = .8

Illustration 21

Software for Printing Music -- 2a
Music Processor (Etienne Darbellay)

Computer: Texas Instruments Professional
[alternative version for IBM PC under development]
Printing device: Star Gemini--10X; Citizen MSP15



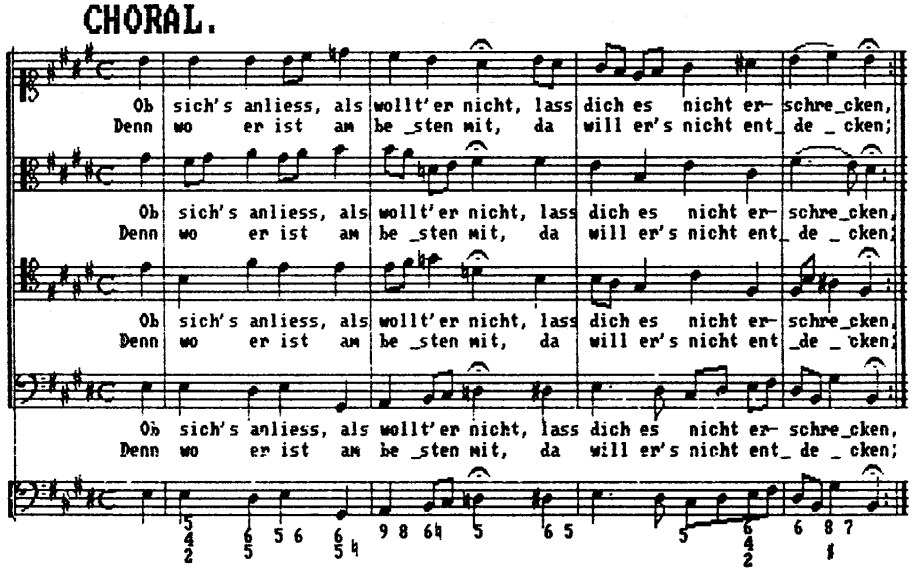


Illustration 22

Software for Printing Music -- 2b
Music Processor (Etienne Darbellay)

Computer: Texas Instruments Professional
[alternative version for IBM PC under development]
Printing device: Star Gemini--10X; Citizen MSP15

Creation of two-stave reduction from five-part score

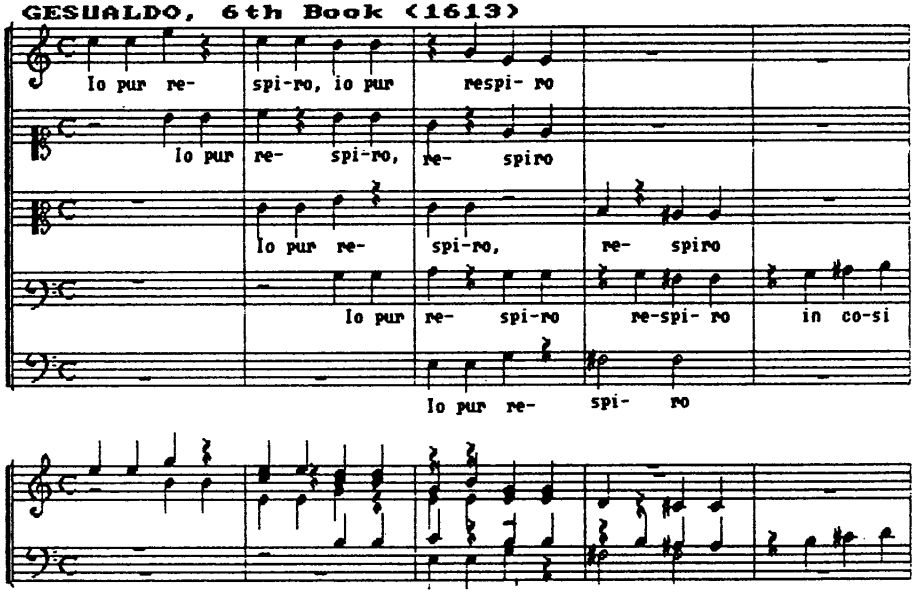
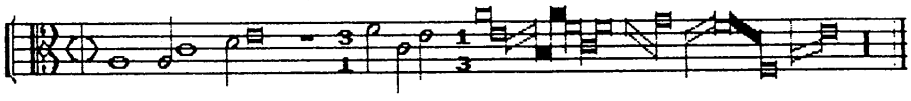


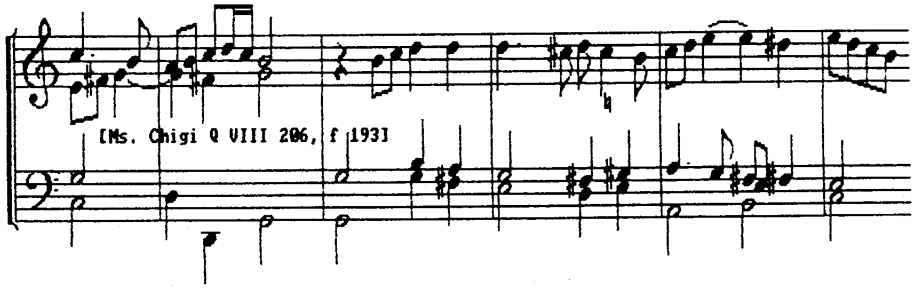
Illustration 23

Software for Printing Music -- 2c
Music Processor (Etienne Darbellay)

Computer: Texas Instruments Professional
[alternative version for IBM PC under development]
Printing device: Star Gemini--10X; Citizen MSP15

Early music, editing, and drawing capabilities





Sample for some possibilities in complex contexts (chords and beaming)

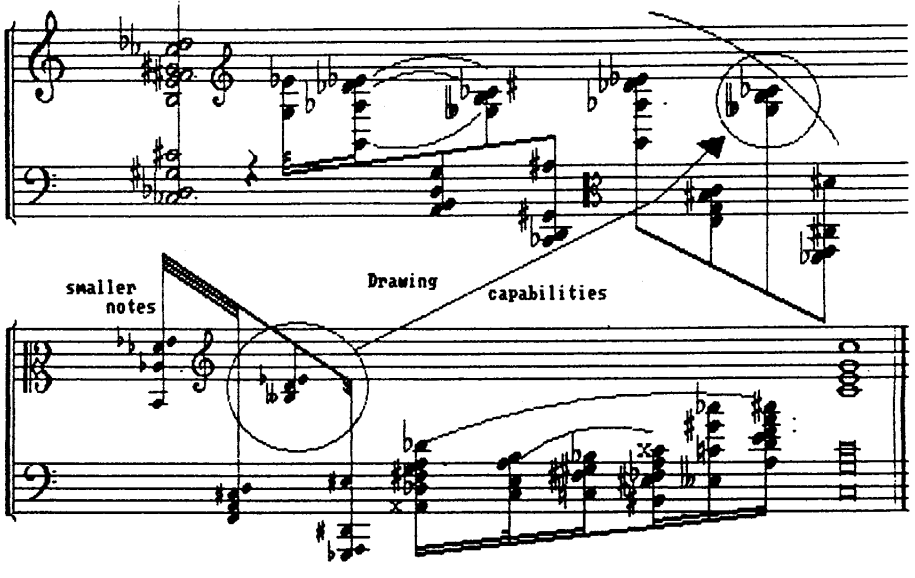
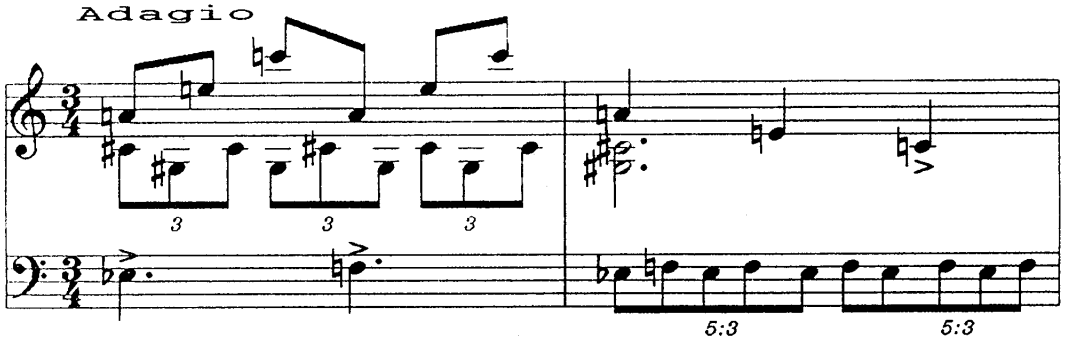


Illustration 24

Software for Printing Music -- 3a
The Note Processor (Stephen Dydo)

Computer: IBM PC
Printing device: NEC P6 dot matrix printer (180 dots per inch)
Font: custom

Music by Stephen Dydo



Computer: IBM PC
Printing device: NEC P6 dot matrix printer (180 dots per inch)
Font: custom

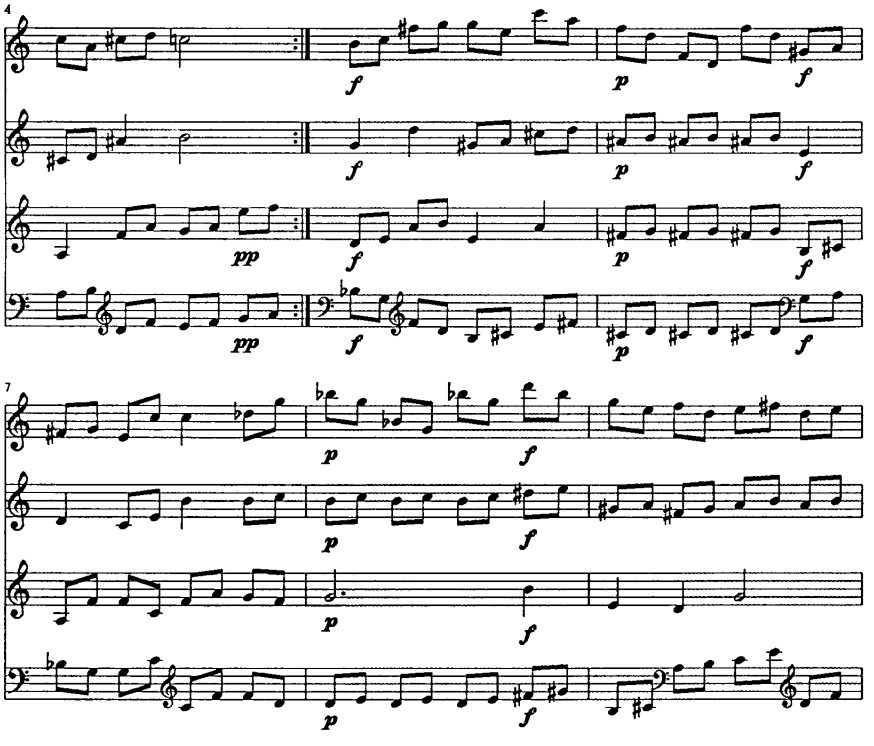


Illustration 25

Software for Printing Music -- 3b
The Note Processor (Stephen Dydo)

