MinimalMarker Installation Guide and Manual for Widows ver.1

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1 Overview

MinimalMarkeris a computer program that detects marker sets with the smallest number of markers to identify all cultivars from polymorphism data obtained by applying co-dominant markers or dominant markers to many cultivars. Refer to the paper for details. We are creating a user interface for input file path specification, output path specification, and optional property with Perl program.

2 Operating environment

◆ OS Windows 10 Pro (64bit)
Windows 8.1 Pro(64bit)
Windows 8.1 Pro(32bit)
Windows 7 Pro(64bit)
Windows 7 Pro(32bit)

.NET .NET Framework4.5 ※1

※Please use Mac version when using with MacOS and Linux

Perl ActivePerl ※

※ ActivePerl is required to run Perl programs. If ActivePeal is not installed, installation is required. Please refer to the contents 3 installation of ActivePerl.

Refference

◆ Develop environment Windows 7 Pro (32bit)
Visual Studio
2012 .NET
Framework4.5

ExcelCreator 2012
ActivePerl
Ver5.20.1.2000

Executable file

MinimalMarker1.04.pl

3 Install ActivePerl

The Perl environment is required to run MinimalMarker on Windows. We recommend ActivePerl.

ActivePerl can be obtained free of charge from the following sites provided by ActiveState:
https://www.activestate.com/products/activeperl/

The version to be installed may be any version 4.5 or later. At the time of writing this manual (August 1, 2019), the version of ActivePerl is 5.28.

4 Install

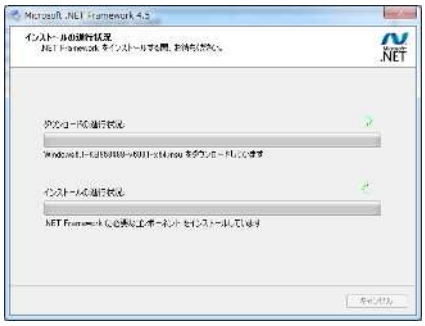
4.1 MinimalMarker installation

Run :\MinimalMarker\setup.exe

.NET Framework4.5 installation

In an environment without .NET Framework 4.5
Install .NET Framework 4.5. (Internet environment required)
If it is already installed, skip the .NET installation and proceed. → Start with the installation of MinimalMarker.

Click "Install"



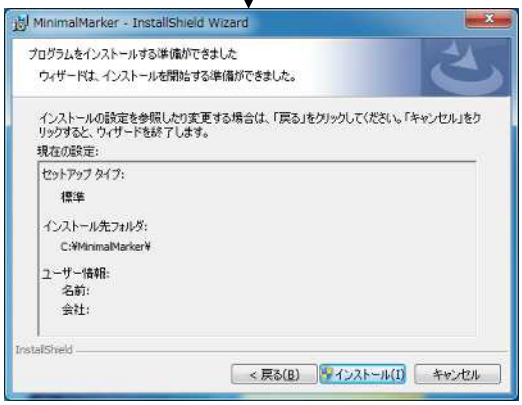
If the "User Account Control" message is displayed, allow changes → click "Yes".

Installation of .NET Framework 4.5 starts.

MinimalMarker installatin

Installation of MinimalMarker starts.

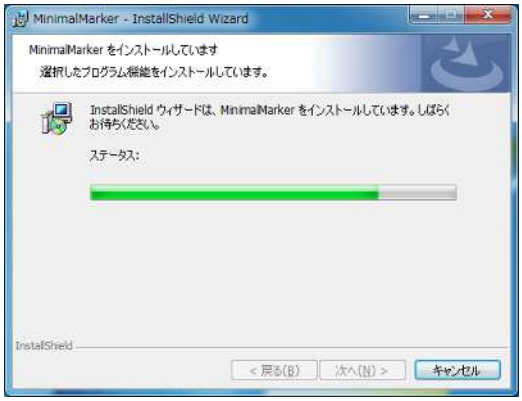
Click "Next".



It will be installed in the "C: \ MinimalMarker" folder.

