

**Bioinformatics
approaches in
animal
breeding**

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University of Zagreb



University of Ljubljana



**MaGelAn 1.0: a software to facilitate
quantitative and population genetic analysis
of maternal inheritance by combination of
molecular and pedigree information**

User's manual

Brajković Vladimir

**Thursday
10th July**

MaGeLLAn Demo



Short communication

Computational approach to utilisation of mitochondrial DNA in the verification of complex pedigree errors

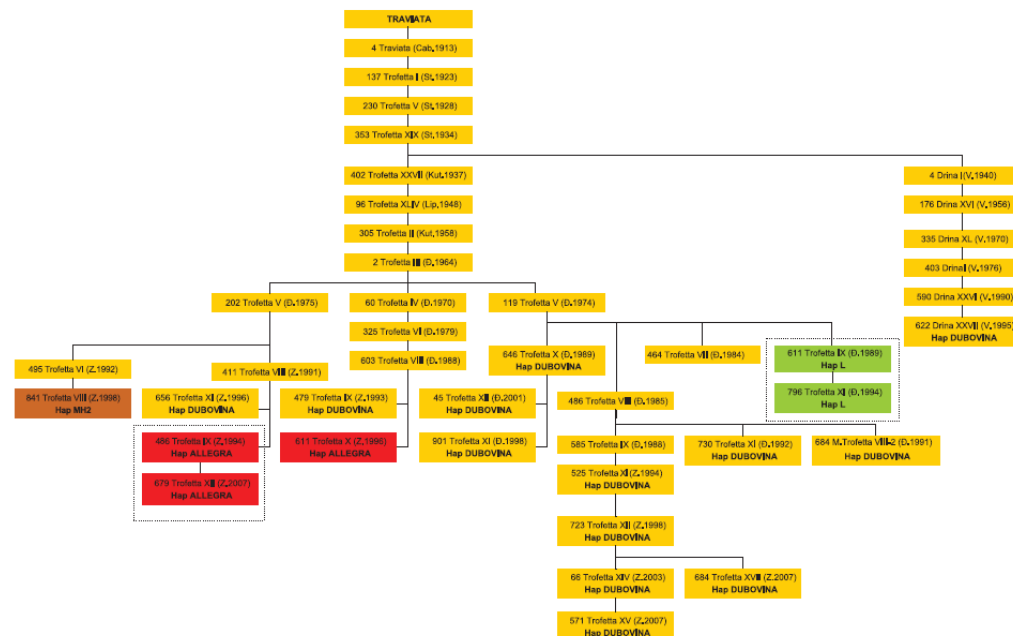
Mato Čačić^a, Vlatka Cubric-Curik^b, Strahil Ristov^{c,*}, Ino Curik^{b,*}

Fig. 2. Graphical illustration of the maternal lineage pedigree for the mare line *Traviata* with sequenced and a priori expected haplotype DUBOVINA (yellow), and non-concordant haplotypes ALEGRA (red), L (green), and MH2 (brown). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

MaGeLLAn 1.0

Ristov et al. *Genet Sel Evol* (2016) 48:65
DOI 10.1186/s12711-016-0242-9



SOFTWARE

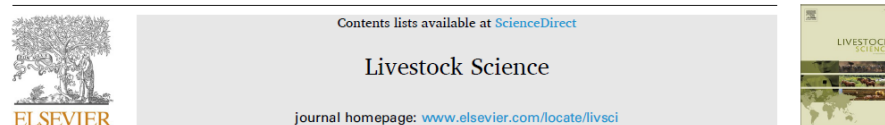
Open Access



MaGelLAn 1.0: a software to facilitate quantitative and population genetic analysis of maternal inheritance by combination of molecular and pedigree information

Strahil Ristov^{1*}, Vladimir Brajkovic², Vlatka Cubric-Curik², Ivan Michieli¹ and Ino Curik²

MaGe|LAn 2.0/2.1



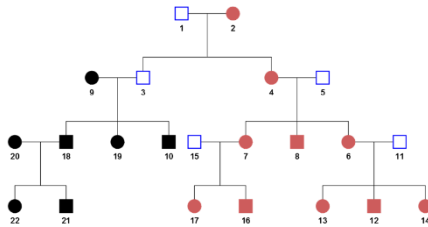
Mitogenome information in cattle breeding and conservation genetics: Developments and possibilities of the SNP chip

V. Brajkovic^{a,1,*}, D. Hršak^{b,1,*}, L. Bradić^a, K. Turkalj^a, D. Novosel^c, S. Ristov^b,
P. Ajmone-Marsan^d, L. Colli^e, V. Cubric-Curik^a, J. Sölkner^f, I. Curik^{a,1,*}

1. Introduction

MaGelLan 1.0

maternal lineage analysis



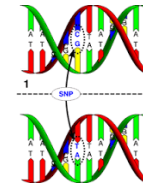
pedigree



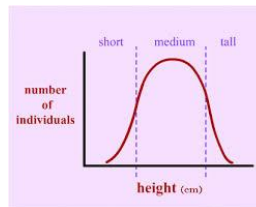
phenotypes



sequences (mitogenome)



polymorphism



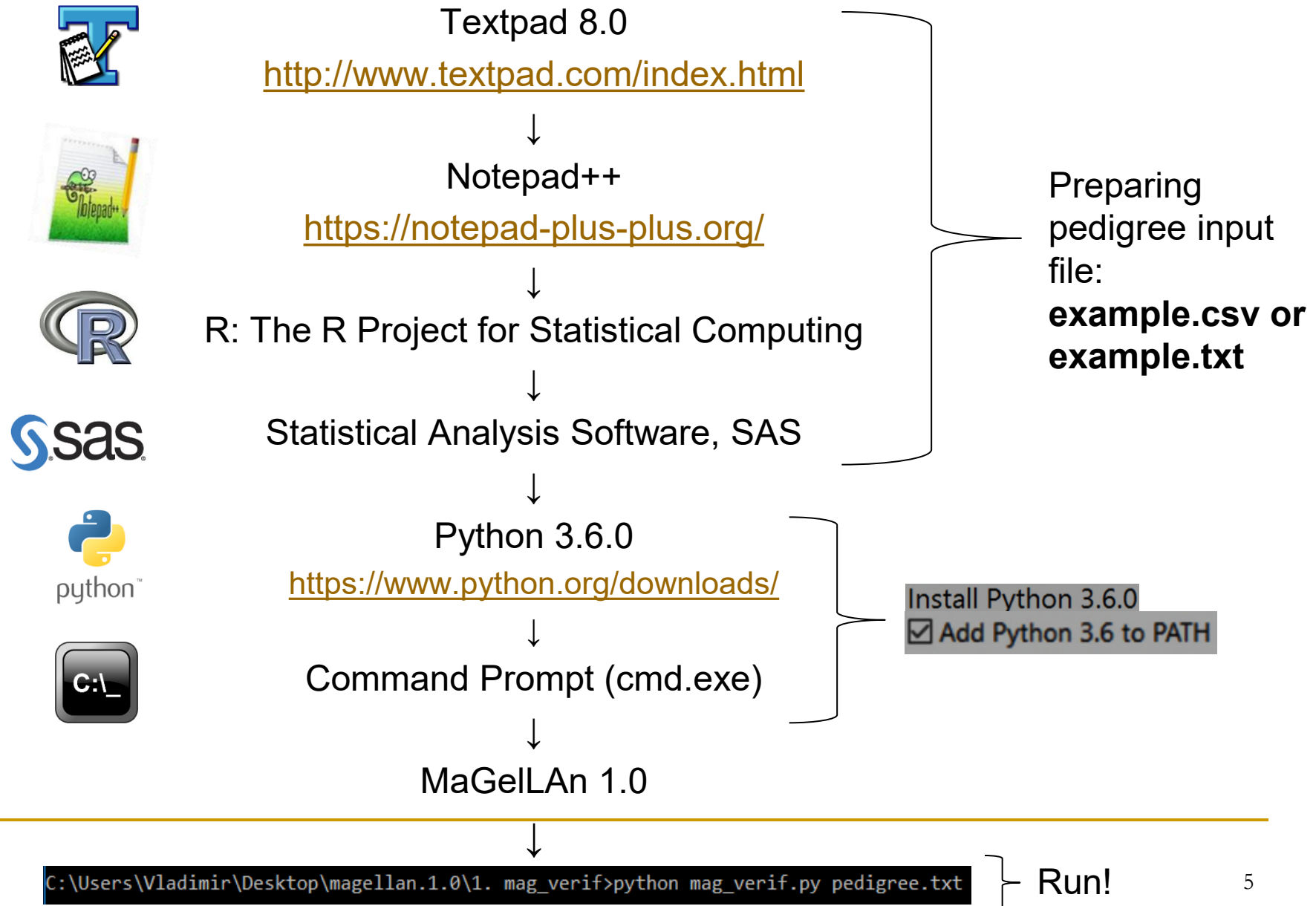
quantitative trait variation

power of analysis

2. Installation

- MaGeLAn 1.0 software
 - Project home page: <http://lissp.irb.hr/software/magellan-1-0/>
 - Article: <https://gsejournal.biomedcentral.com/articles/10.1186/s12711-016-0242-9>
 - Operating system(s): Platform independent
 - Programming language: **Python3**
 - Other requirements: None
 - License: The software is **free**
 - Any restrictions to use by non-academics: Written permission required

2. Installation MaGeLLAn 1.0



2. Installation MaGeLAn 2.0 – 2.1

7-Zip is a file archiver with a high compression ratio

<https://www.7-zip.org/>

TextPad - text editor

<https://www.textpad.com/download#textpad9>

Python 3.10.9 or some of the 3.10.x version — newer versions (3.11.x and above) are not compatible with the TensorFlow version listed below.

