MiDigraph

Manual Version 3.4

Christian Motika, Peter Heeren

MiDigraph

MiDigraph is a program for musical composition.
The basic idea of MiDigraph is composing by means of digraphs.

The program serves to produce MIDI data sets, or score data sets in Csound format through digraphs that predefine the range of properties of the nods to be produced. The parameter values of the notes are determined successively by the sequence of arcs stochastically steered by MiDigraph.

Contents

MiDigraph has been written by **Christian Motika** on Borland C++ Builder 5(http://www.delphino.de). The concept of this program originates from **Peter Heeren** (http://www.peterheeren.de).

Introduction

MiDigraph is a tone generator.

The program produce MIDI data sets, or Score data sets in Csound format by means of **digraph** previously entered. MiDigraph snaps a potential sequence of **arcs steers** the progression of the properties of the notes to be produced.

For each of the following parameters of the notes to be produced, one particular digraph (D1, D2, D3, D4) is entered:

> Notes
> Lengths
> Velocities
> Chords

To designate them there are so-called digraph tabs, i.e. e. the *Notes, Lengths, Velocities, Chords* tabs.

> <u>Definition:</u> A **digraph** D = (V (G), A(G)) consists of two finite quantities: V(G), the non-empty quantity of nodes called **nodes** of D and the possibly empty quantity of **arcs** a(G), denoted as arcs or directed edges or simply edges of D so that a sorted pair of nodes (u, v) is assigned to each arc a in A.

The **nodes** of the digraph denote the values of the different parameters, the **arcs** represent potential links between values (see *Generation of Nodes and Generation of Arcs*).

During the generation of tones, the digraphs steer the progression/succession of values by means of their arc sequences. The arc sequences of the individual digraphs run independently. MiDigraph steers the sequence of arcs <u>stochastically</u>.

The probability is distributed evenly to the arcs that lead away from the initial nodes.

The digraphs needed for MiDigraph to produce data sets must have the following specific <u>property</u>:

> At least one arc each must lead to and away from the individual nodes of the digraph. (The input and output grades of the nodes must be greater than 0.)

Thus, a MIDI data set or a Csound data set cannot be generated until four digraphs have been generated. Moreover, general directions are needed such as Starting Node i.e. the instruction from which node the arc sequence is to start, or the number of the notes to be generated (see *General*)

Installation

New versions of the program will be published on the internet sites

       http://www.delphino.de
       http://www.peterheeren.de

After downloading the setup 'MiDigrapgSETUP.exe' and a concluding double click, just follow the installation directions.

We recommend running the MiDigraph program on a P 300 (or bigger) with at least 32 MB RAM. And it is also be possible, though, to work with MiDigraph using the Win95, Win 98 and Win 2000 operating systems.) A bit of advice: Store the program in a catalogue of your starter menu.

Deinstallation

To deinstall the program, only its data set to be deleted.

If you have any questions regarding the program send us an e-mail to info@delphino.de

Generation of Nodes

The nodes of the digraph are activated with the orders *New Note*, or *New Length*, *New Velocity* and *New Accord* in the respective boxes of the digraph tabs.

On pushing the selected *New* button, the corresponding window will open. In it you can determine the value of the node. After determining its value the node will shown in the digraph working environment, and it will be in its standard position (10; 10).

The position of a node can be steered via the respective input field. (Top left) on the right-hand side of the working environment. As an option, the node may also be moved with the mouse (drag & drop)

The selection of a node is done via the Combo Box, which is placed on the right, too, immediately above the position labels.
s soon as you have selected a node it is highlighted in light blue for a moment so that you can quickly check, which node you have selected. After selecting a node you can process the values (see *Generation of Arcs*) or connections.

Each node has a context menu which is usually accessible via the right-hand mouse button. Here, you also find all the function you can get via the main menu.

To change the value of a node press the respective Change button.
To blank a node again, press the respective Delete icon.

Generation of Arcs

After generating several nodes you may connect them by means of edges. (*)
These are arcs, i.e. directed edges, which mean that they lead from one to the next.
The direction of arcs is indicated by their arrow heads.

Arcs play an important part in MiDigraph since they steer the progression of the
parameter values. MiDigraph steers the succession to arcs stochastically, it is true,
but only those directions are possible that the arcs permit.