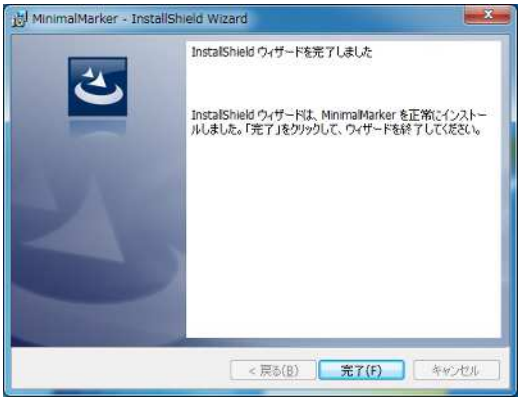
Click "Install"

If the "User Account Control" message is displayed, allow changes → click "Yes".



Installation of MinimalMarker starts.

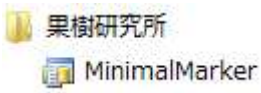
Installation end



When installation is complete, the icon and program menu will be added to the desktop.

Desktop

Program menu



Click the desktop icon or program menu to start the program.

"MinimalMarker" requires ActivePerl.
If ActivePerl is not installed, please install it.

5 Execution

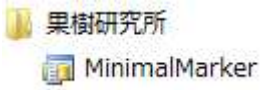
5.1 Start program

Start with Windows in one of the following ways

Start from shortcut icon on desktop

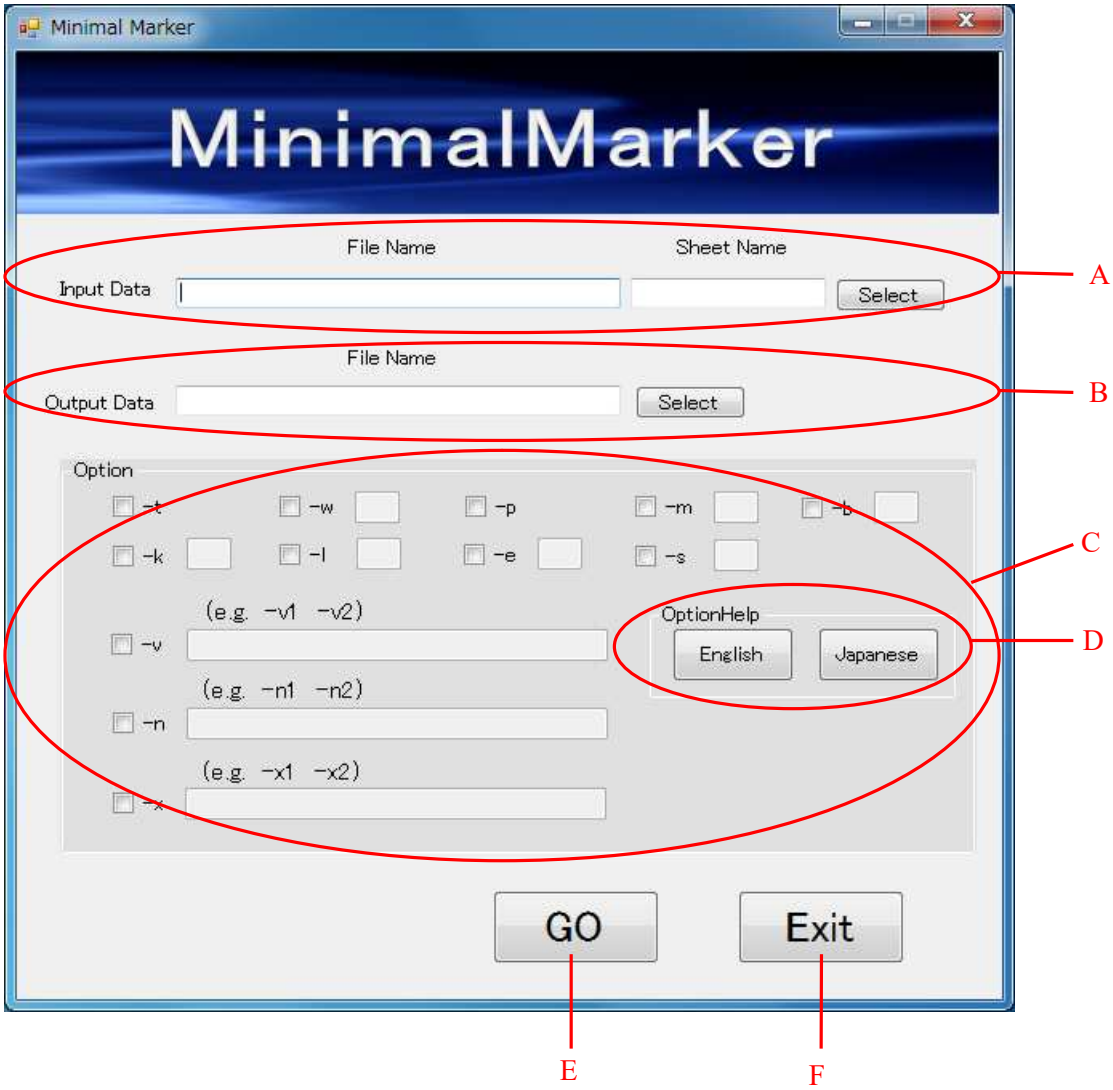
Launch the shortcut icon "MinimalMarker" on the desktop by double-clicking it with the mouse.