Computer: IBM PC
Printing device: NEC P6
Font: custom

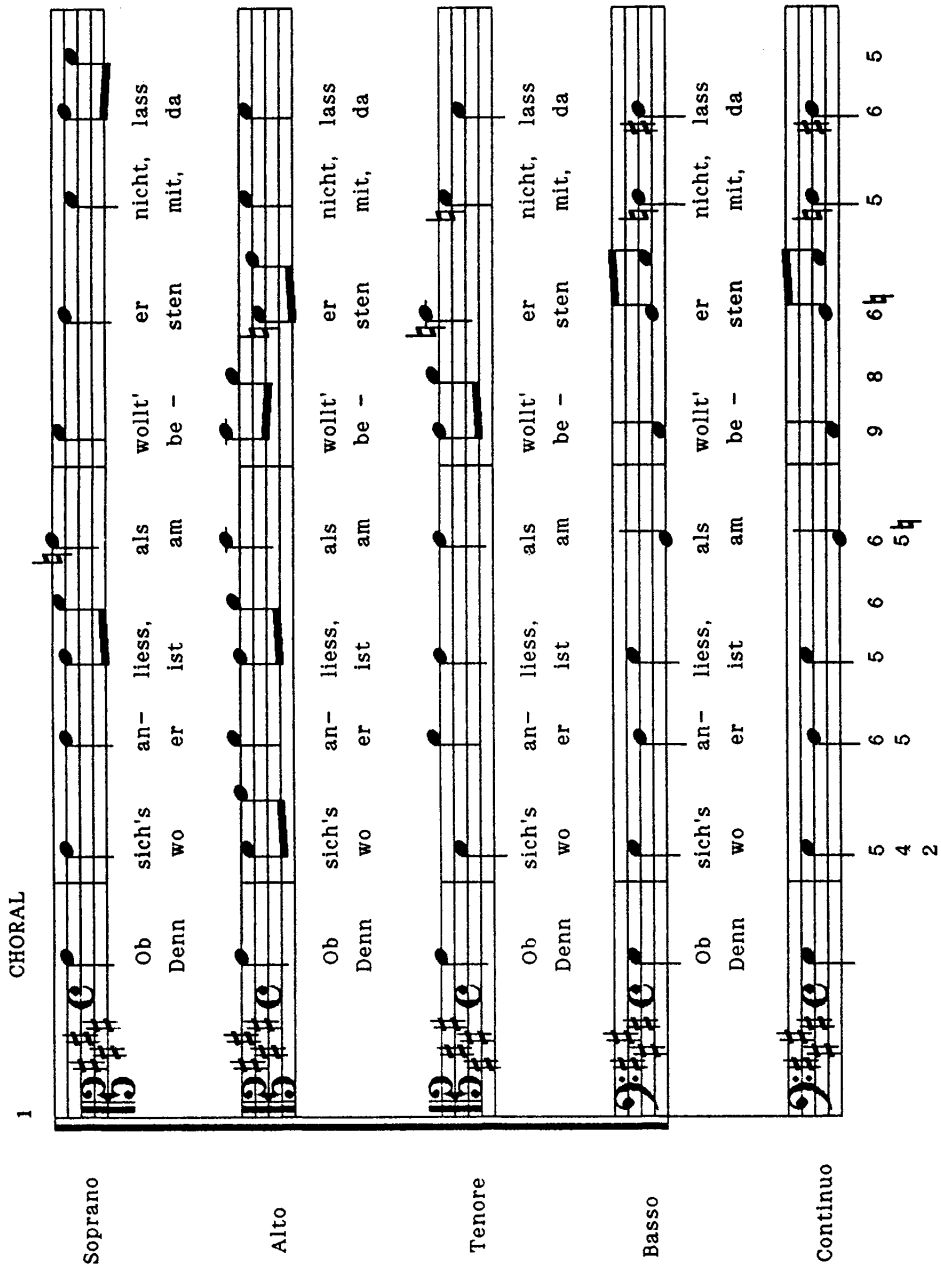


Illustration 26

Software for Printing Music -- 3c
The Note Processor (Stephen Dydo)

Computer: Hewlett Packard Vectra (IBM PC compatible)
Printing device: HP LaserJet II (300 dots per inch)
Music font: custom
Text font: HP 8 pt. Times Roman Softfont Unreduced

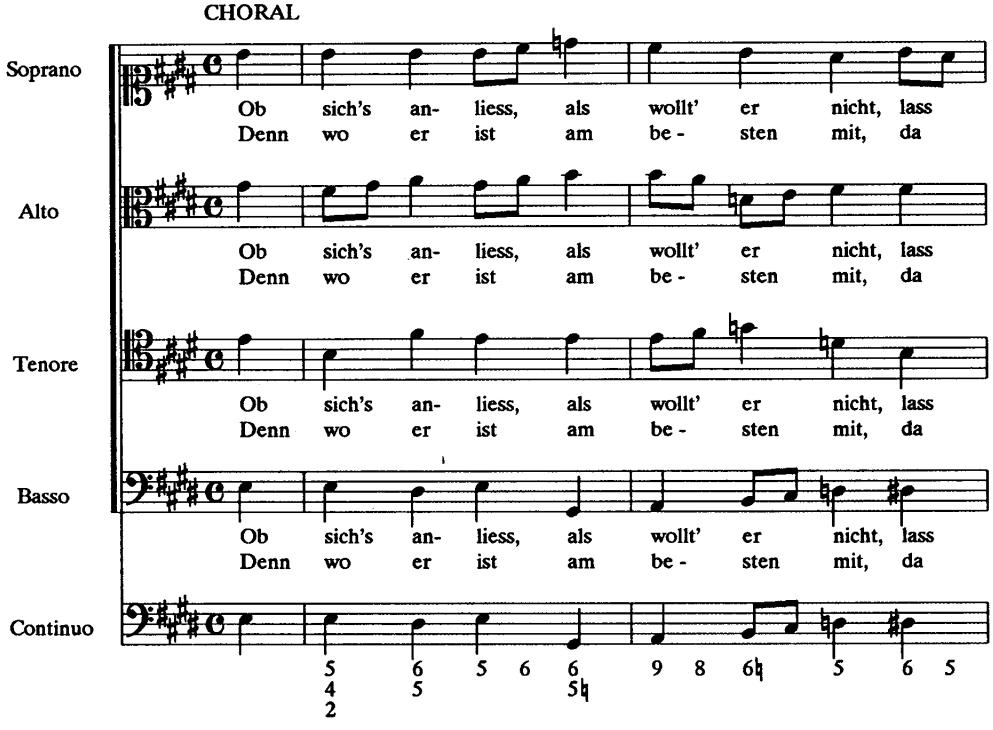


Illustration 27

Software for Printing Music -- 4a
The Copyist (Cris Sion)

Computer: Atari ST (with sequencer software)
[alternative version for IBM PC with sequencer software]
Printing device: Panasonic KX-P1091 (Epson compatible)
[HP Inkjet, GL plotter, and Laserjet Plus also supported]
Vendor: Dr. T's Music Software

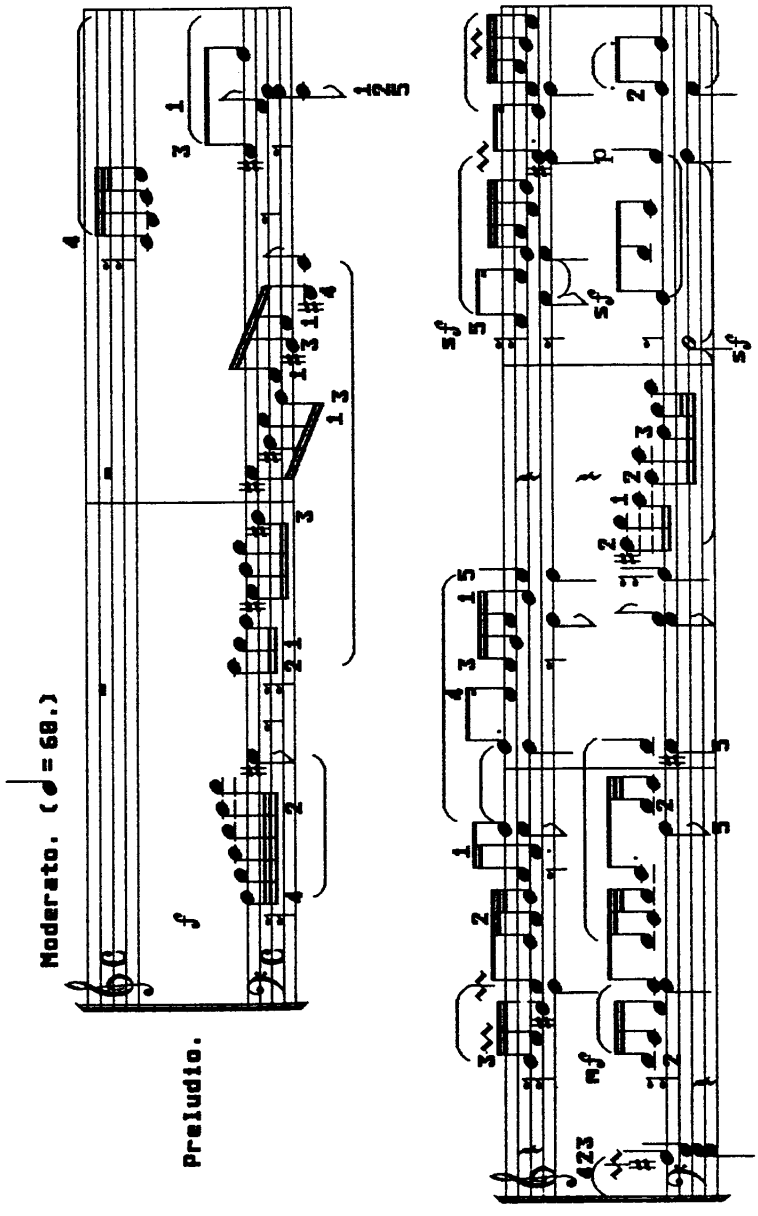


Illustration 28

Software for Printing Music -- 4b
The Copyist (Cris Sion)

Computer: Atari ST (with sequencer software)
[alternative version for IBM PC with sequencer software]
Printing device: Panasonic KX-P1091 (Epson compatible)
[HP Inkjet, GL plotter, and Laserjet Plus also supported]
Vendor: Dr. T's Music Software

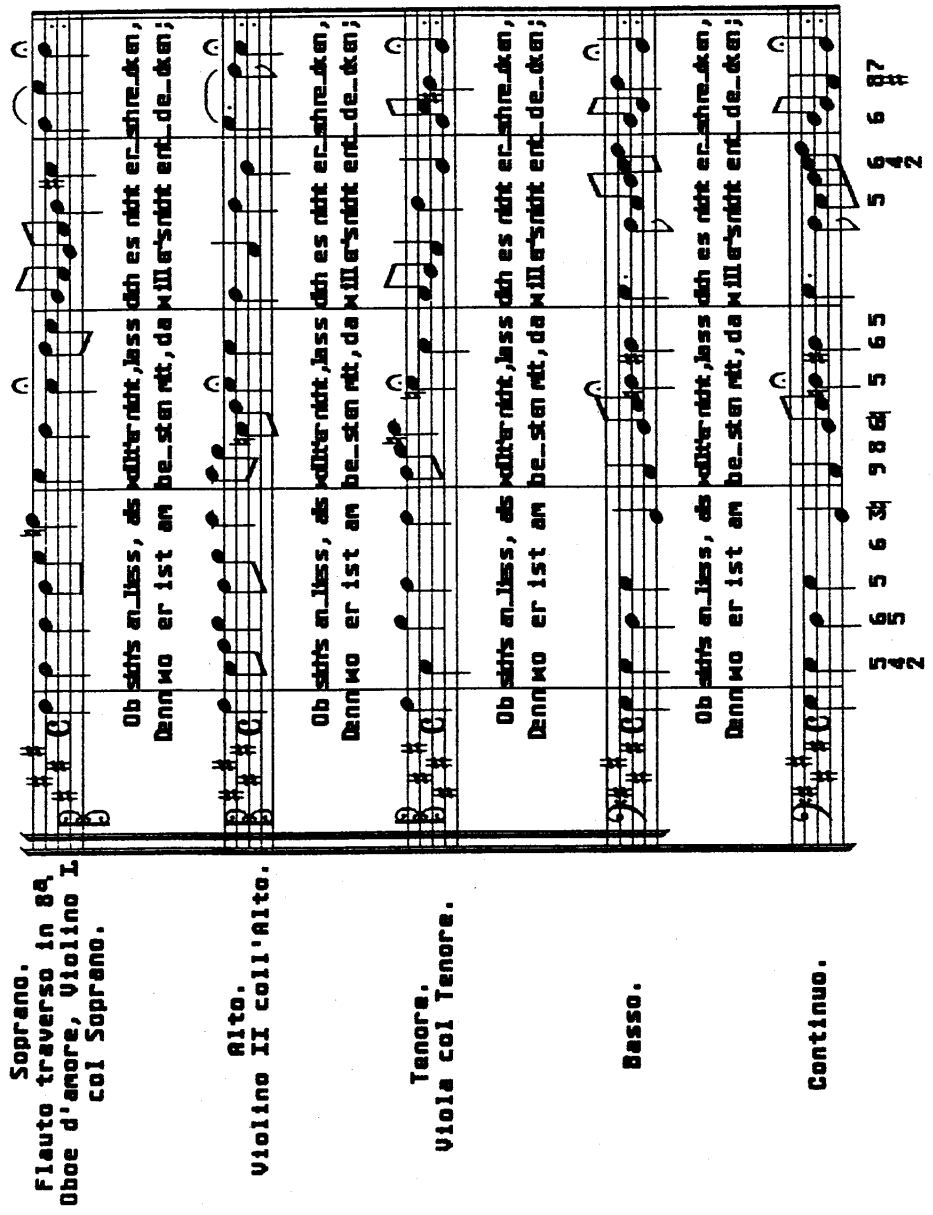


Illustration 29

Software for Printing Music -- 5
Personal Composer System II (Jim Miller)