Arcs are activated by the instruction *Add to* in the *Connections* list or, alternatively,
in the menu:
first, you select the initial node in the node input field or, alternatively, click on the
respective node, then click on the instruction Add to and after that select the end
node in the window now appearing.
Alternatively, you may also activate the arcs by simply selecting the initial and end
nodes with a double click.

Any two arcs that are allocated to the same pair of nodes and point in opposite
directions are replaced by MiDigraph with an arc having an arrow head at each
end.

It is possible to assign a particular **value** to an arc: if two arcs are to be steered as
parallels the arc value is increased to 2. (As a standard, all connections are
initialized with the value 1.)
This rating might be visualized in the image of two connections lying of the top of
each other.

The value may also be greater than 2. The value "5" of an arc, for instance, means
that five arcs have the same initial and end nodes, i.e. they run as parallels.
Note that the distribution of probability is distributed evenly to the arcs that lead
away from their initial nodes even if as in this case they are steered with
correspondingly high value.

You may alter the valuation of a connection by clicking on the Change value button.
In the dialog window that appears now, connections may be marked by means of
the mouse and changed by clicking on the set value button. You may also click
twice on any of the connections in the list connections, if you want to change their
valuations.

The nodes that are connected with themselves by means of a loop (two double
clicks on the same node) are marked by the bold-type lettering of their values.

*) MiDigraph will accept a digraph with only one node if the latter is looped with
itself.

The connection test

The connection test tests only **one property** of the digraphs:

It tests whether at least one arc leads away from each node of the digraph (i.e. e. whether all the input grades of the nodes of the respective digraph are greater than 0).

The connection test does <u>not</u> test whether at least one arc leads to each node of the digraphs (i.e. whether all the output grades of the nodes of the respective digraphs are greater than 0).

Both cases mentioned here lead to a serious error in the generation of MIDI or Csound files.

The connections may be tested (via the respective menue) for each digraph individually. Alternatively, all the connections of all digraphs may be tested via the File menue.
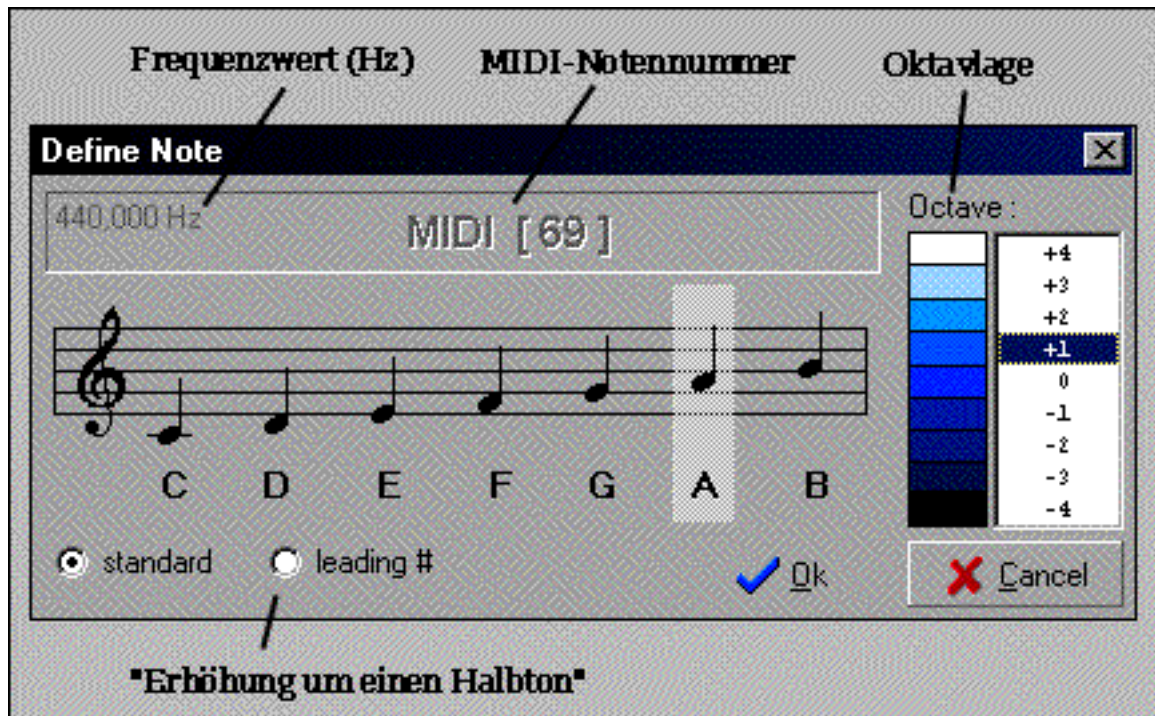
The Notes Tab

In this working environment a digraph is created whose nodes represent the pitch of the notes to be generated.
The sequence of arcs steered stochastically by digraphs determines the pitches of all nodes successively.