<https://www.python.org/downloads/windows/>

- when installing Python, mark "Add python.exe to Path"

Open command prompt in Windows or bash terminal in Linux/Mac/WSL:

pip install pandas

pip install dask

pip install dask[dataframe]

pip install PyQt6

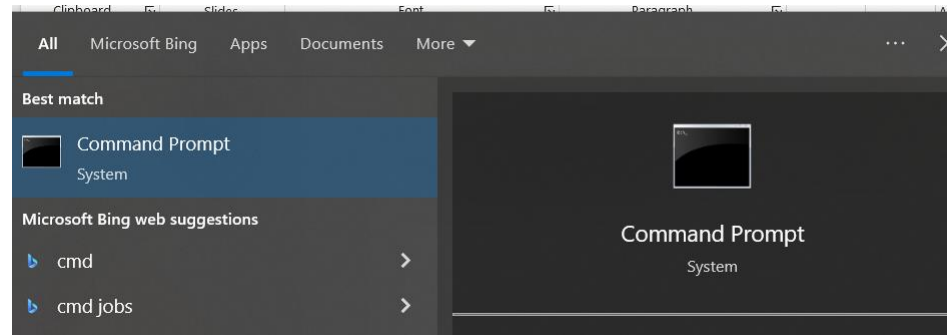
pip install xgboost

pip install tensorflow #maybe

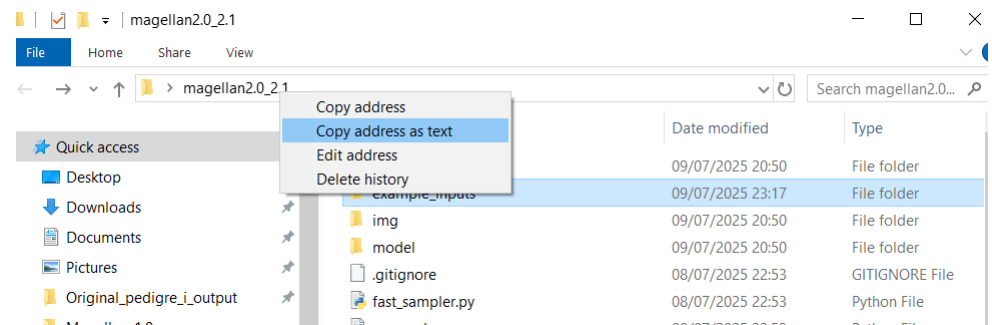
pip install matplotlib

2. Installation MaGeLLAn 2.0 – 2.1

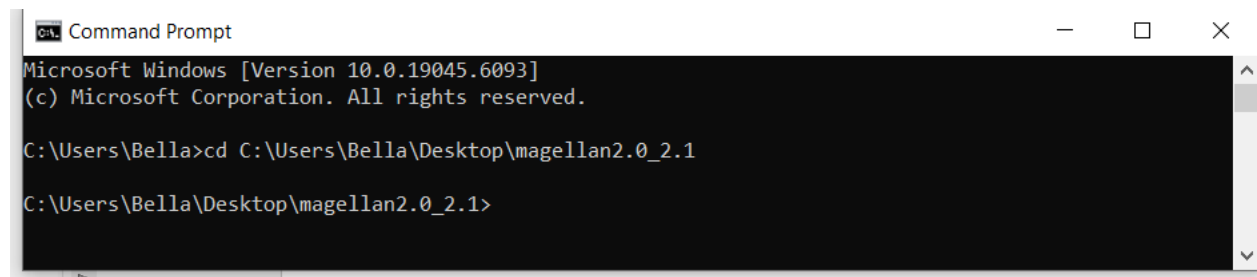
1. After installing packages, open CMD:



2. Copy address of Magellan folder as text:



3. Type: `cd C:\Users\Bella\Desktop\magellan2.0_2.1`



2. Installation MaGeLLAn 2.0 – 2.1

3.Type *dir* to see the content of folder:

```
C:\Users\Bella\Desktop\magellan2.0_2.1>dir
Volume in drive C has no label.
Volume Serial Number is 5E1C-1470

Directory of C:\Users\Bella\Desktop\magellan2.0_2.1

09/07/2025  23:17    <DIR>        .
09/07/2025  23:17    <DIR>        ..
08/07/2025  22:53             449 .gitignore
09/07/2025  23:17    <DIR>        example_inputs
08/07/2025  22:53           8,902 fast_sampler.py
09/07/2025  20:50    <DIR>        img
08/07/2025  22:53             910 magellan.py
08/07/2025  22:53          20,788 mag_calc.py
08/07/2025  22:53          25,866 mag_cl.py
08/07/2025  22:53          18,849 mag_config.py
08/07/2025  22:53          72,336 mag_gui.py
08/07/2025  22:53           1,488 mag_recode.py
08/07/2025  22:53          22,065 mag_sampl.py
08/07/2025  22:53          14,116 mag_snp.py
08/07/2025  22:53          10,814 mag_stat.py
08/07/2025  22:53          32,734 mag_verif.py
08/07/2025  22:53          40,970 mag_viz.py
09/07/2025  20:50    <DIR>        model
08/07/2025  22:53          217,276 OpenSans-Regular.ttf
08/07/2025  22:53          28,534 README.md
08/07/2025  22:53           106 requirements.txt
08/07/2025  22:53           942 setup.cfg
08/07/2025  22:53           38  setup.py
09/07/2025  20:50    <DIR>        __pycache__
                   18 File(s)          517,183 bytes
```

4.Run Magellan by typing: `python mag_gui.py`

The screenshot shows the Magellan-v2.1 GUI. The window title is "Magellan-v2.1". The main text reads: "Welcome to Maternal Genealogy Lineage Analyser v2.1", "Authors: V. Brajkovic, I. Curik, D. Hrsak, S. Ristov", and "MaGeLLAn v2.1 is licenced under GNU General Public License v3.0". There are several buttons: "Load CSV", "Display pedigree file", "Close program", "Run ID recode to numerical", and "Save recoded pedigree as". Below these are tabs for "mag_verif", "mag_stat", "mag_calc", "mag_sampl", "mag_viz", and "mag_snp". The "mag_verif" tab is selected, showing the "MaGeLLAn verification module". It has two sections: "Lineage for conflict check:" with radio buttons for "Maternal" (selected) and "Paternal", and "Object of verification:" with radio buttons for "Haplogroup" (selected) and "SNP Sequence". There are buttons for "Run mag_verif", "View report", and "Clear report". Below this is a section for "Haplotype imputation:" with a button "Impute haplotype", a "Reliability:" section with radio buttons for "high" (selected) and "low", and a button "Save imputed CSV as". At the bottom, a text area displays pedigree statistics:

No. of individuals in pedigree	1647
No. of distinct haplotypes	0
No. of individuals with sequenced haplotype	0
No. of pairwise mismatches	0
Maximal no. of conflicts / individual	0 / NA
No. of informative individuals	0
No. of individuals participating in conflicts	0
No. of conflicting or misplaced individuals	0
Pruned no. of conflicting individuals	0

There are no conflicts in the pedigree.