Start from the start button



Click the [Start] button → "All Programs" → "fruit tree research institute" → "MinimalMarker" in this order.

5.2 Control panel



A・・・Specifies the input file
B・・・Specifies the output file
C・・・Specifies an options
D・・・Display HELP massage of option calculation
E・・・Run the MinimalMarker program
F・・・Exit the application

5.3 Input file specification

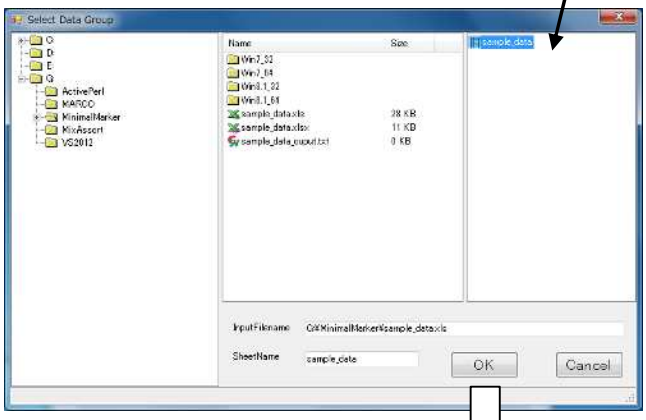
Specifies the input file.

1 Click the Select button to display the screen for specifying the input file.

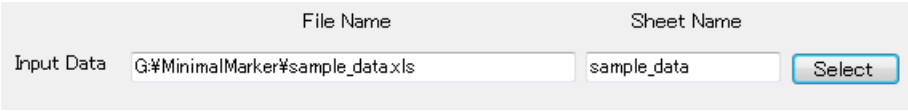
Sheet name display field
The selectable sheet name is displayed when an Excel file is specified

2 Specify the input file.

File types that can be specified xls,xXlsx, CSV files.
Click the Excel file to display a list of Sheet names. In case of Excel file, also specify Sheet.



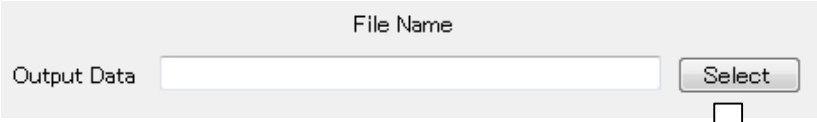
3 Click the OK button to enter the text into the input text box.
Click the Cancel button to cancel the specified content and return to the main screen.



For Excel files, the Sheet name is also entered.