Computer: IBM PC compatibles
Printing device: Apple LaserWriter
Font: PostScript 'Sonata' by Adobe Systems

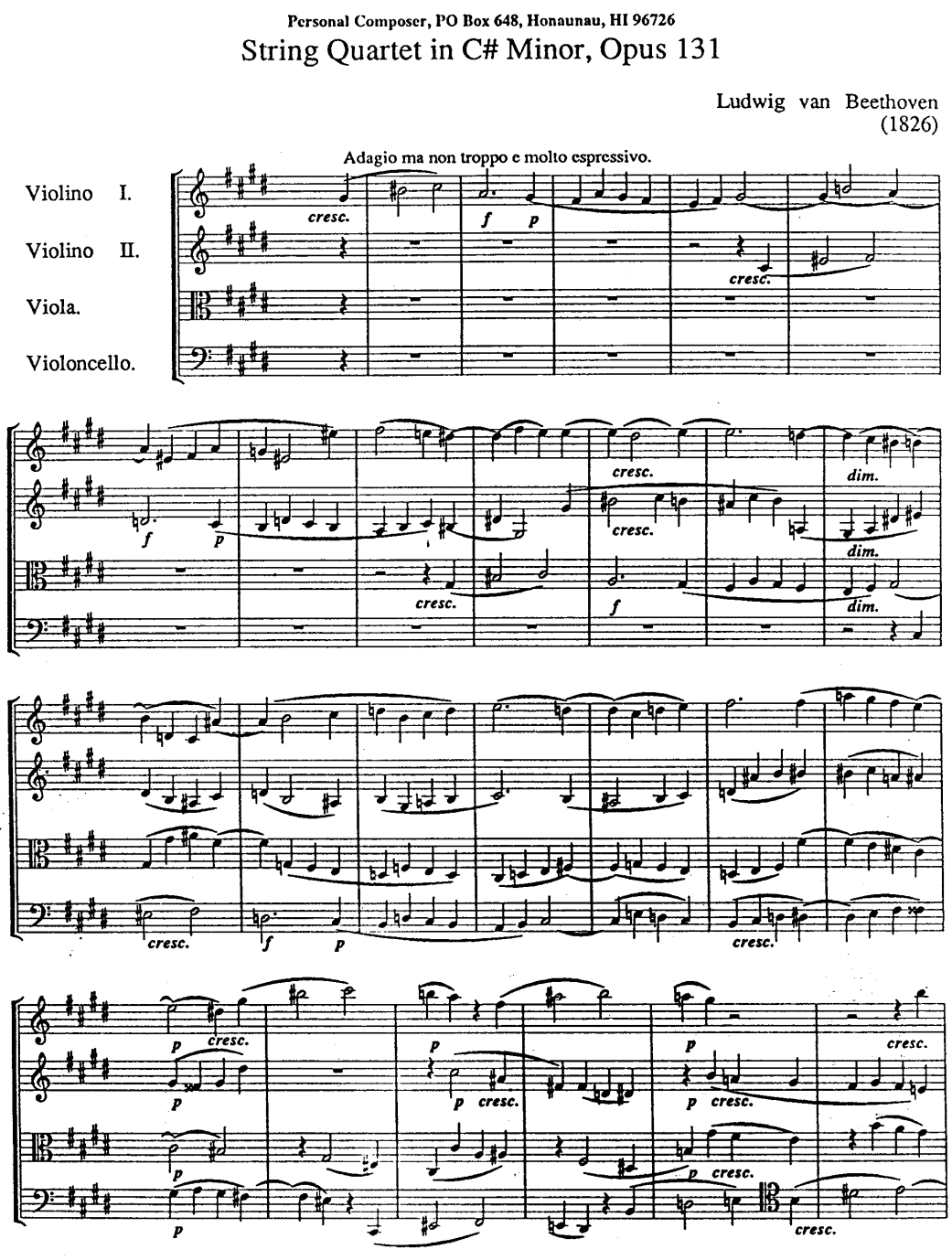


Illustration 30

Software for Printing Music -- 6
Noteprocessor (Piero De Berardinis)

Computer: Apple II
Printing device: C.ITOH 8510A with Apple interface #85APL-II

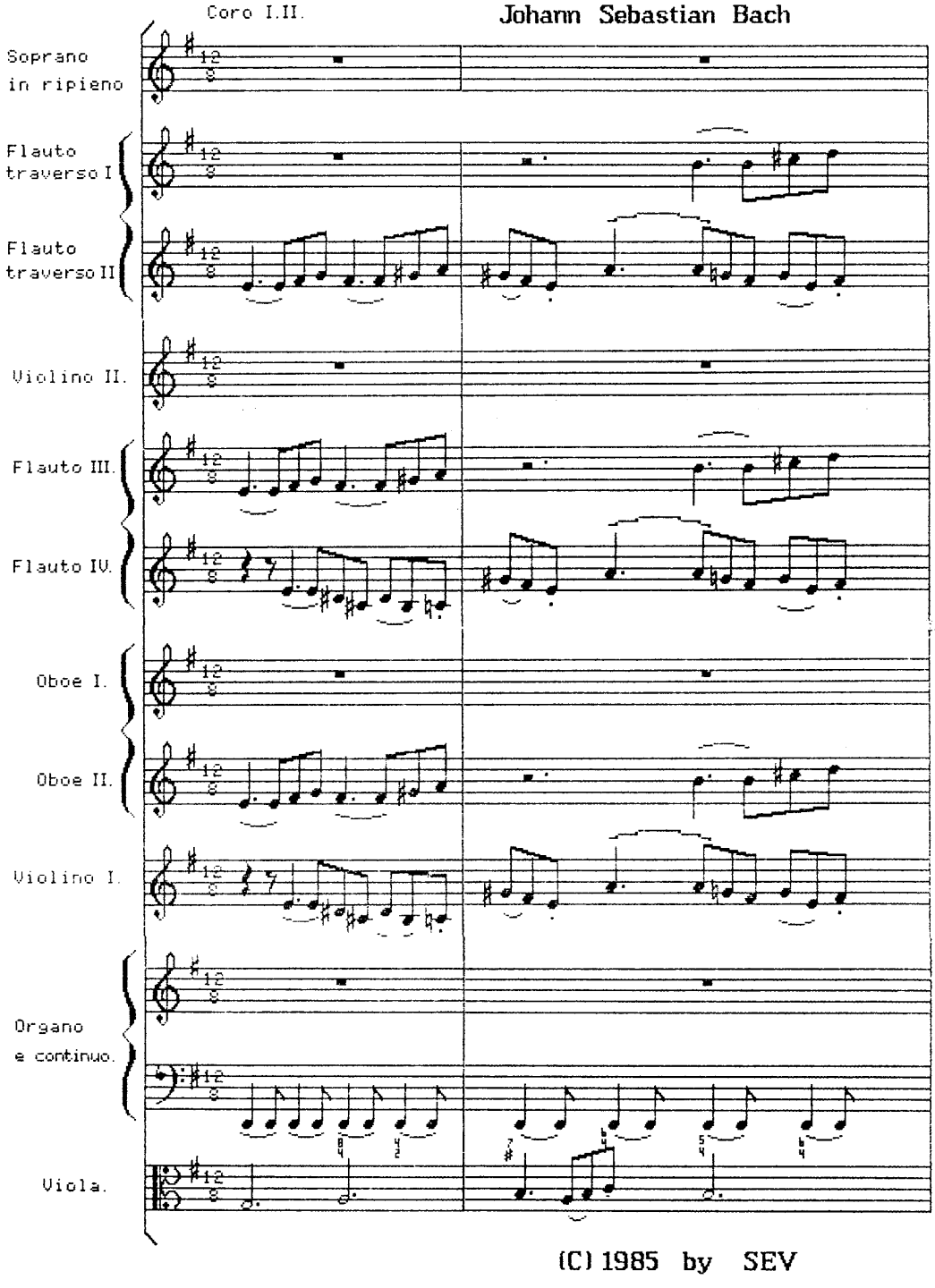


Illustration 31

Software for Printing Music -- 7
Professional Composer

Computer: Apple Macintosh
Printing device: Apple LaserWriter
Vendor: Mark of the Unicorn

GLUCK ZU KREUZ 8.7.8.7.
HARMONIZED BY CHARLES WOOD

FLOSSIE L. HEYWOOD
Darmstadt Gesangbuch, 1698

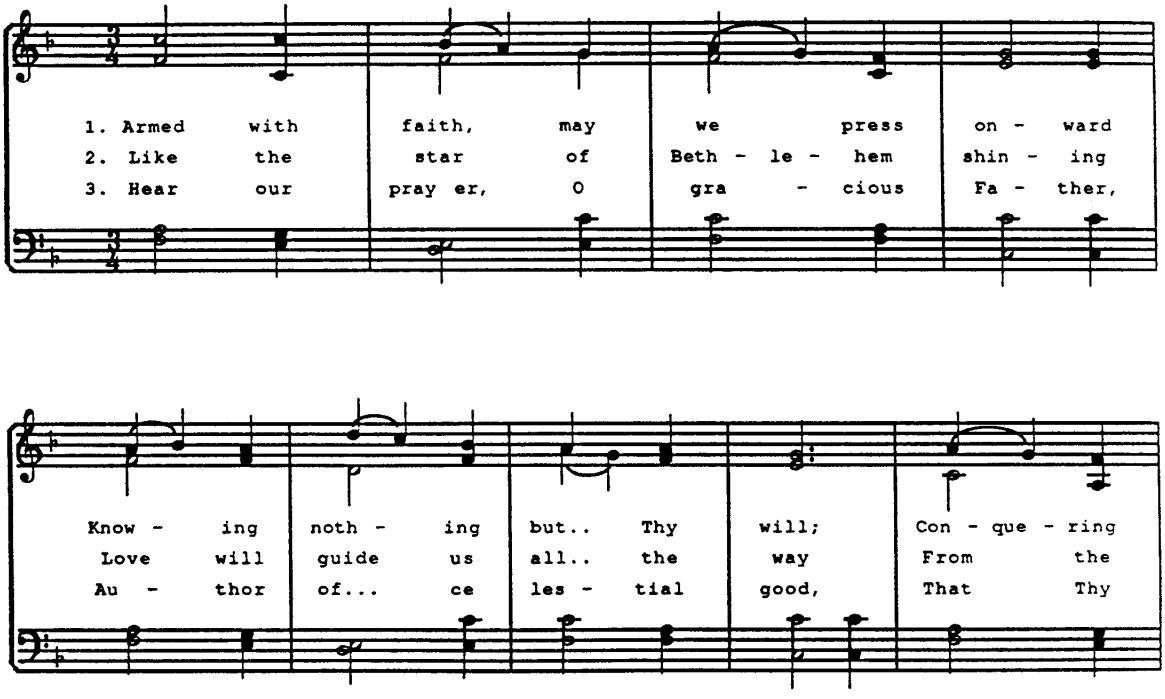


Illustration 32

Software for Printing Music -- 8
MusScript (Keith Hamel)