3. Software functionalities

- **MaGeLan** – suite of four modules:

- ***mag_verif***



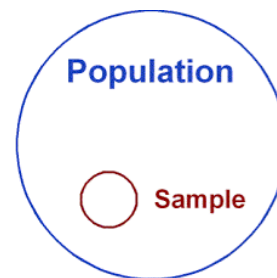
- ***mag_stat***



- ***mag_calc***

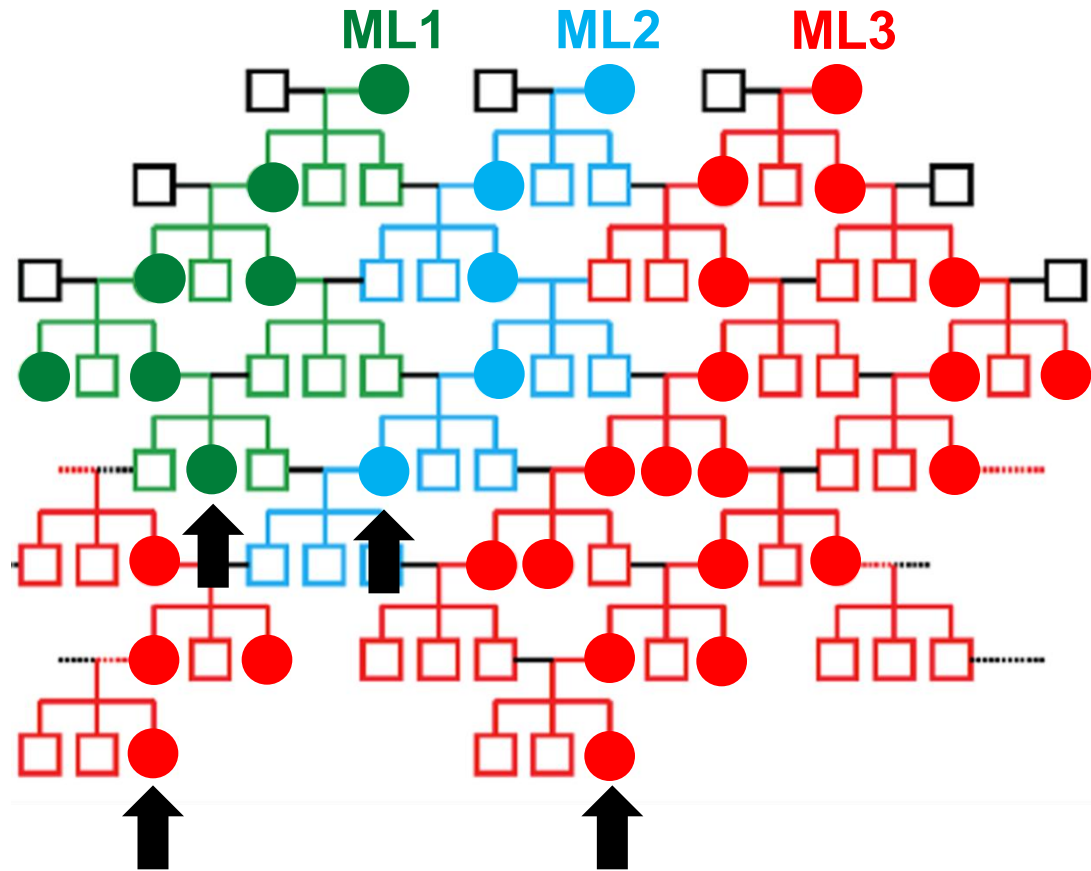
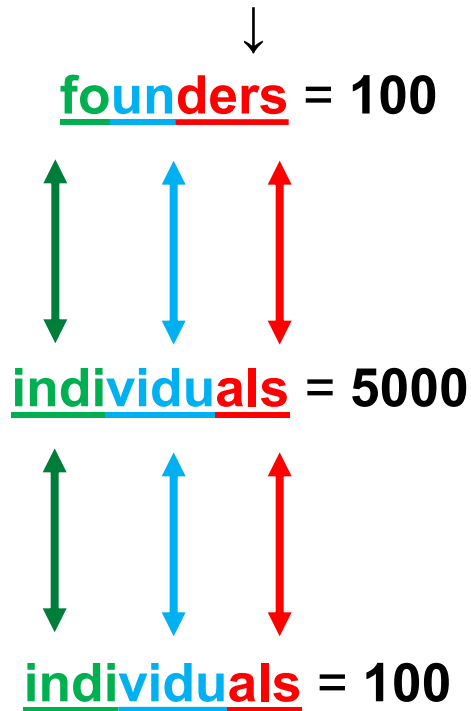


- ***mag_sampl***



3. Software functionalities

Maternal lineages



"Maternal inheritance without recombination"

MaGeLAn (Maternal Genealogy Lineage Analyser)

3.1. *mag_verif*

■ **Verification of the pedigree correctness**

- finds inconsistencies in female haplotype line
- calculates haplotype error rates
- search for standard pedigree errors:
 - 1. cycles in a pedigree – an individual repeated as its own parent
 - 2. gender inconsistencies
 - 3. when an individual is listed as a parent, but does not have its own record in the pedigree → non fatal error → „autocorrectional_log.txt”

■ **Output files are:**

- OutputVerif_Summary.txt
- OutputVerif_ConflictingIndividuals.txt
- OutputVerif_MisplacedBranches.txt
- ERROR_ALERT.TXT

OutputVerif_Summary.txt

No. of individuals in pedigree	4413
No. of distinct haplotypes	0
No. of individuals with sequenced haplotype	0
No. of pairwise mismatches	0
Maximal no. of conflicts / individual	0 / NA
No. of informative individuals	0
No. of individuals participating in conflicts	0
No. of conflicting or misplaced individuals	0
Pruned no. of conflicting individuals	0

There are no conflicts in the pedigree.

3.2. *mag_stat*

- Outputs various useful distributions of individuals over maternal pedigree lines.
- In particular, lists all individuals belonging to a given **founder dam line** with the **corresponding haplotype**.
- Imputation of a haplotype to each individual in pedigree (**connection between phenotype and mitochondrial haplotype**)
- **Output files** are:
 - OutputStat_DamLineMembership_1.txt
 - OutputStat_DamLineMembership_2.txt
 - OutputStat_DamLineMembershipAllInRefPop.txt
 - OutputStat_DamLineMembershipFemaleOnlyInRefPop.txt
 - OutputStat_DamLinesWithFemalesInRefPop.txt
 - OutputStat_DamLinesWithOnlyMalesInRefPop.txt

OutputStat_DamLineMembership_1.txt

```
founder dam: 040000093111973      number of individuals in dam line = 8      haplotype = N/A
040000606937973
040000340162842
040000497533142
040000468688573
040000254837173
040000093111973
040000398973273
040000529104773
founder dam: 040000087046873      number of individuals in dam line = 7      haplotype = N/A
040000087046873
040000040417773
040000328567273
040000560171473
040000413949473
040000450971973
040000352568373
```

OutputStat_DamLineMembership_2.txt

```
founder dam:individual in dam line
8400000000003841:84000000000055163
8400000000003841:8400000000005502
8400000000003841:840000000000275936
8400000000003841:84000000000090827
040000571672743:040000694704845
040000571672743:040000758088634
040000571672743:040000345550211
040000571672743:040000620785742
040000571672743:040000305001244
84000000000053381:84000000000053381
84000000000053381:040000566339973
84000000000053381:840000000000755396
84000000000053381:040000331228362
84000000000053381:040000569348773
```

OutputStat_DamLinesWithFemalesInRefPop.txt

```
276000970206864: no. of desc. in ref. pop. = 8
276000979313425: no. of desc. in ref. pop. = 3
756111900504092: no. of desc. in ref. pop. = 3
840000000011105: no. of desc. in ref. pop. = 4
756111900897729: no. of desc. in ref. pop. = 3
040000003577323: no. of desc. in ref. pop. = 3
040000053037464: no. of desc. in ref. pop. = 6
040000047670964: no. of desc. in ref. pop. = 6
756110154021003: no. of desc. in ref. pop. = 5
040000077586786: no. of desc. in ref. pop. = 2
040000025707749: no. of desc. in ref. pop. = 13
040000026691249: no. of desc. in ref. pop. = 4
840000000426072: no. of desc. in ref. pop. = 3
756110121091459: no. of desc. in ref. pop. = 4
```

3.3. *mag_calc*

- Calculates the **effective population** size separately for **founder dam lines**, **founder haplotype lines**, and **founder sire lines**.
- A meaningful haplotype line N_e can be computed only if enough of the individuals are sampled.
- **Output file** is:
 - OutputCalc_InputAndResults.txt

OutputCalc_InputAndResults_1925_2002.txt

```
Records in the studbook = 4413
No. of individuals in the reference population (1925 - 2002) = 3764
No. of female individuals in the reference population = 2404
No. of founder dams = 881
No. of founder dam lines in reference population = 748
No. of founder dam lines including lines with only males in reference population = 870
No. of founder dam lines in reference population with samples = 0
No. of founder dam lines in reference population with only one sample = 0
Total number of samples (haplotyped individuals) = 0
No. of samples in reference population = 0:   dams = 0,   sires = 0
```

-----|

Dam lines:

```
Probability of identity in founder dams = 0.0011350737797956867
Probability of identity of a dam line in reference population = 0.0019538982450214796
Increase in identity = 0.0008197549475726404
Effective dam line size = 1219.876748485727
```

Haplotype lines:

```
Probability of identity of a haplotype line in founder population = 0.0011350737797956858
Probability of identity of a haplotype line in reference population = 0.0019538982450214818
Increase in identity = 0.0008197549475726434
Effective haplotype line size = 1219.8767484857224
```

3.4. *mag_sampl*

- Accepts the optional “**available**” column with (‘1’ / anything) values.
- **Calculates** the **target number** of the **individuals** per dam line **for sequencing** within given **planned number of sequencing**.
- Restricts the target numbers to **available individuals** if available data is present.
- **Selects** the **candidates** that provide the **highest potential** for **haplotype diversity** within dam line.
- **Output files** are:
 - OutputSampl_IndividualsForSampling.txt
 - OutputSampl_DetailedInfo.txt
 - OutputSampl_AvailabilityRestrictions.txt