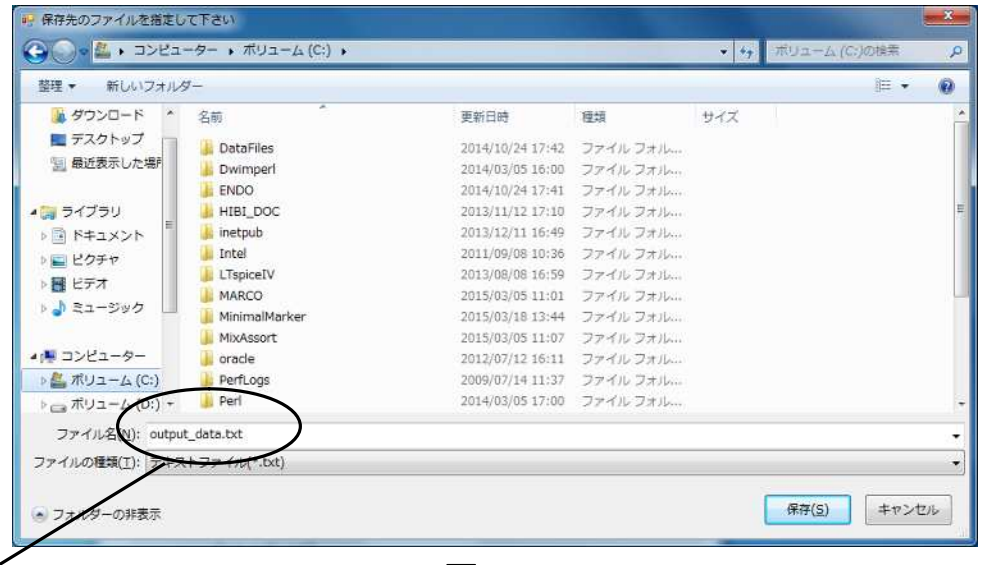
5.4 Output file specification

Specify the destination folder and file name.



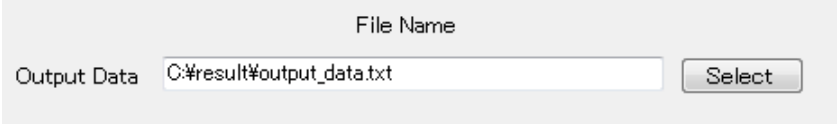
1 Click the Select button to display the screen for specifying the output file.

2 Specify the output destination and enter a file name.



By default "output_data.txt" Although it is displayed, you can change it to any file name.

3 Click the Save button and it will be entered in the destination text box.

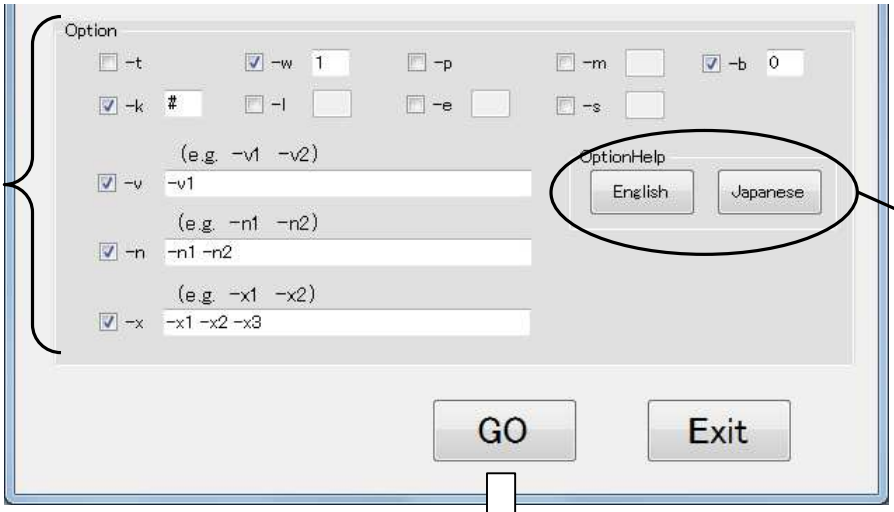


5.5 Calculation options

1 For options that require an argument, mark the checkbox to activate the text box. Enter the argument.

Please refer to help for explanation (argument, definition) of option.

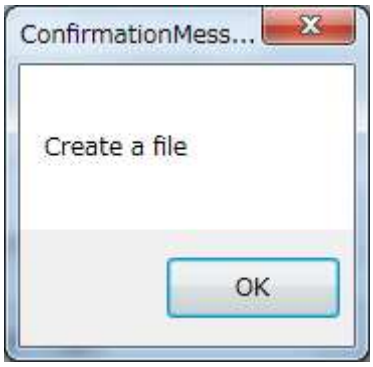
1



Click the Help button to display the optional help message.