Computer: Apple Macintosh
Printing device: Apple LaserWriter
Font: PostScript 'Sonata' by Adobe Systems

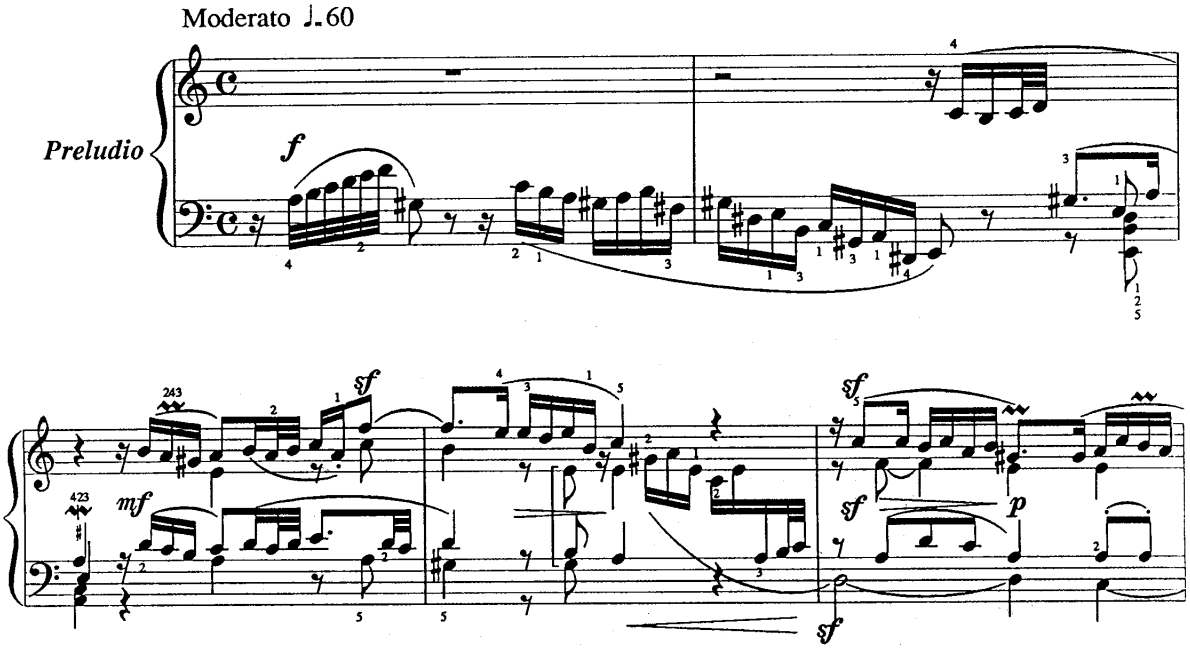


Illustration 33

Software for Printing Music -- 9a
Theme: The Music Editor (Mark Lambert)

Computer: IBM PC-compatible Zenith Z-158
Printing device: Star Micronics Gemini 10X dot-matrix printer

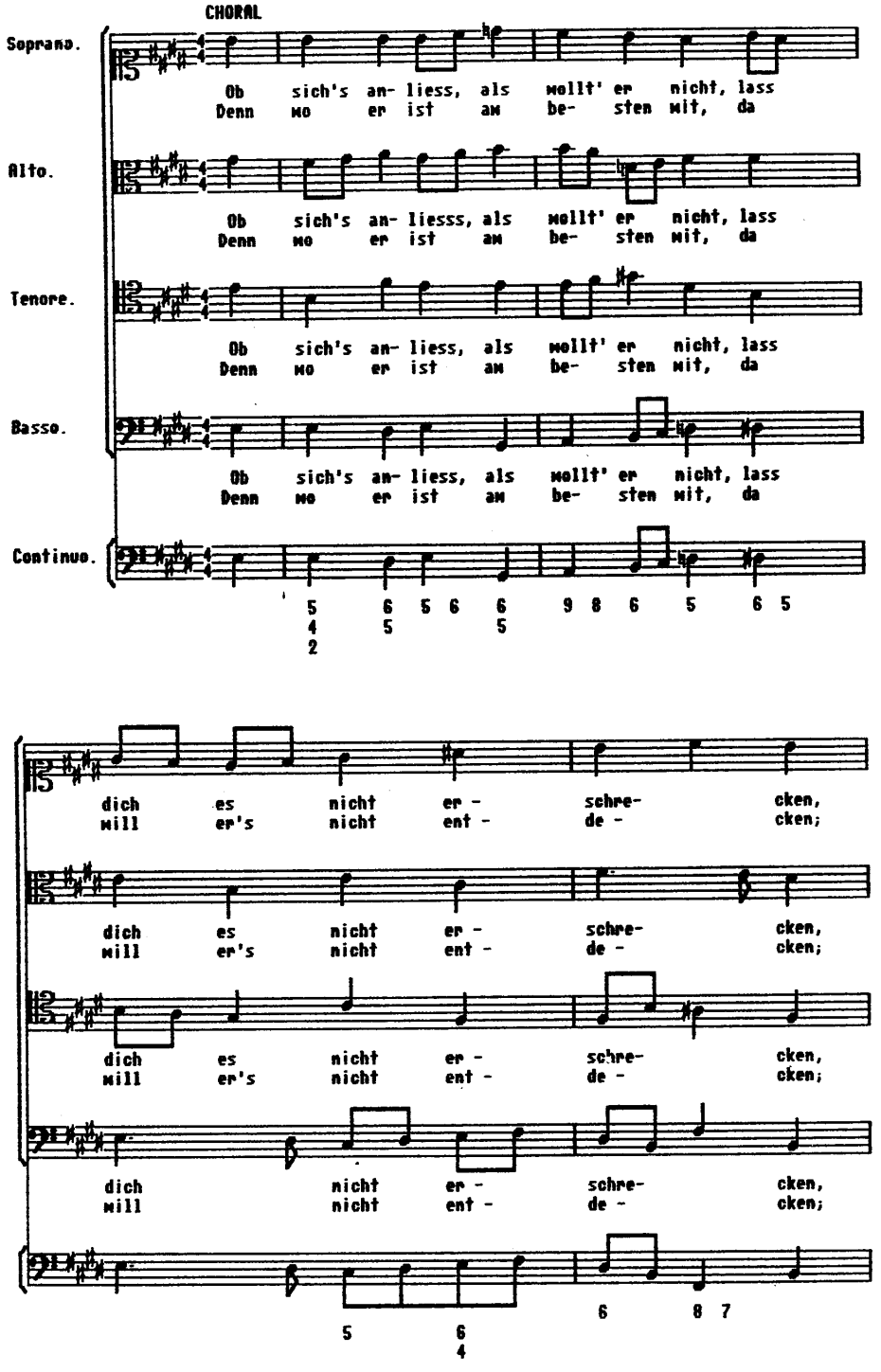


Illustration 34

Software for Printing Music -- 9b
Theme: The Music Editor (Mark Lambert)

Computer: IBM PC-compatible Zenith Z-158
Printing device: Star Micronics Gemini 10X dot-matrix printer

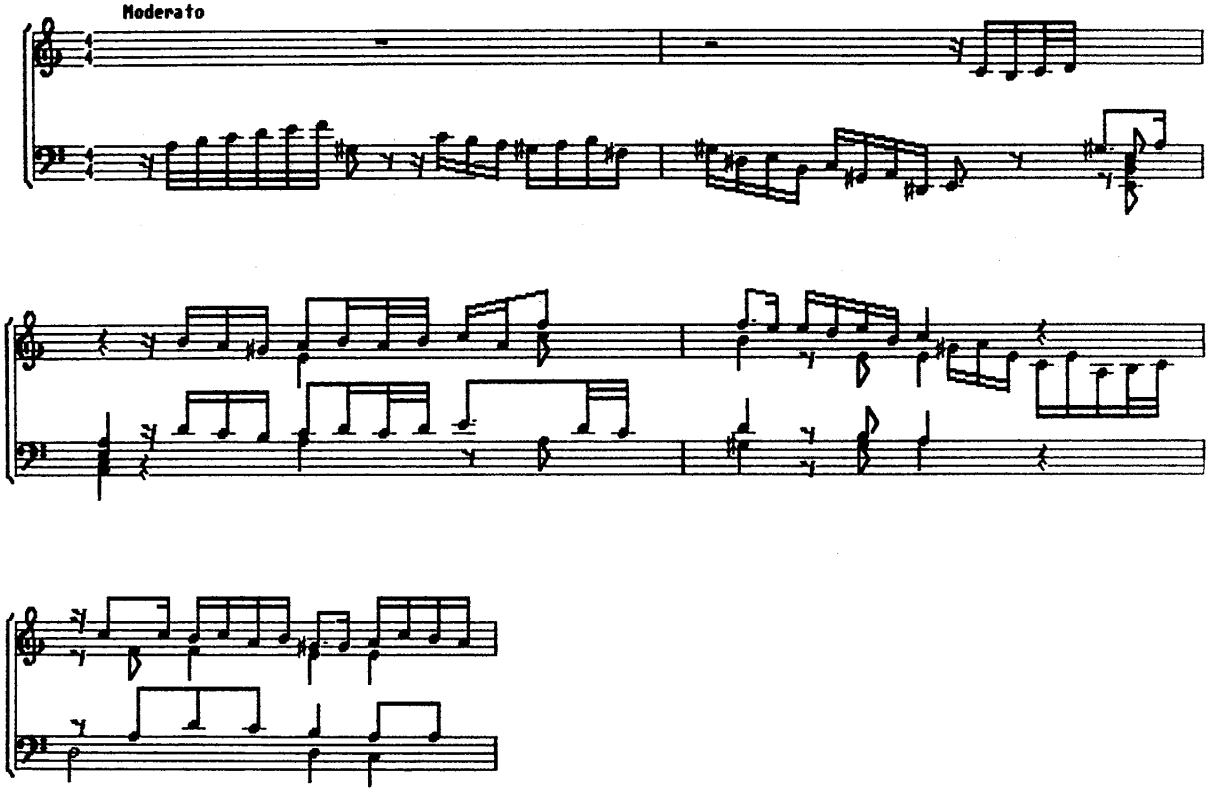


Illustration 35

Software for Printing Music -- 10a
Oberon System II (Nancy Colton)

Computer: Hewlett Packard Vectra (IBM PC compatible)
Printing device; HP LaserJet Plus
Font: Oberon Music Font