The instruction *New Note* opens a new window (s. a.). This window represents a musical stave and a table. You choose the note you want, getting the chromatic notes by employing the 'leading#' modulation instruction.

The octave position of the note selected is regulated in the Octave table. Note that MiDigraph will generate the note c (c0) when the note C is selected under the Octave setting 0.
The Midi number of the note as well as its frequency value is flashed above the notes stave. (cf. known bugs)

The node generated appears in the Digraph working environment in the shade of colour of the respective Octave setting. The node selected including its position is shown in the node input field in the Digraph working environment.

It is possible to change existing values of the nodes with the instruction *Change note*, or to delete nodes with the instruction *Delete note*. When a node is deleted its arcs are automatically deleted with it.

The arcs are activated in the arc input field with the instruction *Add to*: you first select the initial node in the node input field, then click on the instruction *Add to* in the arc input field and finally select the end node in the window that appears. Alternatively, you may activate the arcs by simply selecting the initial and the endnodes with a double click (cf. *Generation of Arcs*).

The Lengths Tab
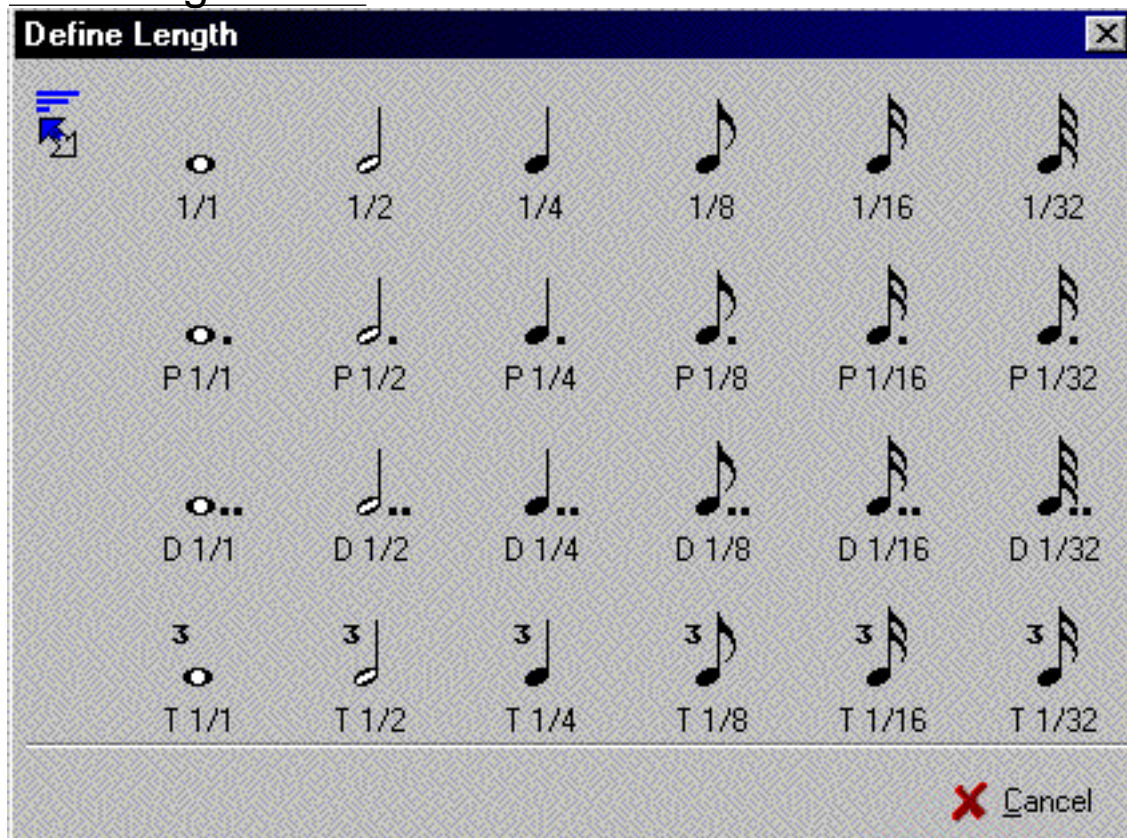
In this environment, a digraph is created whose nodes represent the duration of the notes to be generated.
The sequence of arcs determined stochastically by Digraph fixes the lengths values of the notes successively.