OutputSampl_DetailedInfo.txt

```
reference population size = 3764
dam lines in ref.pop. = 870
IndividualsMissingFounderDamInRefPopCount = 241
PreviouslySequencedInRefPop = 0
HowManyToSequence = 50
Number of lines without previous samples = 870
TargetSum (that remains to be proportionally divided among dam lines) = 0
```

FOUNDER DAM:

```
276000970206864 -> in ref.pop.: 8   targ: 0   prev: 0   todo:0
276000979313425 -> in ref.pop.: 3   targ: 0   prev: 0   todo:0
756111900504092 -> in ref.pop.: 3   targ: 0   prev: 0   todo:0
840000000011105 -> in ref.pop.: 4   targ: 0   prev: 0   todo:0
756111900897729 -> in ref.pop.: 3   targ: 0   prev: 0   todo:0
040000003577323 -> in ref.pop.: 3   targ: 0   prev: 0   todo:0
040000053037464 -> in ref.pop.: 6   targ: 0   prev: 0   todo:0
040000047670964 -> in ref.pop.: 6   targ: 0   prev: 0   todo:0
756110154021003 -> in ref.pop.: 5   targ: 0   prev: 0   todo:0
040000077586786 -> in ref.pop.: 2   targ: 0   prev: 0   todo:0
040000025707749 -> in ref.pop.: 13  targ: 0   prev: 0   todo:1
040000026691249 -> in ref.pop.: 4   targ: 0   prev: 0   todo:0
840000000426072 -> in ref.pop.: 3   targ: 0   prev: 0   todo:0
756110121091459 -> in ref.pop.: 4   targ: 0   prev: 0   todo:0
```

OutputSampl_IndividualsForSampling.txt

```
founder dam 040000025707749 : 040000567134473,  
founder dam 040000024292449 : 040000647564843,  
founder dam 040000062987186 : 040000199321586,  
founder dam 040000002556523 : 040000251634126,  
founder dam 840000000040077 : 8400000000181926,  
founder dam 840000000089500 : 8400000000853876,  
founder dam 040000002905723 : 040000340174334,  
founder dam 040000052761964 : 040000143225961,  
founder dam 040000432933532 : 040000243952345,
```

4. Example of the input pedigree file

- The input file must be in CSV (**comma-separated values**) → .csv or .txt
- The position of the information in columns must match the position of the corresponding keyword in the header!

x, extra information which I use to count number of individual
↑
header line → x,ID,father,mother,YOB,gender,haplotype,available,
1,ld100,0,0,2000,1,,0,
2,ld101,ld100,ld102,2005,2,hap1,1,
3,ld102,0,0,2001,2,hap1,0,

- **1 – male, 2 – female; 0 – missing parents;**
- **haplotype** - name tag of a haplotype; if present, haplotype data enables full functionality of all modules, however, modules are partially functional without it
- **available** - '1' for available, anything else for not available; exclusive use in module *mag_sampl*

5. Additional input files:

■ **reference_years.txt**

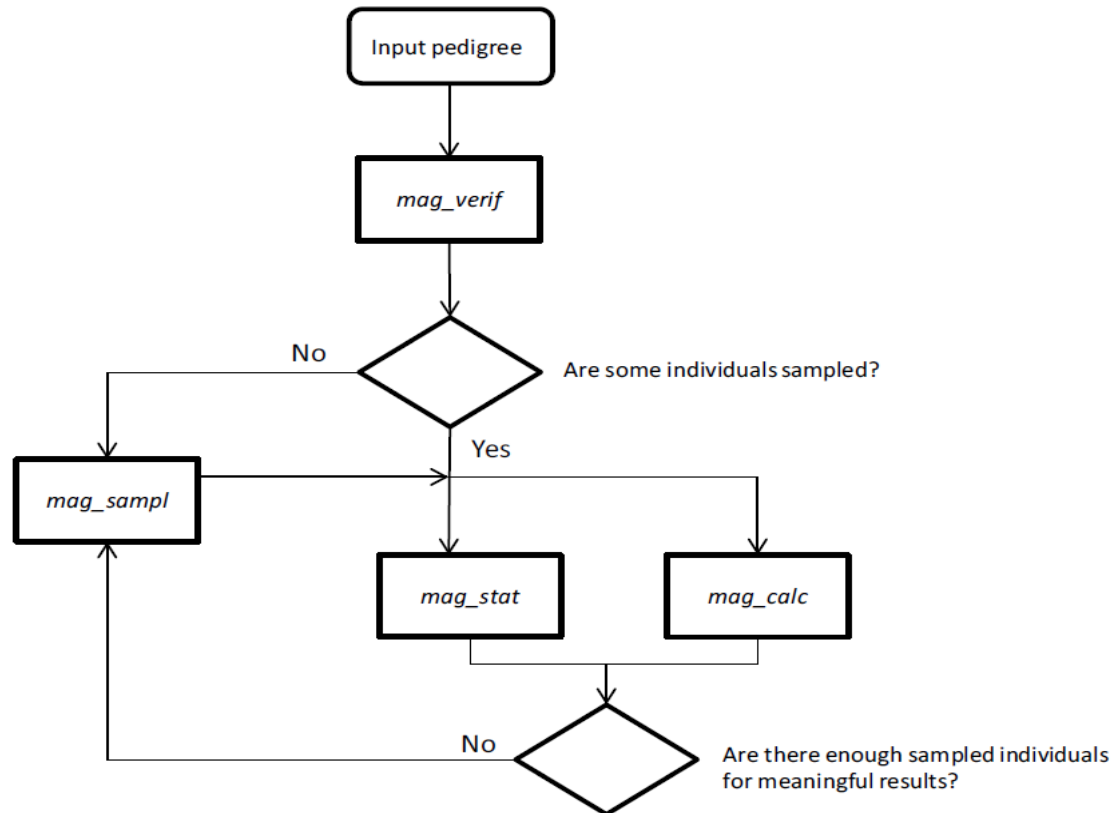
- stores the first and the last year of birth for the individuals included in the reference population
- formatted as two numbers in two lines
- used in modules *mag_stat*, *mag_calc* and *mag_sampl*

■ **planned_number_of_sequencings.txt**

- stores the number of planned sequencings
- formatted as one number in a single line
- exclusive use in module *mag_sampl*

If any of the additional files is missing, the default values (coded in the scripts) are used.

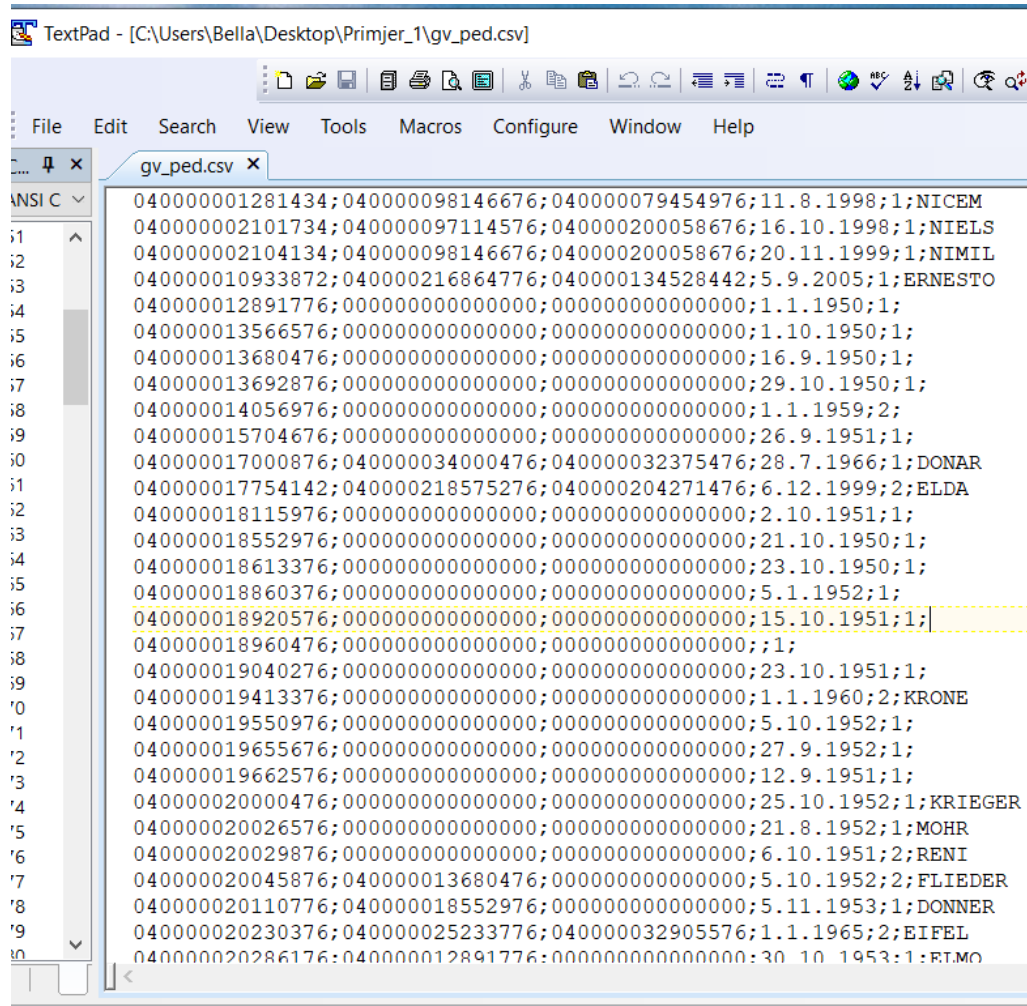
6. A typical workflow of the MaGelLan modules with a new pedigree



Each **module** performs the initial **verification** of pedigree correctness. In case of errors in the pedigree, module *mag_verif* outputs the description of errors, while other modules abort the execution and direct the user to module *mag_verif*.