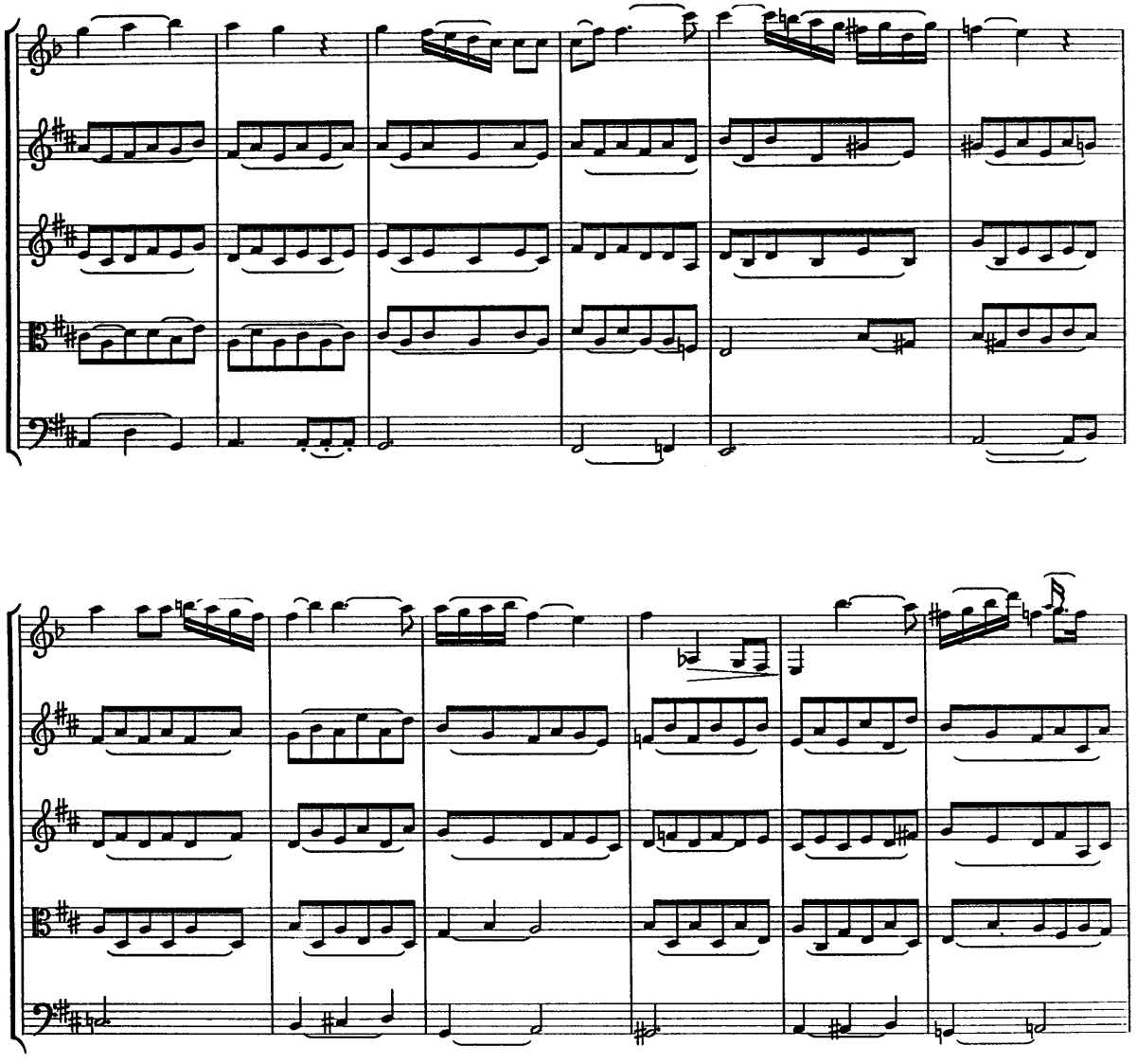


Illustration 36

Software for Printing Music -- 10b
Oberon System II (Nancy Colton)

Computer: Hewlett Packard Vectra (IBM PC compatible)
Printing device; HP LaserJet Plus
Music font: Oberon Music Font
Text: Word Perfect

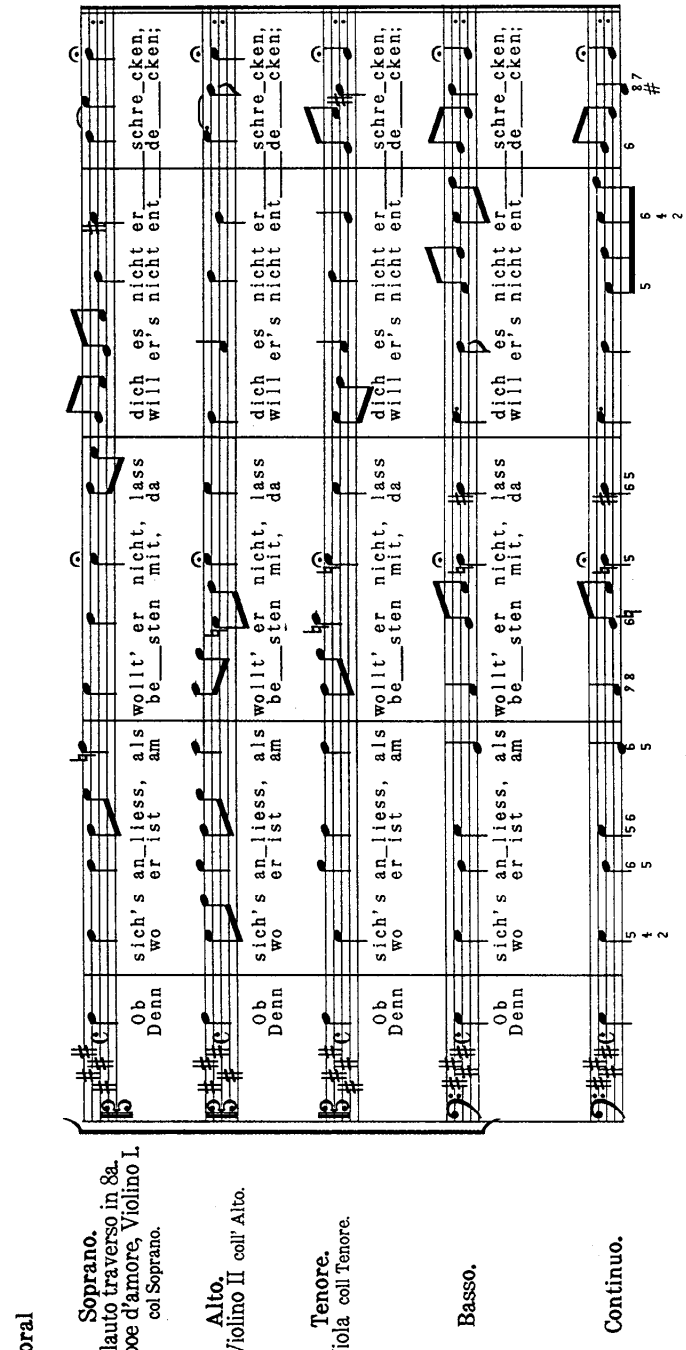


Illustration 37

Software for Printing Music -- 11a
Music Writer (Armando Dal Molin)

Computer: IBM PC with custom 'piano keyboard' peripheral
Printing device: Okidata 192 dot matrix printer
[Epson and IBM dot matrix printers also supported]

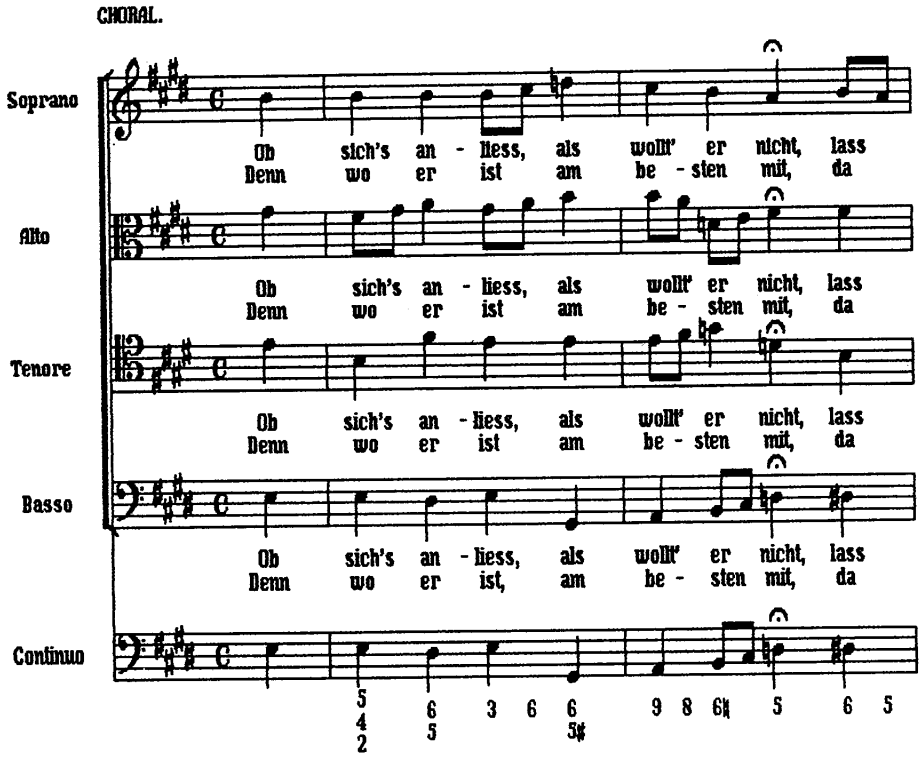


Illustration 38

Software for Printing Music -- 11b
Music Writer (Armando Dal Molin)

Computer: IBM PC with custom 'piano keyboard' peripheral
Printing device: Okidata 192 dot matrix printer
[Epson and IBM dot matrix printers also supported]

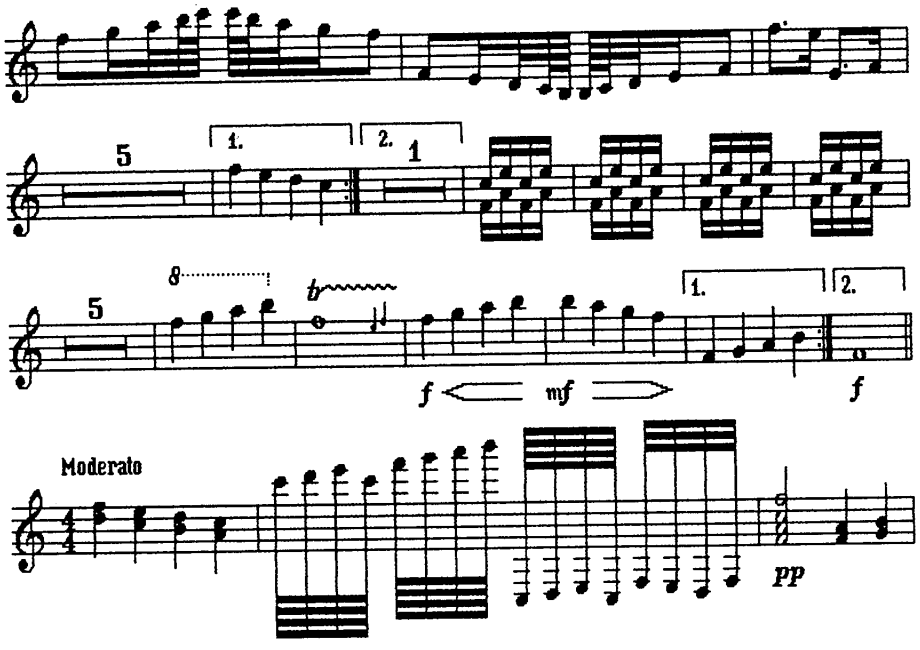


Illustration 39

Software for Printing Music -- 12a
Deluxe Music Construction Set, Version 2.0 (Geoff Brown)

Computer: Apple Macintosh
Printing device: Linotronics typesetter
Font: PostScript 'Sonata' by Adobe Systems
Vendor: Electronic Arts