The instruction *New Lengths* makes a new window appear showing various note values. You select the note value you want, and the corresponding node appears in the Digraph working environment.

The values on the nodes are displayed as follows:
1 :1/1 = a whole note
2 : 1/2 = a half note
4 : 1/4 = a quarter note
etc.
P 1 : 1/1 dotted note value
D 1 : 1/1 double-dotted note
T 1 : 1/1 one third of triplet

It is possible to change existing values on the nodes by means of the instruction *Change Lengths*, or to delete nodes by means of *Delete Lengths*. When a node is deleted its arcs are automatically delete with it.

The arcs are activated with the instruction Add to in the arc input field: You first select the initial node in the top right field, then click on the instruction Add to, and finally select the endnote in the window that appears. Alternatively, you may activate the arcs by simply selecting the initial and the endnodes with a double click (cf. *Generation of Arcs*).

The Velocities Tab
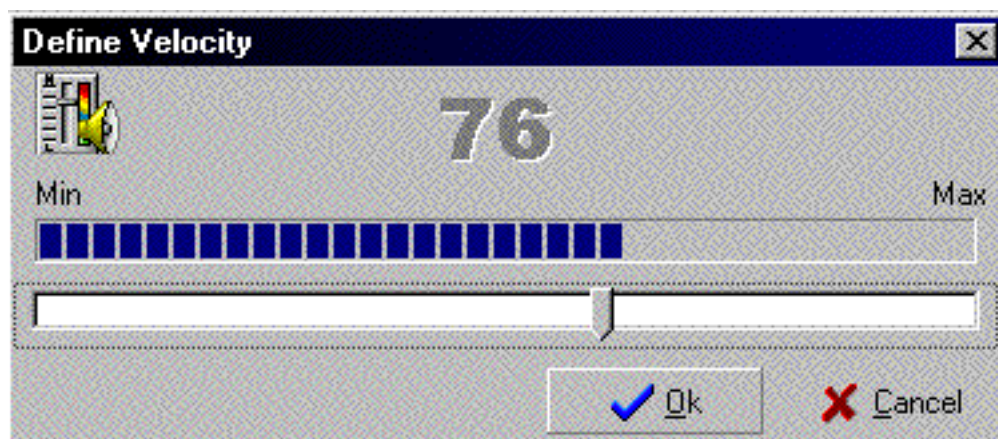
In this environment, a digraph is created whose nodes represent the velocities of the notes to be generated.
The sequence of arcs stochastically steered by MiDigraph successively determines the velocity values of the notes..

By clicking on the button New velocity a new window appears displaying a fader. You select the value desired, and the corresponding node appears in the digraph environment.

MiDigraph supports the range of values from 0 to 126. Note that setting the node value at 0 has the effect of a musical rest.

It is possible to change existing values of the node employing the instruction *Change velocity*, or to delete nodes with *Delete Velocity*. When a node is deleted its arcs are automatically deleted with it.

The arcs are activated in the arc input field by *Add to*: You first select the initial node in the top right field, then click on the instruction *Add to*, and finally select the endnode in the window that appears. Alternatively, you may activate the arcs by simply selecting the initial and the endnodes with a double click (cf. *Generation of Arcs*).