Practical – preparation of pedigree for Magellan format

■ 1. Open pedigree “gv_ped.csv” using Textpad or Notepad



```
TextPad - [C:\Users\Bella\Desktop\Primjer_1\gv_ped.csv]
File Edit Search View Tools Macros Configure Window Help
gv_ped.csv x
ANSI C
i1 040000001281434;040000098146676;040000079454976;11.8.1998;1;NICEM
i2 040000002101734;040000097114576;040000200058676;16.10.1998;1;NIELS
i3 040000002104134;040000098146676;040000200058676;20.11.1999;1;NIMIL
i4 040000010933872;040000216864776;040000134528442;5.9.2005;1;ERNESTO
i5 040000012891776;000000000000000;000000000000000;1.1.1950;1;
i6 040000013566576;000000000000000;000000000000000;1.10.1950;1;
i7 040000013680476;000000000000000;000000000000000;16.9.1950;1;
i8 040000013692876;000000000000000;000000000000000;29.10.1950;1;
i9 040000014056976;000000000000000;000000000000000;1.1.1959;2;
i10 040000015704676;000000000000000;000000000000000;26.9.1951;1;
i11 040000017000876;040000034000476;040000032375476;28.7.1966;1;DONAR
i12 040000017754142;040000218575276;040000204271476;6.12.1999;2;ELDA
i13 040000018115976;000000000000000;000000000000000;2.10.1951;1;
i14 040000018552976;000000000000000;000000000000000;21.10.1950;1;
i15 040000018613376;000000000000000;000000000000000;23.10.1950;1;
i16 040000018860376;000000000000000;000000000000000;5.1.1952;1;
i17 040000018920576;000000000000000;000000000000000;15.10.1951;1;
i18 040000018960476;000000000000000;000000000000000;1;
i19 040000019040276;000000000000000;000000000000000;23.10.1951;1;
i20 040000019413376;000000000000000;000000000000000;1.1.1960;2;KRONE
i21 040000019550976;000000000000000;000000000000000;5.10.1952;1;
i22 040000019655676;000000000000000;000000000000000;27.9.1952;1;
i23 040000019662576;000000000000000;000000000000000;12.9.1951;1;
i24 040000020000476;000000000000000;000000000000000;25.10.1952;1;KRIEGER
i25 040000020026576;000000000000000;000000000000000;21.8.1952;1;MOHR
i26 040000020029876;000000000000000;000000000000000;6.10.1951;2;RENI
i27 040000020045876;040000013680476;000000000000000;5.10.1952;2;FLIEDER
i28 040000020110776;040000018552976;000000000000000;5.11.1953;1;DONNER
i29 040000020230376;040000025233776;040000032905576;1.1.1965;2;EIFEL
i30 040000020286176;040000012891776;000000000000000;30.10.1953;1;EIMO
```

■ 2. Copy (CTRL + A) whole pedigree and paste it into Excel

Practical

■ 3. Import pedigree into Excel (mark column A → Data → Text to columns)

The screenshot shows the Microsoft Excel interface with the 'Data' tab selected. The 'Text to Columns' button in the 'Data Tools' group is highlighted with a yellow arrow. The 'Convert Text to Columns Wizard - Step 1 of 3' dialog box is open, showing that the data is delimited. The 'Delimited' radio button is selected. The preview shows the first few lines of the pedigree data being imported. A yellow arrow points to the 'Next >' button.

Original data type

Choose the file type that best describes your data:

☒ Delimited - Characters such as commas or tabs separate each field.

☐ Fixed width - Fields are aligned in columns with spaces between each field.

Preview of selected data:

1	040000001281434;040000098146676;040000079454976;11.8.1998;1;NICEM
2	040000002101734;040000097114576;040000020058676;16.10.1998;1;NIELS
3	040000002104134;040000098146676;040000020058676;20.11.1999;1;NIMIL
4	040000010933872;0400000216864776;040000013452802;5.9.2005;1;ERNESTO
5	040000012891776;0000000000000000;0000000000000000;1.1950;1;
6	040000013566576;0000000000000000;0000000000000000;1.1950;1;

Practical

■ 4. Set Delimiter “:” to separate columns

Convert Text to Columns Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.

Delimiters

☐ Tab

☐ Semicolon

☐ Comma

☐ Space

☒ Other:

☐ Treat consecutive delimiters as one

Text qualifier:

Data preview

040000001281434	040000098146676	040000079454976	11.8.1998	1	NICEM
040000002101734	040000097114576	040000200058676	16.10.1998	1	NIELS
040000002104134	040000098146676	040000200058676	20.11.1999	1	NIMIL
040000010933872	040000216864776	040000134528442	5.9.2005	1	ERNESTO
040000012891776	000000000000000	000000000000000	1.1.1950	1	
040000013566576	000000000000000	000000000000000	1.10.1950	1	

< >

Cancel < Back **Next >** Finish

00000000:25 10 1952:1:KRIFGFR

Practical

■ 5. Set first four columns to the **Text**, and last two to **General**

Convert Text to Columns Wizard - Step 3 of 3

This screen lets you select each column and set the Data Format.

Column data format

☒ General
☐ Text
☐ Date: DMY
☐ Do not import column (skip)

'General' converts numeric values to numbers, date values to dates, and all remaining values to text.

Advanced...

Destination: \$A\$1


Data preview

Text	Text	Text	Text	General	General
040000001281434	040000098146676	040000079454976	11.8.1998	1	NICEM
040000002101734	040000097114576	040000200058676	16.10.1998	1	NIELS
040000002104134	040000098146676	040000200058676	20.11.1999	1	NIMIL
040000010933872	040000216864776	040000134528442	5.9.2005	1	ERNESTO
040000012891776	000000000000000	000000000000000	1.1.1950	1	
040000013566576	000000000000000	000000000000000	1.10.1950	1	

Cancel < Back Next > Finish

Practical

■ 6. Now we have to extract year of birth



	A	B	C	D	E	F
1	040000001281434	0400000098146676	0400000079454976	11.8.1998	1	NICEM
2	040000002101734	0400000097114576	040000200058676	16.10.1998	1	NIELS
3	040000002104134	0400000098146676	040000200058676	20.11.1999	1	NIMIL
4	040000010933872	040000216864776	040000134528442	5.9.2005	1	ERNESTO
5	040000012891776	0000000000000000	0000000000000000	1.1.1950	1	
6	040000013566576	0000000000000000	0000000000000000	1.10.1950	1	
7	040000013680476	0000000000000000	0000000000000000	16.9.1950	1	
8	040000013692876	0000000000000000	0000000000000000	29.10.1950	1	
9	040000014056976	0000000000000000	0000000000000000	1.1.1959	2	
10	040000015704676	0000000000000000	0000000000000000	26.9.1951	1	
11	040000017000876	040000034000476	040000032375476	28.7.1966	1	DONAR
12	040000017754142	040000218575276	040000204271476	6.12.1999	2	ELDA
13	040000018115976	0000000000000000	0000000000000000	2.10.1951	1	
14	040000018552976	0000000000000000	0000000000000000	21.10.1950	1	
15	040000018613376	0000000000000000	0000000000000000	23.10.1950	1	
16	040000018860376	0000000000000000	0000000000000000	5.1.1952	1	
17	040000018920576	0000000000000000	0000000000000000	15.10.1951	1	
18	040000018960476	0000000000000000	0000000000000000		1	
19	040000019040276	0000000000000000	0000000000000000	23.10.1951	1	
20	040000019413376	0000000000000000	0000000000000000	1.1.1960	2	KRONE
21	040000019550976	0000000000000000	0000000000000000	5.10.1952	1	
22	040000019655676	0000000000000000	0000000000000000	27.9.1952	1	
23	040000019662576	0000000000000000	0000000000000000	12.9.1951	1	
24	040000020000476	0000000000000000	0000000000000000	25.10.1952	1	KRIEGER
25	040000020026576	0000000000000000	0000000000000000	21.8.1952	1	MOHR
26	040000020029876	0000000000000000	0000000000000000	6.10.1951	2	RENI