Unreduced

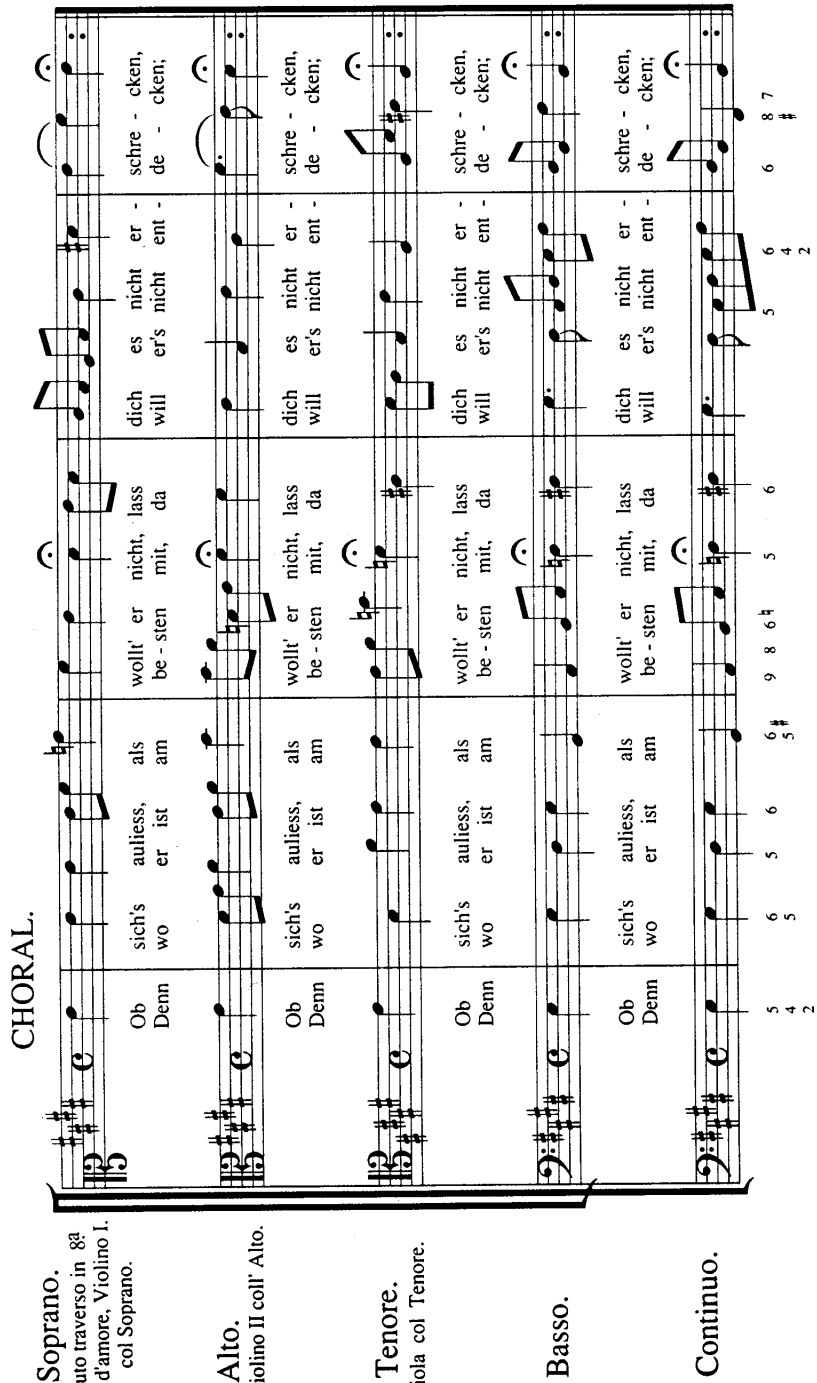


Illustration 40

Software for Printing Music -- 12b
Deluxe Music Construction Set, Version 2.0 (Geoff Brown)

Computer: Apple Macintosh
Printing device: Linotronics typesetter
Font: PostScript 'Sonata' by Adobe Systems
Vendor: Electronic Arts

Unreduced

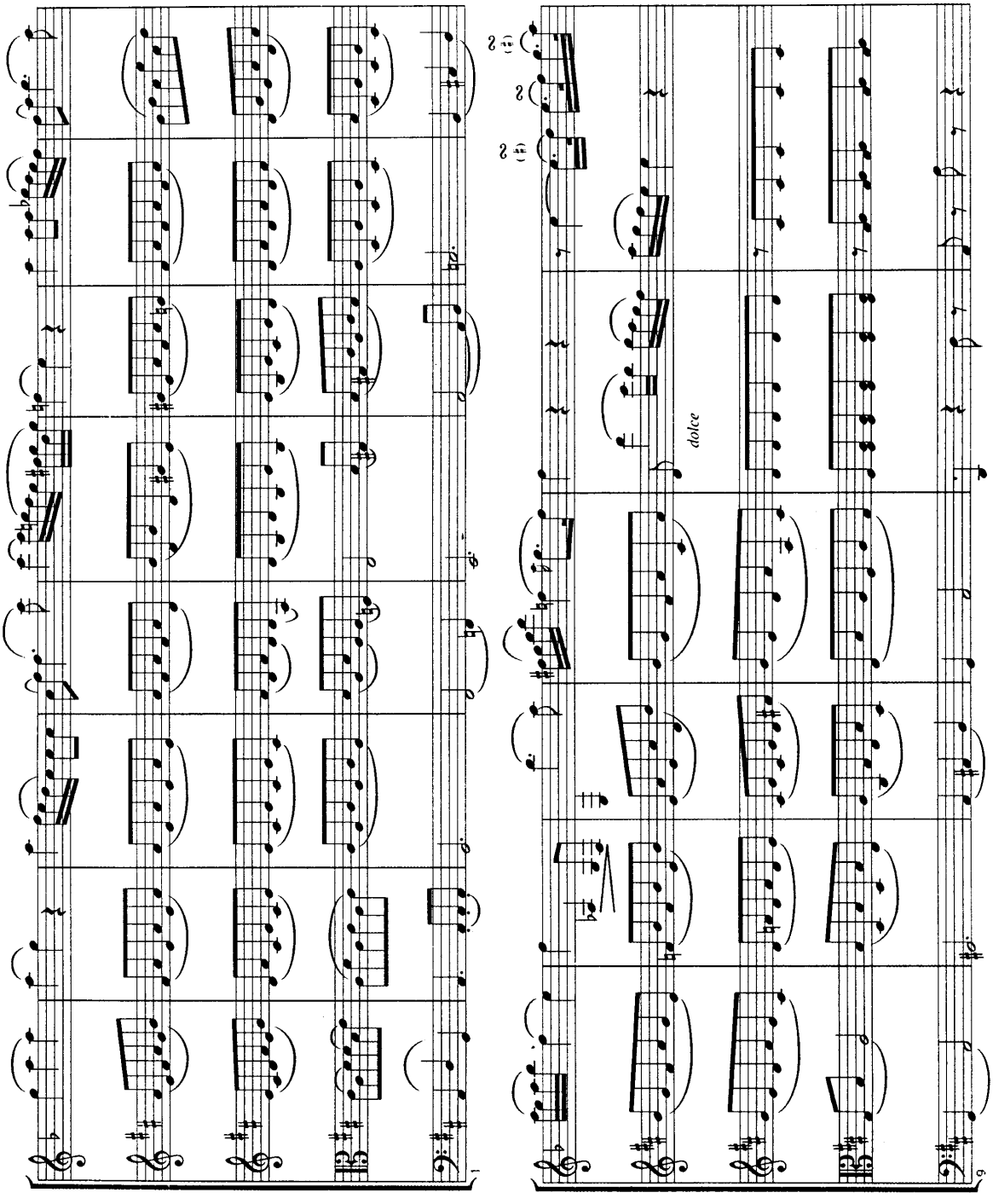


Illustration 41

Software for Music Printing -- 13a
High Score (Donald Byrd and Kimball Stickney)

Computer: Apple Macintosh
Printing device: Linotronics 100 typesetter
Font: PostScript 'Sonata' by Adobe Systems

Fourth String Quartet

BELA BARTOK

(1928)

I.

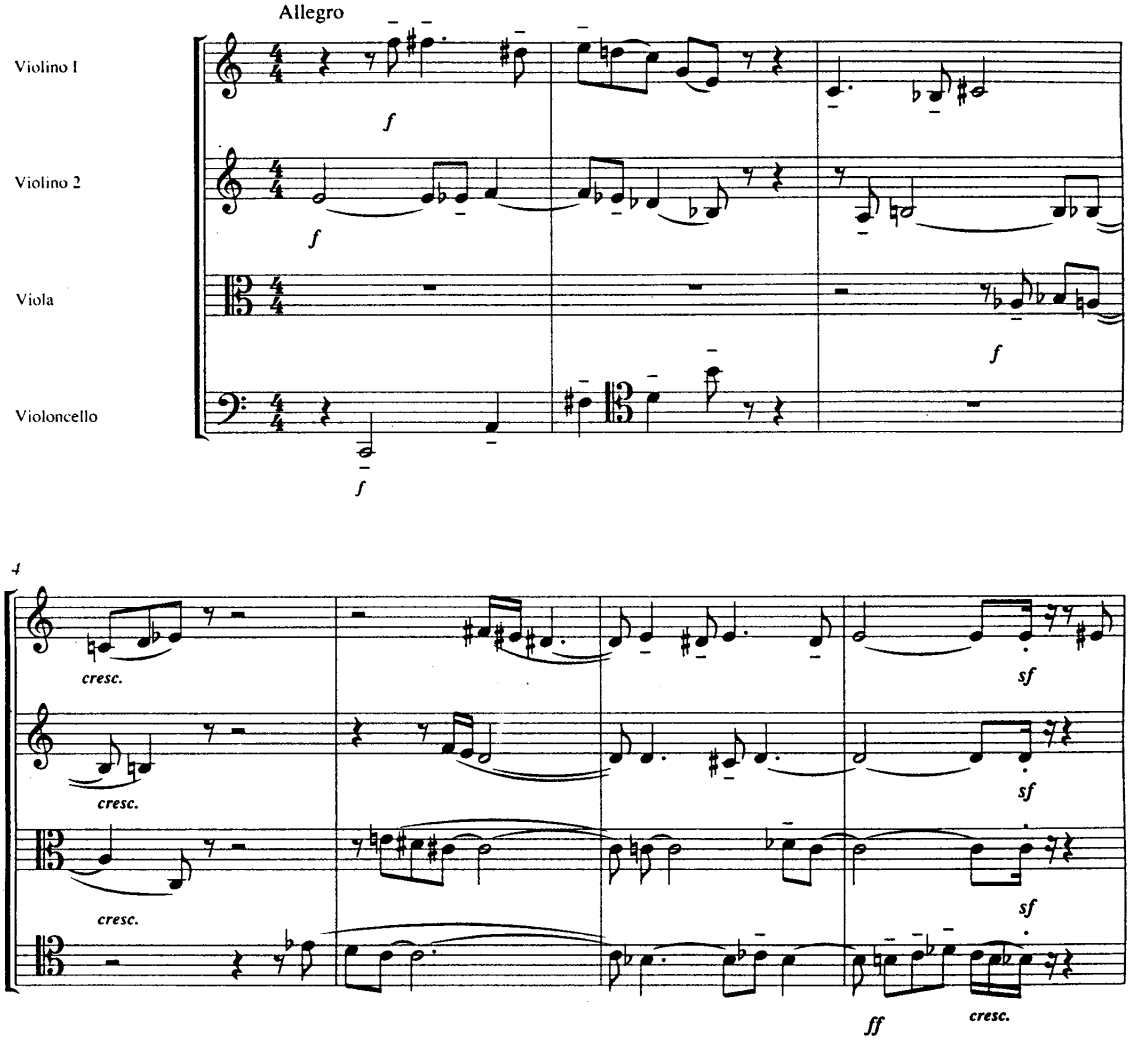


Illustration 42

Software for Music Printing -- 13b
High Score (Donald Byrd and Kimball Stickney)

Computer: Apple Macintosh
Printing device: Apple LaserWriter
Font: PostScript 'Sonata' by Adobe Systems

Fourth String Quartet

BELA BARTOK

(1928)

I.