The Chords Tab
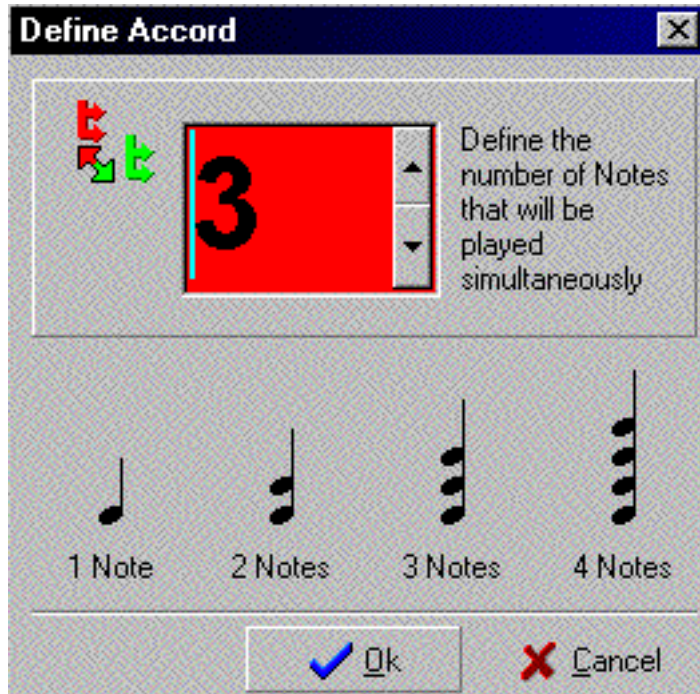
In this environment, a digraph is created whose nodes represent the number of notes to be played simultaneously, i.e. the number of notes sounding together, with identical beginning and duration. (The velocities of the notes are also identical.)

The sequence of arcs stochastically steered by MiDigraph successively determines this number of notes.

With the instruction *New chord* a new window (cf. a.) appears showing four types of chord in the bottom half (the first chord being a unisono one!) and a number in the top half.
By logging in the type of chord, or by setting a number, you may determine in the number of notes meant to sound together. This number appears in the digraph environment.

Explanation of this function:

Assuming that the number n is selected, MiDigraph will successively call n arcs $(a_1, a_2 ...a_n)$ by means of a simple random generator.

The endnodes connected with these arcs are registered by the program as values: In the D1 digraph, which determines the pitch of successive notes, the D2 and D3 digraphs, which determine the velocity and the lengths values of successive notes, locate only one value at a time, which determines all the notes of a chord, i.e. all its notes are of the same length and velocity.

In the 'General' file, the button _Chord option_ offers the possibility of selecting the particular arc that continues the sequence of arcs, from the set of arcs located successively by a random generator, or the arcs continuing the sequence may be stochastically located from the set of arcs.

Note that n different values are located only if the value id(v) of the node v, from which the sequence of arcs starts, is greater than n(n). If the starting value is > n only the corresponding number of values is located.

If the starting value I smaller than the number of notes that MiDigraph is instructed to make sound simultaneously in a chord, MiDigraph will repeat individual values.

Note that during the later compilation with the orchestra file it frequently happens that the error message out of range appears, since the repetition of the same frequency at same time induces a multiplication of the same frequency at the same time induces a multiplication of the amplitude of the note.

Arcs are activated with the instruction _Add to_ in the arc input field: first, you select the initial node in the top right field, and then click on the instruction _Add to_ and finally select the endnode in the window that appears. Alternatively, you may activate the arcs by simply selecting the initial and the endnodes with a double click (cf. _Generation of Arcs_).

Producing a MIDI File

You produce a MIDI file by selecting Create MIDI File level in the Menue File.
If the error Insufficient Data Provided appears, check if you have created the four digraphs correctly. Carry out a connection test if necessary.

During the production a window will flash to show the progression window ('Play MIDI File')

Using Settings in Creation file, you may produce a score file in the Csound format and/or an additional logfile, automatically. Via 'show logfile' you can view the current logfile.

Producing a Score File in Csound Format

You produce a Csound file by selecting the Create Csound file level in the menue file.

If the error message 'Insufficient date provided' Flashes, check whether you have created the four digraphs correctly. Have a connection test performed if necessary.

What will be produced is a score file in Csound format in which p4 indicates the pitch of the notes (in Hz) and p5 their velocities (in dB). The velocities values are automatically reduced, the maximum value being 105 dB.

Via *Settings* you determine whether or not an orchestra file in Csound is produced in addition to the obligatory score file.

The orchestra file produced by MiDigraph represents a simple pattern, which may be modified by the individual composer.
;During the production (of the score file) a window flashes that shows the progression of the production.

If you have given the instruction that a MIDI file be produced in addition to the score file you may play the former directly from the progression window, after the production. (Play MIDI File).
You may watch the current logfile via Show logfile.