< > Sheet1 +

Practical

■ 7. Add two/three empty columns on the right side of column D



	A	B	C	D	E	F	G	H	I
1	040000001281434	0400000098146676	040000079454976	11.8.1998				1	NICEM
2	040000002101734	0400000097114576	0400000200058676	16.10.1998				1	NIELS
3	040000002104134	0400000098146676	0400000200058676	20.11.1999				1	NIMIL
4	040000010933872	0400000216864776	0400000134528442	5.9.2005				1	ERNESTO
5	040000012891776	0000000000000000	0000000000000000	1.1.1950				1	
6	040000013566576	0000000000000000	0000000000000000	1.10.1950				1	
7	040000013680476	0000000000000000	0000000000000000	16.9.1950				1	
8	040000013692876	0000000000000000	0000000000000000	29.10.1950				1	
9	040000014056976	0000000000000000	0000000000000000	1.1.1959				2	
10	040000015704676	0000000000000000	0000000000000000	26.9.1951				1	
11	040000017000876	040000034000476	040000032375476	28.7.1966				1	DONAR
12	040000017754142	0400000218575276	0400000204271476	6.12.1999				2	ELDA
13	040000018115976	0000000000000000	0000000000000000	2.10.1951				1	
14	040000018552976	0000000000000000	0000000000000000	21.10.1950				1	
15	040000018613376	0000000000000000	0000000000000000	23.10.1950				1	
16	040000018860376	0000000000000000	0000000000000000	5.1.1952				1	
17	040000018920576	0000000000000000	0000000000000000	15.10.1951				1	
18	040000018960476	0000000000000000	0000000000000000					1	
19	040000019040276	0000000000000000	0000000000000000	23.10.1951				1	
20	040000019413376	0000000000000000	0000000000000000	1.1.1960				2	KRONE
21	040000019550976	0000000000000000	0000000000000000	5.10.1952				1	
22	040000019655676	0000000000000000	0000000000000000	27.9.1952				1	
23	040000019662576	0000000000000000	0000000000000000	12.9.1951				1	
24	040000020000476	0000000000000000	0000000000000000	25.10.1952				1	KRIEGER
25	040000020026576	0000000000000000	0000000000000000	21.8.1952				1	MOHR
26	040000020029876	0000000000000000	0000000000000000	6.10.1951				2	RENI

Practical

- 8. Separate column D (mark column D → Data → Text to columns → separator “.” → next

The screenshot shows the 'Convert Text to Columns Wizard - Step 2 of 3' dialog box in Microsoft Excel. The 'Delimiters' section has 'Other' checked, and the text box next to it contains a period '.'. The 'Data preview' section shows the resulting data split by periods. The spreadsheet data in column D includes dates like '11.8.1998', '16.10.1998', etc.

	A	B	C	D
1	040000001281434	040000098146676	040000079454976	11.8.1998
2	040000002101734	040000097114576	040000200058676	16.10.1998
3	040000002104134	040000098146676	040000200058676	20.11.1999
4	040000010933872	040000216864776	040000134528442	5.9.2005
5	040000012891776	000000000000000	000000000000000	1.1.1950
6	040000013566576	000000000000000	000000000000000	1.10.1950
7	040000013680476	000000000000000	000000000000000	16.9.1950
8	040000013692876	000000000000000	000000000000000	29.10.1950
9	040000014056976	000000000000000	000000000000000	1.1.1959
10	040000015704676	000000000000000	000000000000000	26.9.1951
11	040000017000876	040000034000476	040000032375476	28.7.1966
12	040000017754142	040000218575276	040000204271476	6.12.1999
13	040000018115976	000000000000000	000000000000000	2.10.1951
14	040000018552976	000000000000000	000000000000000	21.10.1950
15	040000018613376	000000000000000	000000000000000	23.10.1950
16	040000018860376	000000000000000	000000000000000	5.1.1952
17	040000018920576	000000000000000	000000000000000	15.10.1951
18	040000018960476	000000000000000	000000000000000	
19	040000019040276	000000000000000	000000000000000	23.10.1951
20	040000019413376	000000000000000	000000000000000	1.1.1960
21	040000019550976	000000000000000	000000000000000	5.10.1952
22	040000019655676	000000000000000	000000000000000	27.9.1952
23	040000019662576	000000000000000	000000000000000	12.9.1951
24	040000020000476	000000000000000	000000000000000	25.10.1952
25	040000020026576	000000000000000	000000000000000	21.8.1952
26	040000020029876	000000000000000	000000000000000	6.10.1951

Practical

■ 9. Leave “General” for all three columns → Finish

Convert Text to Columns Wizard - Step 3 of 3

This screen lets you select each column and set the Data Format.

Column data format

- ☒ General
- ☐ Text
- ☐ Date: DMY
- ☐ Do not import column (skip)

'General' converts numeric values to numbers, date values to dates, and all remaining values to text.

Advanced...

Destination: \$D\$1

Data preview

General	General	General
11	8	1998
16	10	1998
20	11	1999
5	9	2005
1	1	1950
1	10	1950

1 KRIEGER
1 MOHR
2 RENI

Ready Accessibility: Good to go Count: 1573 100%

Practical

■ 10. Subset only these columns:

	A	B	C	D	E
1	040000001281434	040000098146676	040000079454976	1998	1
2	040000002101734	040000097114576	040000200058676	1998	1
3	040000002104134	040000098146676	040000200058676	1999	1
4	040000010933872	040000216864776	040000134528442	2005	1
5	040000012891776	000000000000000	000000000000000	1950	1
6	040000013566576	000000000000000	000000000000000	1950	1
7	040000013680476	000000000000000	000000000000000	1950	1
8	040000013692876	000000000000000	000000000000000	1950	1
9	040000014056976	000000000000000	000000000000000	1959	2
10	040000015704676	000000000000000	000000000000000	1951	1
11	040000017000876	040000034000476	040000032375476	1966	1
12	040000017754142	040000218575276	040000204271476	1999	2
13	040000018115976	000000000000000	000000000000000	1951	1
14	040000018552976	000000000000000	000000000000000	1950	1
15	040000018613376	000000000000000	000000000000000	1950	1
16	040000018860376	000000000000000	000000000000000	1952	1
17	040000018920576	000000000000000	000000000000000	1951	1
18	040000018960476	000000000000000	000000000000000		1
19	040000019040276	000000000000000	000000000000000	1951	1
20	040000019413376	000000000000000	000000000000000	1960	2
21	040000019550976	000000000000000	000000000000000	1952	1
22	040000019655676	000000000000000	000000000000000	1952	1
23	040000019662576	000000000000000	000000000000000	1951	1
24	040000020000476	000000000000000	000000000000000	1952	1
25	040000020026576	000000000000000	000000000000000	1952	1
26	040000020029876	000000000000000	000000000000000	1951	2

Practical

■ 11. Prepare input for Magellan format:

1	x	ID	father	mother	YOB	gender	haplotype	available
2		1 040000001281434	040000098146676	040000079454976	1998	1		
3		2 040000002101734	040000097114576	040000200058676	1998	1		
4		3 040000002104134	040000098146676	040000200058676	1999	1		
5		4 040000010933872	040000216864776	040000134528442	2005	1		
6		5 040000012891776	000000000000000	000000000000000	1950	1		
7		6 040000013566576	000000000000000	000000000000000	1950	1		
8		7 040000013680476	000000000000000	000000000000000	1950	1		
9		8 040000013692876	000000000000000	000000000000000	1950	1		
10		9 040000014056976	000000000000000	000000000000000	1959	2		
11		10 040000015704676	000000000000000	000000000000000	1951	1		
12		11 040000017000876	040000034000476	040000032375476	1966	1		
13		12 040000017754142	040000218575276	040000204271476	1999	2		
14		13 040000018115976	000000000000000	000000000000000	1951	1		
15		14 040000018552976	000000000000000	000000000000000	1950	1		
16		15 040000018613376	000000000000000	000000000000000	1950	1		
17		16 040000018860376	000000000000000	000000000000000	1952	1		
18		17 040000018920576	000000000000000	000000000000000	1951	1		
19		18 040000018960476	000000000000000	000000000000000		1		
20		19 040000019040276	000000000000000	000000000000000	1951	1		
21		20 040000019413376	000000000000000	000000000000000	1960	2		
22		21 040000019550976	000000000000000	000000000000000	1952	1		
23		22 040000019655676	000000000000000	000000000000000	1952	1		
24		23 040000019662576	000000000000000	000000000000000	1951	1		
25		24 040000020000476	000000000000000	000000000000000	1952	1		
26		25 0000020026576	000000000000000	000000000000000	1952	1		

Practical

■ 12. Replace all individuals 0000000000000000 with 0

The screenshot shows a Microsoft Excel spreadsheet with columns labeled ID, father, mother, YOB, and gender. The data is organized into rows, with the first row (row 1) containing the header information. The 'ID' column contains a series of 16-digit numbers, many of which are '0000000000000000'. The 'father' and 'mother' columns contain 12-digit numbers. The 'YOB' column contains years, and the 'gender' column contains '1'.