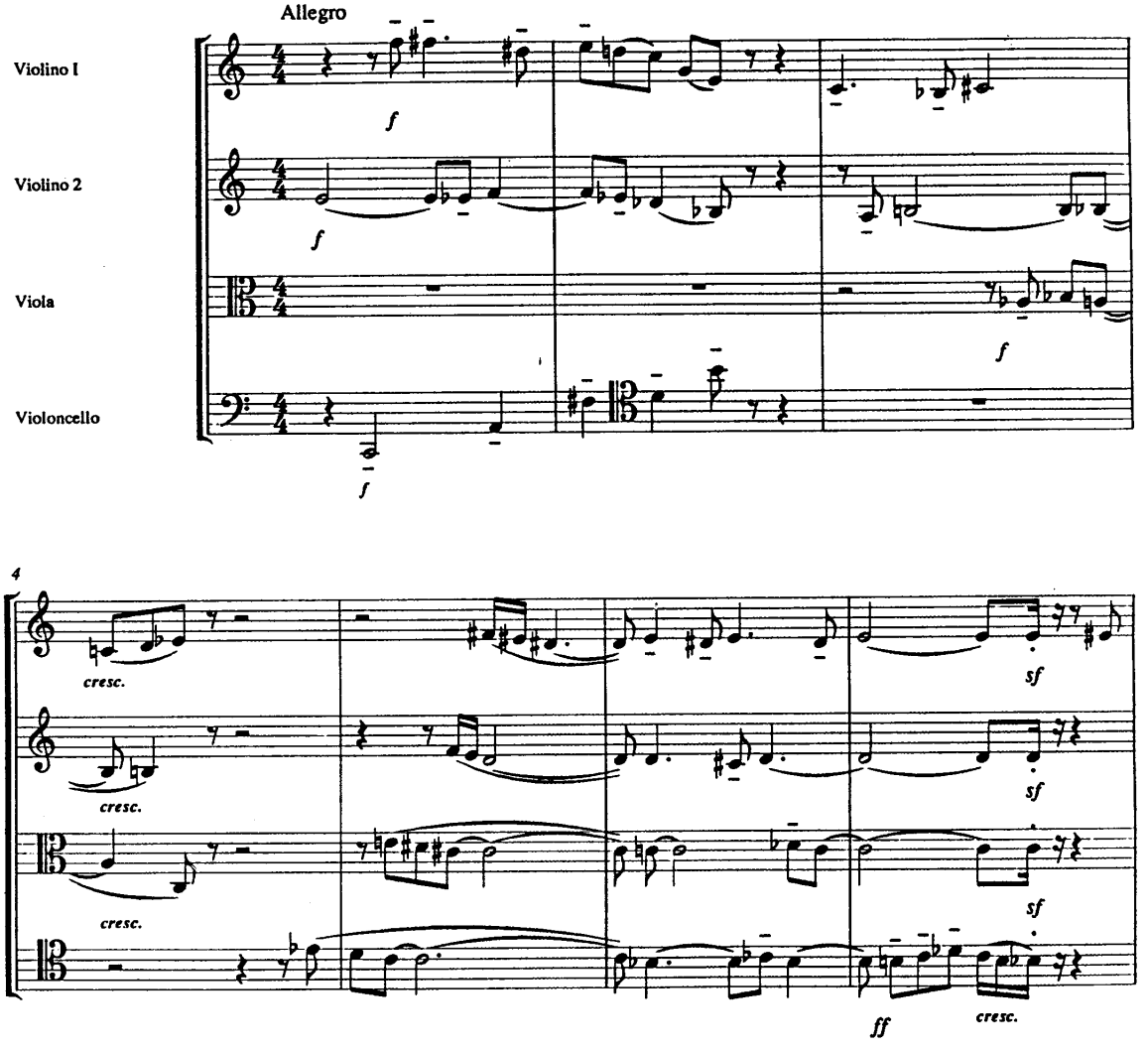


Illustration 43

Software for Printing Music -- 14
Oxford Music Processor (Richard Vendome)

Computer: IBM PC or compatible
Output device: Gould Colorwriter 6320

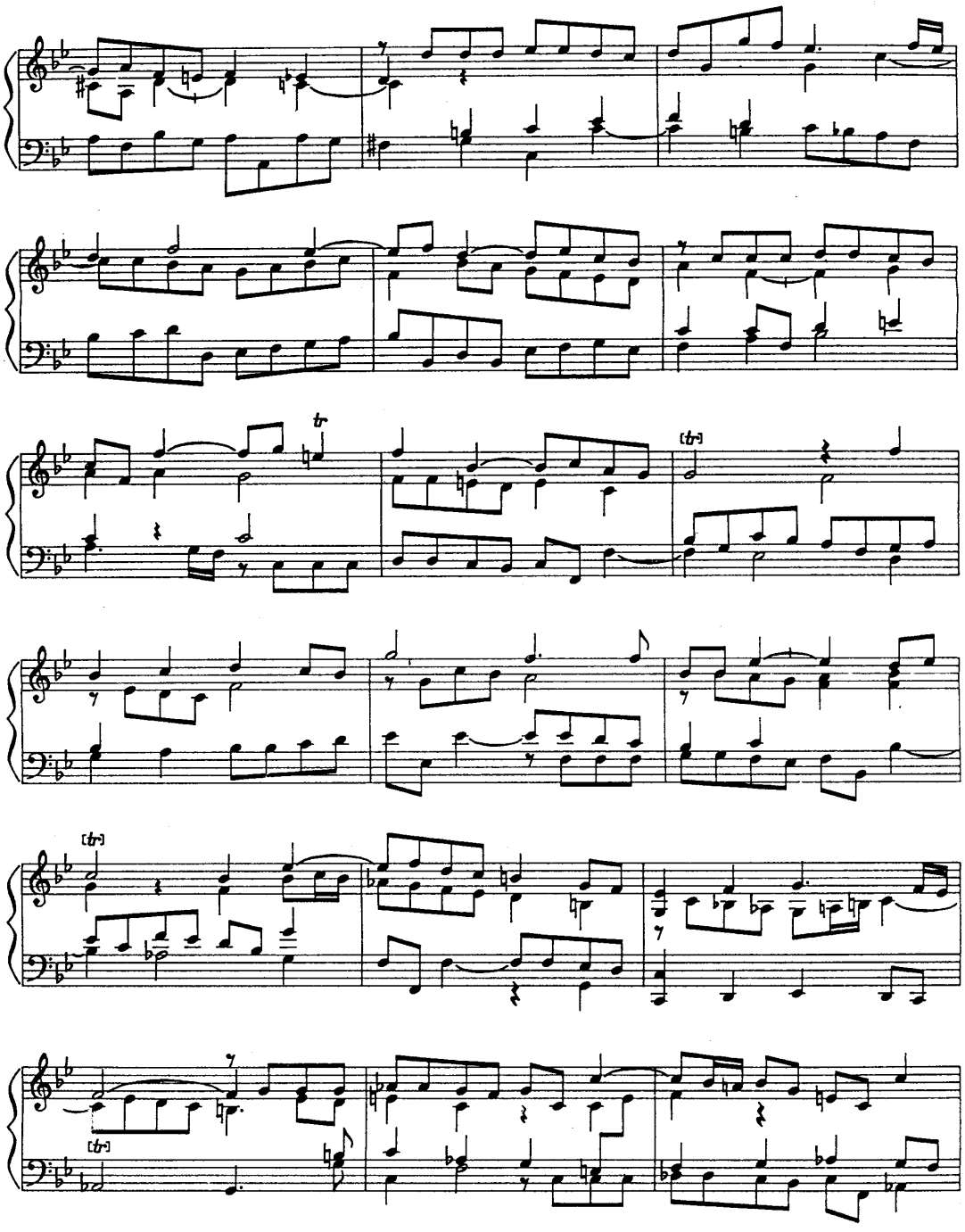


Illustration 44

Software for Printing Music -- 15
ETH (Giovanni Müller)

Hardware: LILITH workstation
Software: interactive editor in Modula--2 under development

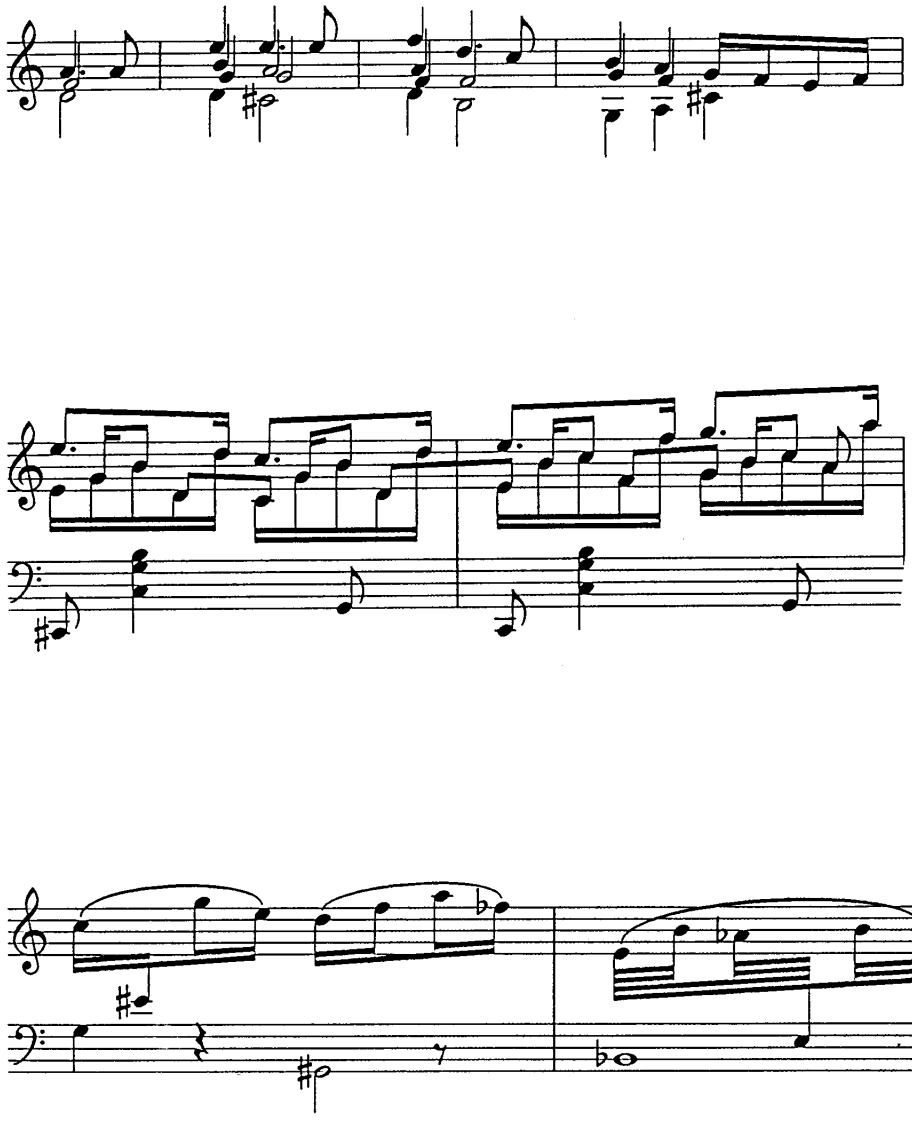


Illustration 45

Software for Printing Music -- 16
ALPHA/TIMES (Christoph Schnell)