Note: If the output value of a node is smaller than the number of notes MiDigraph is instructed to make sound together. MiDigraph repeats individual values (cf. Chords Tab).
You should take into consideration that this might be a problem when producing a score file because it frequently happens during the compilation of the score file with the orchestra file that the error message OUT OF RANGE flashes, since the repetition of the same frequency at the same time leads to a multiplication of the amplitude of the note.

the File-Menue

New   produce a new file
Save   safeguards file in its current status
Save as   safeguards file for a new one
Open   opens a file from the fixed disk (*.mdg)
                                 **<u>Attention:</u> MiDigraph does not
                                 open *.mdg files if the digraph of
                                 these Files do not correspond to
                                 the properties (cf. above) that are
                                 required for the program
                                 designed to produce notes.**
Play MIDI File   play the MIDI file produced
Test Connections   cf. Creation of MIDI file
Create MIDI File   cf. Creation of MIDI file
Create Csound File   cf. Production of a Score File in Csound
                                 Format

Settimgs   cf. Settings
Exit   leave program

Settings

In the function **Settings** it is possible to define the pitch and depth of the **work area** of the digraph working environment via the Work Area file.

Via the cue **arrows** the size and the colour of the arcs may be set.

In the **File Type** index card, the MDG-file type may be linked to MiDigraph, so that the present MiDigraph is opened when you double-click on such file (e.g. in the explorer).

In the file **Creation**, you determine whether MiDigraph is to automatically produce a score file for Csound and/or a logfile when producing a MIDI file, and vice versa, i.e. whether MiDigraph is to automatically produce a MIDI file when producing a score file for Csound.

The General File Type

In the **General** file, you determine the node from which the sequence of arcs is to start, using the lists **Start-Note, Start-Length, Start-Velocity, Start-Accord**

By activating the button **Random**, it is possible to stochastically locate the node from which the sequence of arcs is to start. In the box **Number of notes to generate**, you set the number of notes to be produced by MiDigraph.

In the **Chord-Options** working area, it is possible to select the specific arc that continues the sequence of arcs, from the number of arcs created by MiDigraph via the chords digraph 4. It may the first or the last of the arcs located <u>successively</u> by MiDigraph by means of a stochastic generator. Alternatively, the continuing arc is stochastically located from the entire number of arcs.

Mathematical Fundamentals

A **digraph** D = (V (G), A(G)) consists of two finite quantities: V(G), the non-empty **quantity of nodes** called nodes of D and the possibly empty **quantity of arcs** a(G), denoted as arcs or directed edges or simply edges of D so that a sorted pair of nodes (u, v) is assigned to each arc a in A.

If a be an arc in the digraph D, to which the sorted pair of nodes (u,v) belongs, we say that a **connects** with v, being regarded as the **initial node** of the direction of the arc is indicated by an **arrow head**.

If two (or several) arcs of G have the same initial and endnodes they are called **parallel** arcs.

It is possible to connect a node with itself by means of an arc; such an arc is called **loop**.

A **series of arc** in a digraph is a finite series:
$W = v_0 e_1 v_1 e_2 v_2 ... v_{k-1} e_k v_k,$
whose elements are alternately nodes and arcs.

The **input degree** $id_{(v)}$ of v is a number of arcs of D, whose head is y, viz. the number of arcs moving towards v. The **output degree** od is the number of arcs of D whose tail is v, viz. the number of arcs moving away from v.

Copyright

You are allowed to

- make a copy of the program for your records or as backup
- to transfer the program to another person, though only if you
  - o cede all the rights of the license agreements
  - o stop any utilization of the program
  - o delete or destroy all your copies of the program (on any driving mechanism & including the fixed disk) that you have made in the course of working with the program, and if the other person expressly agrees to the conditions laid down in this license contract.

You are NOT allowed to

- Translate the program, subject it to reverse engineering, decompile or disassemble it
- Let the product, lend it, give it or transfer it (to another person) except subject to the conditions mentioned above.
- Alter the program or embed it completely or partly in another program.
The program is made available to you as freeware.

Pay attention to the instructions on the Delphino Internet Site http://www.delphino.de under the menue level Impressum!

known bugs

- MiDigraph does not round down or up when you enter a frequency value into the window *Define Note*, or when it is instructed to produce a score file in Csound format with the instruction *New Note* . I.e. instead of calculating a frequency value of, say, 220 Hz for the note a0, MiDigraph will present the frequency value 219.999 Hz.

- When the option to produce a MIDI file in addition to a score file in Csound format has been clicked on the under the *Creation* file, MiDigraph cannot play that MIDI file automatically.