A 'Find and Replace' dialog box is open, showing the 'Find' tab. The 'Find what' field contains '0000000000000000', and the 'Replace with' field contains '0'. The 'Within' dropdown is set to 'Sheet', and the 'Search' dropdown is set to 'By Rows'. The 'Look in' dropdown is set to 'Formulas'. The 'Match case' and 'Match entire cell contents' checkboxes are unchecked. The 'Replace All' button is highlighted.

A 'Microsoft Excel' message box is displayed, stating 'All done. We made 647 replacements.' with an 'OK' button.

x	ID	father	mother	YOB	gend	haploty	availabl
1	040000001281434	040000098146676	040000079454976	1998	1		
2	040000002101734	040000097114576	040000200058676	1998	1		
3	040000002104134	040000098146676	040000200058676	1999	1		
4	040000010933872	040000216864776	040000079454976	1998	1		
5	040000012891776	0	0				
6	040000013566576	0	0				
7	040000013680476	0	0				
8	040000013692876	0	0				
9	040000014056976	0	0				
10	040000015704676	0	0				
11	040000017000876	040000034000476	040000079454976	1998	1		
12	040000017754142	040000218575276	040000079454976	1998	1		
13	040000018115976	0	0				
14	040000018552976	0	0				
15	040000018613376	0	0				
16	040000018860376	0	0				
17	040000018920576	0	0	1951	1		
18	040000018960476	0	0		1		
19	040000019040276	0	0	1951	1		
20	040000019413376	0	0	1960	2		
21	040000019550976	0	0	1952	1		
22	040000019655676	0	0	1952	1		
23	040000019662576	0	0	1951	1		
24	040000020000476	0	0	1952	1		
25	040000020026576	0	0	1952	1		

Practical

- 13. Filter all "Blank" YEAR OF BIRTH and replace by 0; sort YOB from smallest to largest, notice interval 1950 - 2006

Sort & Filter task pane for column YOB:

- Sort Smallest to Largest (selected)
- Sort Largest to Smallest
- Sort by Color
- Sheet View
- Clear Filter From "YOB"
- Filter by Color
- Number Filters
 - Search
 - ☐ 1999
 - ☐ 2000
 - ☐ 2001
 - ☐ 2002
 - ☐ 2003
 - ☐ 2004
 - ☐ 2005
 - ☐ 2006
 - ☒ (Blanks)

OK Cancel

ID	father	mother	YOB	gend	haploty	ava
18	040000018960476	0		1		
32	040000020439576	0		1		
33	040000020440776	0		1		
39	040000021040576	0		1		
43	040000021132676	0		1		
47	040000021525276	0		1		
53	040000022000876	0		1		
57	040000022190976	0		1		
73	040000023231176	0		1		
79	040000023503976	0		1		
85	040000024121976	0		1		
93	040000024648776	0		1		
96	040000024786576	0		2		
99	040000024878676	0		1		
102	040000024931176	0		2		
110	040000025251976	0		2		
113	040000025320376	0		1		
120	040000025484276	0		2		
131	040000026025776	0		1		
133	040000026162476	0		1		
135	040000026194376	0		1		
139	040000026480976	0		2		
160	040000026930476	0		1		
167	040000027285576	0		2		
175	040000027626776	0		2		

Sheet1

Ready 74 of 1647 records found Accessibility: Good to go

Sort & Filter task pane for column YOB:

- Sort Smallest to Largest (selected)
- Sort Largest to Smallest
- Sort by Color
- Sheet View
- Clear Filter From "YOB"
- Filter by Color
- Number Filters
 - Search
 - ☐ 1999
 - ☐ 2000
 - ☐ 2001
 - ☐ 2002
 - ☐ 2003
 - ☐ 2004
 - ☐ 2005
 - ☐ 2006
 - ☒ (Blanks)

OK Cancel

ID	father	mother	YOB	gend	haploty	availabl
18	040000018960476	0	0	1		
32	040000020439576	0	0	1		
33	040000020440776	0	0	1		
39	040000021040576	0	0	1		
43	040000021132676	0	0	1		
47	040000021525276	0	0	1		
53	040000022000876	0	0	1		
57	040000022190976	0	0	1		
73	040000023231176	0	0	1		
79	040000023503976	0	0	1		
85	040000024121976	0	0	1		
93	040000024648776	0	0	1		
96	040000024786576	0	0	2		
99	040000024878676	0	0	1		
102	040000024931176	0	0	2		
110	040000025251976	0	0	2		
113	040000025320376	0	0	1		
120	040000025484276	0	0	2		
131	040000026025776	0	0	1		
133	040000026162476	0	0	1		
135	040000026194376	0	0	1		
139	040000026480976	0	0	2		
160	040000026930476	0	0	1		
167	040000027285576	0	0	2		
175	040000027626776	0	0	2		

Sheet1

74 of 1647 records found Accessibility: Good to go

Practical

- 14. Mark field A1, then CTRL+A to mark all columns and copy pedigree in Texpad

A	B	C	D	E	F	G	H
x	ID	father	mother	YOB	gender	haplotype	available
18	040000018960476	0	0	0	1		
32	040000020439576	0	0	0	1		
33	040000020440776	0	0	0	1		
39	040000021040576	0	0	0	1		
43	040000021132676	0	0	0	1		
47	040000021525276	0	0	0	1		
53	040000022000876	0	0	0	1		
57	040000022190976	0	0	0	1		
73	040000023231176	0	0	0	1		
79	040000023503976	0	0	0	1		
85	040000024121976	0	0	0	1		
93	040000024648776	0	0	0	1		
96	040000024786576	0	0	0	2		
99	040000024878676	0	0	0	1		
102	040000024931176	0	0	0	2		
110	040000025251976	0	0	0	2		
113	040000025320376	0	0	0	1		
120	040000025484276	0	0	0	2		
131	040000026025776	0	0	0	1		
133	040000026162476	0	0	0	1		
135	040000026194376	0	0	0	1		
139	040000026480976	0	0	0	2		
160	040000026930476	0	0	0	1		
167	040000027285576	0	0	0	2		
175	040000027626776	0	0	0	2		

Practical

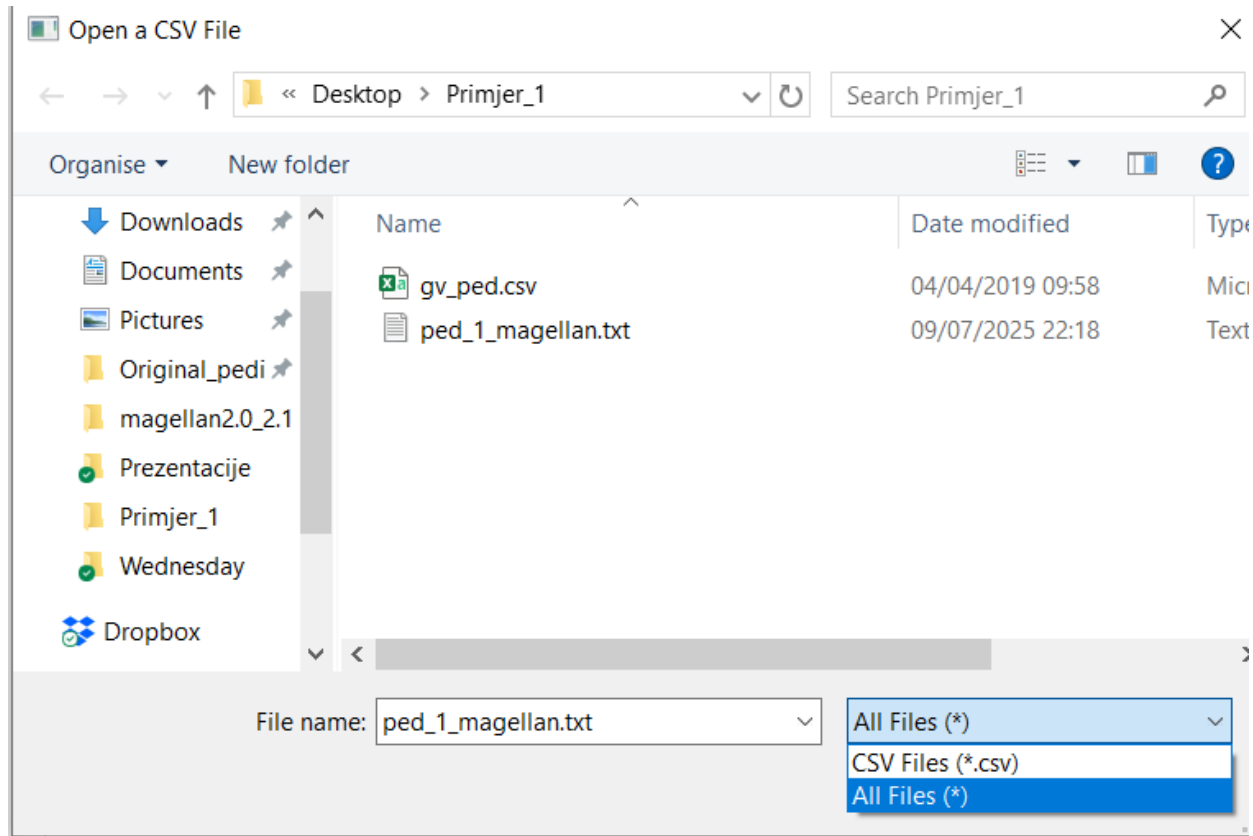
- 15. Mark and copy “invisible” delimiter and replace with “,”, and save as “ped_1_magellan.txt