2 Click "GO" button to execute the program.

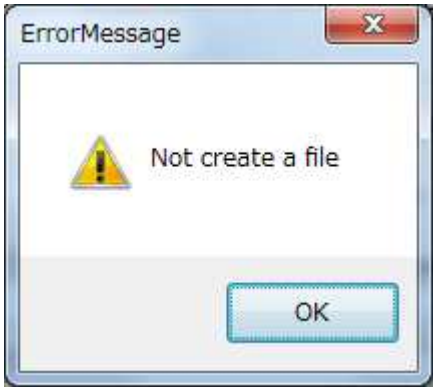
Successful completion



When the file is createdA message will be displayed.

The result file (text file) is created in the folder specified in the output destination

Abnormal termination



If it terminates abnormally, an error message will be displayed.

6 Input file format

A

```
Variety,V1,V2,V3,V4,V5
M1,aa,ab,aa,ab,aa
M2,aa,ab,ab,aa,bb
M3,aa,aa,aa,aa,bb
M4,aa,aa,ab,ab,aa
M5,ab,ab,bb,ab,aa
```

B

```
Variety,V1,V2,V3,V4,V5
M1,+,+,+,+,+
M2,+,-,-,-,+
M3,+,+,+,+,-
M4,+,-,+,+,-
M5,-,+,-,-,+
```

C

```
Variety,V1,V2,V3,V4,V5
M1,ab,ad,ae,bf,cg
M2,aa,bb,cc,dd,ee
M3,ab,cd,ef,gh,hi
M4,bc,cd,ac,de,dd
M5,ab,ab,bb,ab,aa
```

D

```
Variety,V1,V2,V3,V4,V5
M1,80/84,80/84,84/84,80/84,80/84
M2,78/94,78/94,78/88,88/94,80/94
M3,193/197,193/197,195/197,195/201,193/197
M4,177/195,195/195,177/195,177/177,177/195
M5,136/136,136/136,132/136,136/136,136/136
```

E

Variety	V1	V2	V3	V4	V5
M1	aa	ab	aa	ab	aa
M2	aa	ab	ab	aa	bb
M3	aa	aa	aa	aa	bb
M4	ab	aa	ab	ab	aa
M5	ab	ab	bb	ab	aa

F

Variety	V1	V2	V3	V4	V5
M1	+	+	+	+	+
M2	+	-	-	-	+
M3	+	+	+	+	-
M4	+	-	+	+	-
M5	-	+	-	-	+

G

Variety	V1	V2	V3	V4	V5
M1	ab	ad	ae	bf	cg
M2	aa	bb	cc	dd	ee
M3	ab	cd	ef	gh	hi
M4	bc	cd	ac	de	dd
M5	ab	ab	bb	ab	aa

H

Variety	V1	V2	V3	V4	V5
M1	80/84	80/84	84/84	80/84	80/84
M2	78/94	78/94	78/88	88/94	80/94
M3	193/197	193/197	195/197	195/201	193/197
M4	177/195	195/195	177/195	177/177	177/195
M5	136/136	136/136	132/136	136/136	136/136

・MinimalMarkerrequires input files in comma separated value (CSV) format or Excel file.
・First term of the data should be ‘Variety’ in the first line and following it names of cultivar must be written in first line. After second line, names of markers must be written in first column and following maker types.
・Any words are permitted in the cultivarnames and the marker names instead of ‘ V1’ or ‘ M1’, such as (A)
・Character notation of co-dominant marker of diploid and it is the input example of sample data shown in (A) and (E).
・(B) and (F) are +/-notation of dominant marker.
・(C) and (G) are co-dominant marker with any number of alleles
・(D) and (H) are Numerical notation of SSR marker of diploid. 2 figures must be separated by delimiter such as ‘/’.

7 Outputfileformat

```
number of markers:   17
number of varieties: 17
option switches:
-p: 0, -w: OFF, -g: OFF, -m: 1, -b: ON
Akatsuki x Gyosei
No marker(s) can discriminate between varieties listed above
number of marker sets found: 6
list of marker sets found:
M1a,M4c,MA023a
M4c,MA007a,MA023a
M4c,MA007a,MA035a
M4c,MA014a,MA023a
M4c,MA015a,MaA027a
M4c,MaA027a,MA035a
elapsed time: 0 sec.
```

·Sample output data. Peach data was used as sample data (Yamamoto et al., 2003, Breed Sci 2003, 53:35-40.). The program outputted that SSR genotypes of 'Akatsuki' and 'Gyosei' are identical, and computation was continued. Six minimal marker sets which consist of three markers were outputted.