Computer: Macintosh
Printing device: Apple ImageWriter II

Unreduced

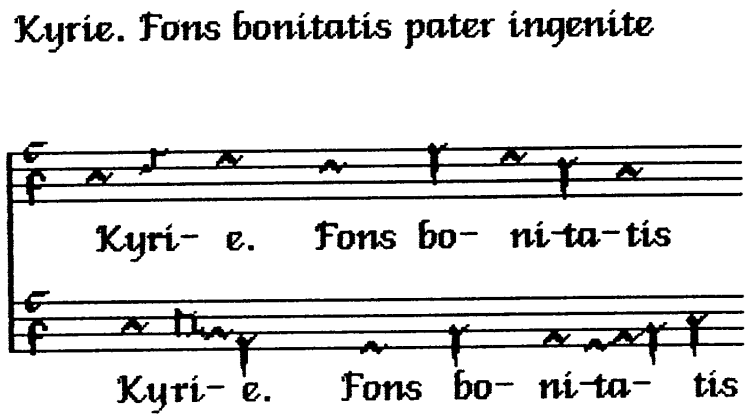
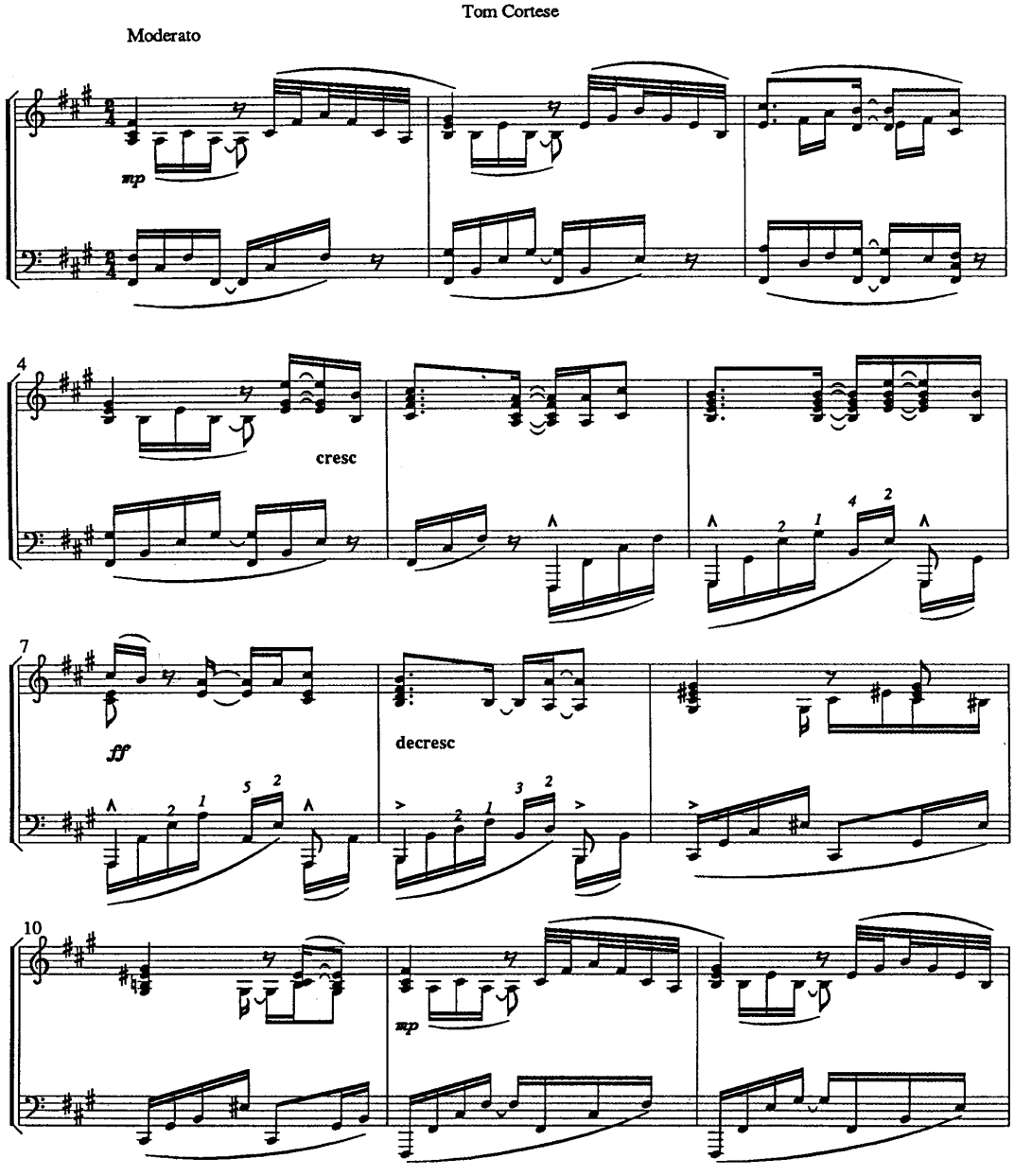


Illustration 46

Software for Printing Music -- 17
Interactive Music System (Lippold Haken, Kurt Hebel)

Computer: PLATO System
Printing device: Apple LaserWriter

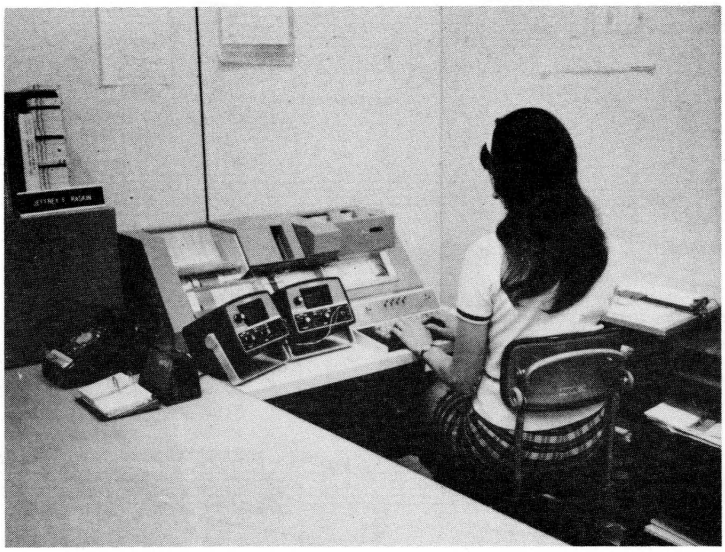


An Early System for Printing Music:
Jef Raskin's Lingua Musica pro Machinationibus IV
(1966-67)

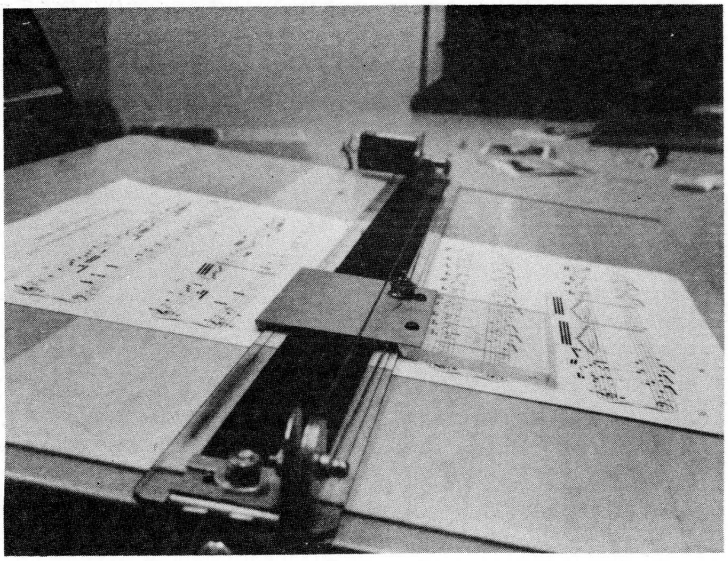
The recurrence of certain concepts in efforts to represent and print music is well illustrated by work done by Jef Raskin in the 1960's. Raskin had been involved as a high school student in the earliest phase of DARMS development. As a graduate student in computer science at Pennsylvania State University in 1966-67, he developed a Lingua Musica pro Machinationibus to support music printing. It was designed to represent music of arbitrary complexity and to reproduce it at any size. The printing program used vector graphics, with output from a Calcomp plotter.

Problems of positioning were resolved by specifying X and Y axis locations. A drafting system coordinated with a keypunch machine facilitated data entry. A screen display was also supported. The screen could display notation that looked the same as the printed output (the only photograph made of screen display is the one shown here).

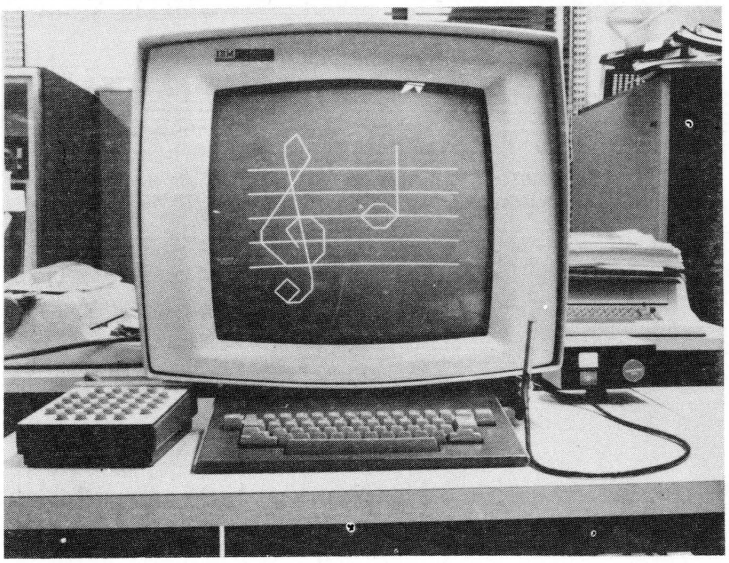
Raskin, a musician and conductor, subsequently gained recognition as a computer graphics artist, a reporter for *Byte Magazine*, and a designer of the Apple Macintosh. An important motivation in designing the Macintosh was, according to him, to make computer printing of music available inexpensively. Raskin is the founder and president of Information Appliance, Inc. The Center extends special thanks to Mr. Raskin for making available the following illustrations and other documents.



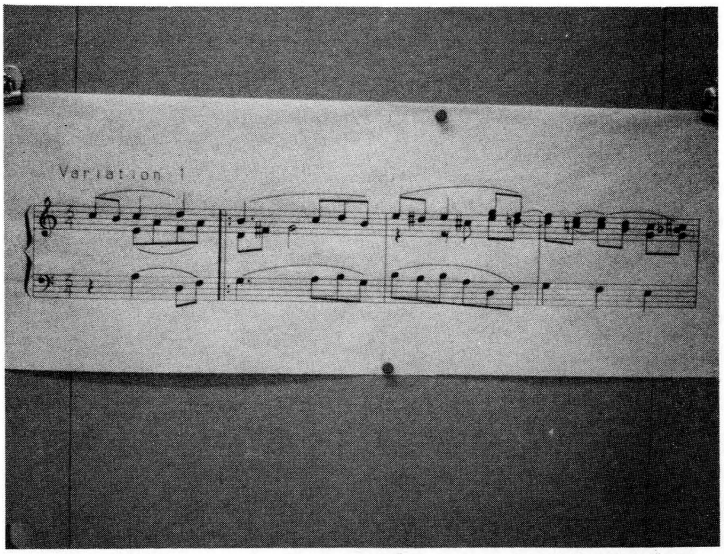
Karen Kalinsky entering the music of Bach onto punch cards using a combination of a keypunch machine and an X - Y graphics digitizer (shown in the following illustration).



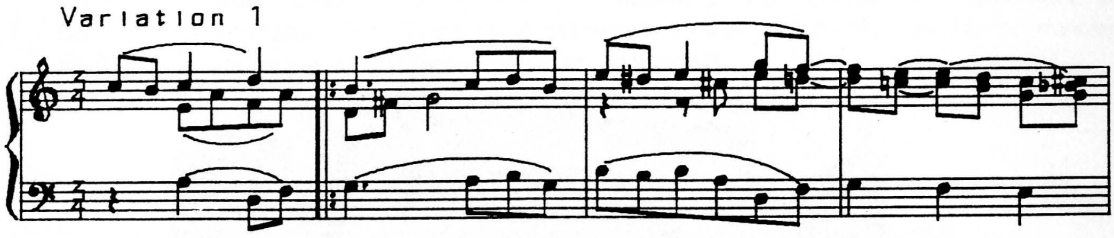
Determination of X and Y coordinates.



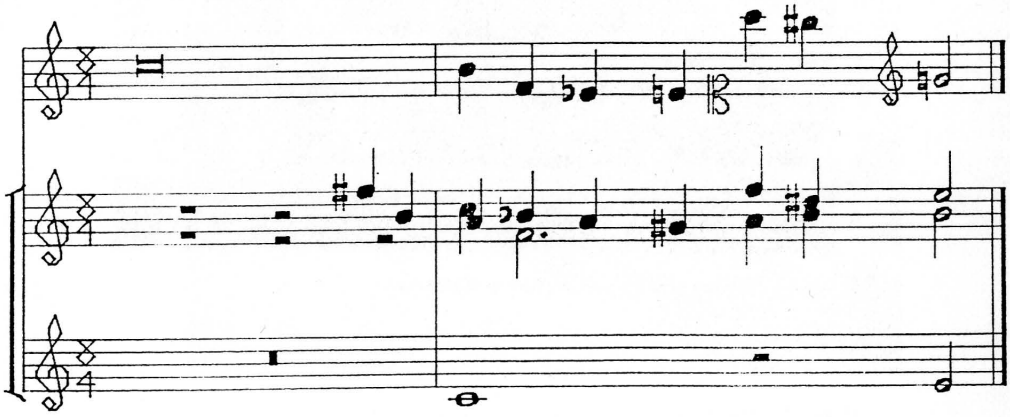
Screen display (monitor for IBM mainframe).



Photograph of the first musical output.



Recent reproduction of the same material.



Another example from the same system.