8 Calculation options in MinimalMarker

Option	Argument	Definition
-t		Display all identified minimal marker set(s) on the screen.
-w[1/2/n]	1: (default) 2: ("-w" is the same as "-w2") n: (n>2)	Search for the minimum marker set(s) necessary to identify all two cultivar combinations with at least n markers. Even if this option is specified, redundant marker sets which just added another marker to the minimum marker set will not be detected
-p[0/1]	0: Not output the table (default) 1: Output the table but not search	Output a table indicating whether or not to distinguish between the two cultivars with each marker, as in Table 2 (Fujii et al. 2013)
-m[0/1/2/n]	0: Enumaration metod 1: Branch-and-bound method (default) 2: Heuristic method n: Heuristic method with n power (n>2)	Enumeration method and branch-and-bound method can achieve the same result. By using the branch-and-bound method, the calculation speed can be increased more than the enumeration method. The heuristic method can dramatically reduce the calculation time when the number of markers and the number of varieties are large. However, we do not guarantee that it is a minimal marker set and that it will detect all minimal marker sets. Increasing n increases the power of detection but slows the calculation time.
-b[0/1]	0: Arithmetic operation 1: Bit operation (default)	When the calculation time is expected to be long, computation can be accelerated by use of the bit operation. Bit operations give the same results as arithmetic operatinos.
-k[character or symbol]	(e.g. -kZ -k#)	Specify a character or symbol indicating missing data (case sensitive)
-l[0/n]	0: Search all minimal marker sets (default) n: Search for a specified number (n) of marker sets and stop (n>0)	Specifies the number of minimal marker sets to search. Use when searching for all minimal marker sets may take time.
-v[n]	n: Column number of cultivar in given table Multiple can be specified (e.g. -v1 -v2)	When searching for a minimal marker set to distinguish one/some cultivar(s) from all other cultivars, the cultivar(s) is/are designated
-n[n]	n: Row number of marker in given table Multiple can be specified (e.g. -n1 -n2)	Specify marker(s) that must be included in the minimum marker set.
-x[n]	n: Row number of marker in given table Multiple can be specified (e.g. -x1 -x2)	Designate marker(s) to be excluded from the minimum marker set.
-e[1/n]	1: Stop searching when all minimum marker sets are found (default) n: Continue searching to the specified number of markers even if all the minimum marker sets are detected (n>1)	Specify the number of markers to stop the search (with or without minimum marker set detection).
-s[1/n]	1: Start search from 1 marker (default) n: Number of markers to start the search (n>1)	Specify the number of markers to start the search. In the case of dominant markers, at least 7 markers are required to identify 100 cultivars. To speed up such searches, use the -s7 option.

9 Disclaimer

・MinimalMarker provided by National Agriculture and Food Research Organization of Japan (NARO) may be freely distributed, provided that no charge above the cost of distribution is levied, and that the disclaimer below is always attached to it.

・MinimalMarkeris provided as is without any guarantees or warranty. Although the author has attempted to find and correct any bugs in the program on MinimalMarker, the author is not responsible for any damage or losses of any kind caused by the use or misuse of MinimalMarker. The author is under no obligation to provide support,

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11 Citation

When publishing an academic paper using the results obtained using the MinimalMarker, please describe the use of MinimalMaker in the paper and cite the following literature.

Hiroshi Fujii, Tatsushi Ogata, Takehiko Shimada, Tomoko Endo, Hiroyuki Iketani, Tokurou Shimizu, Toshiya Yamamoto and Mitsuo Omura (2013) MinimalMarker: An algorithm and computer program for the identification of minimal sets of discriminating DNA makers for efficient variety identification. Journal of Bioinformatics and Computational Biology. 11 (2) 1250022 (17 pages) . DOI: 10.1142/S0219720012500229.

12 History of MinimalMarker Installation Guide and Manual

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