The screenshot shows a text editor window with a table of data. The table has columns: x, ID, father, mother, YOB, gender, haplotype, and available. Row 18 is highlighted, and a context menu is open over it. The 'Copy' option is selected. A 'Replace' dialog is open on the right, showing 'Find what:' as an empty field and 'Replace with:' as a comma (,). The 'Conditions' section has 'Text' selected, 'Match whole words' unchecked, 'Match case' checked, and 'Regular expression' unchecked. The 'Scope' section has 'Active document' selected, 'Selected text' unchecked, and 'All documents' unchecked. The 'Replace All' button is highlighted.

x	ID	father	mother	YOB	gender	haplotype	available
18	0400000018960476	0	0	0	0	1	
32				0	0	1	
33				0	0	1	
39				0	0	1	
43				0	0	1	
47				0	0	1	
53				0	0	1	
57				0	0	1	
73				0	0	1	
79				0	0	1	
85				0	0	1	
93				0	0	1	
96				0	0	2	
99				0	0	1	
102				0	0	2	
110				0	0	2	
113				0	0	1	
120				0	0	2	
131				0	0	1	
133				0	0	1	
135				0	0	1	
139				0	0	2	
160	040000026930476	0	0	0	0	1	
167	040000027285576	0	0	0	0	2	
175	040000027626776	0	0	0	0	2	
177	040000027660976	0	0	0	0	1	
185	040000027872676	0	0	0	0	2	
200	040000028428976	0	0	0	0	2	
204	040000028500776	0	0	0	0	1	

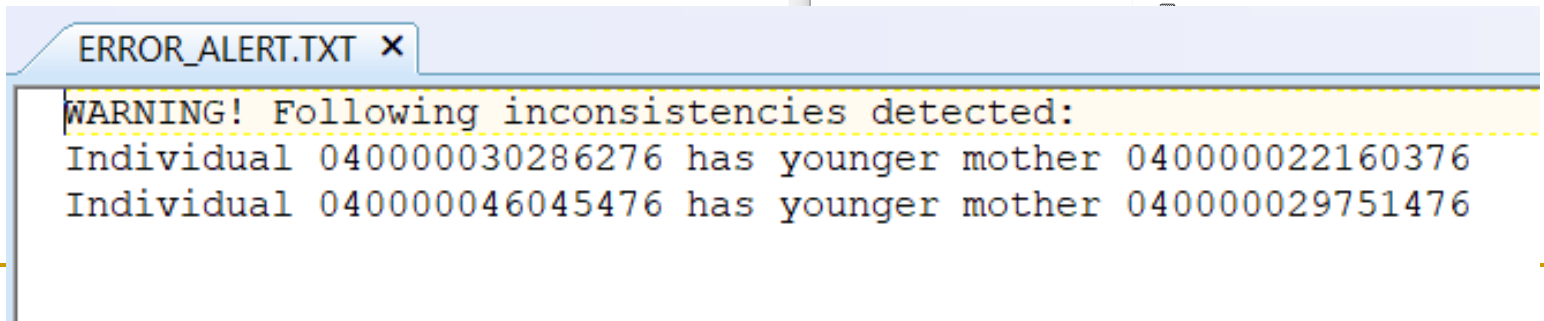
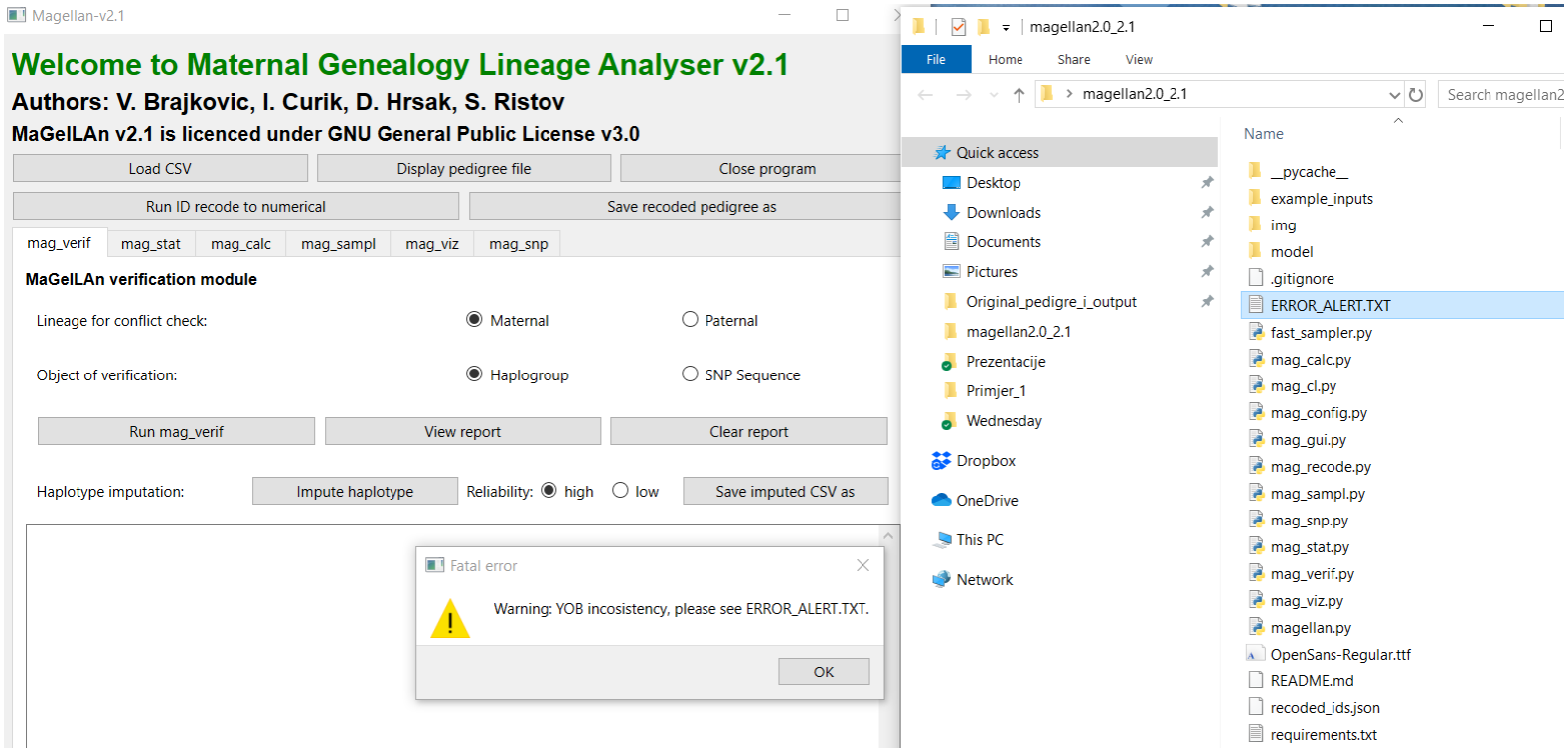
Practical

■ 16. Open with magellan 2.0/2.1 GUI



Practical

■ 17. Notice error alert



Practical

- 18. Notice error alert – replace year of birth of younger mothers with 0, search

```
ERROR_ALERT.TXT x
WARNING! Following inconsistencies detected:
Individual 040000030286276 has younger mother 040000022160376
Individual 040000046045476 has younger mother 040000029751476
```

x	ID	father	mother	YOB	gender	haplotype	available
---	----	--------	--------	-----	--------	-----------	-----------

273,	040000030286276	040000023500676	040000022160376	1959	2	,	,
275,	040000030413576	040000024340576	0	1959	2	,	,

ID

mother

54,	040000022030576	0	0	1960	2	,	,
56,	040000022160376	0	0	1960	2	,	,
91,	040000024519176	0	0	1960	2	,	,

mother

Practical

■ 19. Load corrected pedigree, Run mag_verif, View report

Magellan-v2.1

Welcome to Maternal Genealogy Lineage Analyser v2.1
Authors: V. Brajkovic, I. Curik, D. Hrsak, S. Ristov
MaGeLLAn v2.1 is licenced under GNU General Public License v3.0

Load CSV Display pedigree file Close program

Run ID recode to numerical Save recoded pedigree as

mag_verif mag_stat mag_calc mag_sampl mag_viz mag_snp

MaGeLLAn verification module

Lineage for conflict check: ☒ Maternal ☐ Paternal

Object of verification: ☒ Haplogroup ☐ SNP Sequence

Run mag_verif View report Clear report

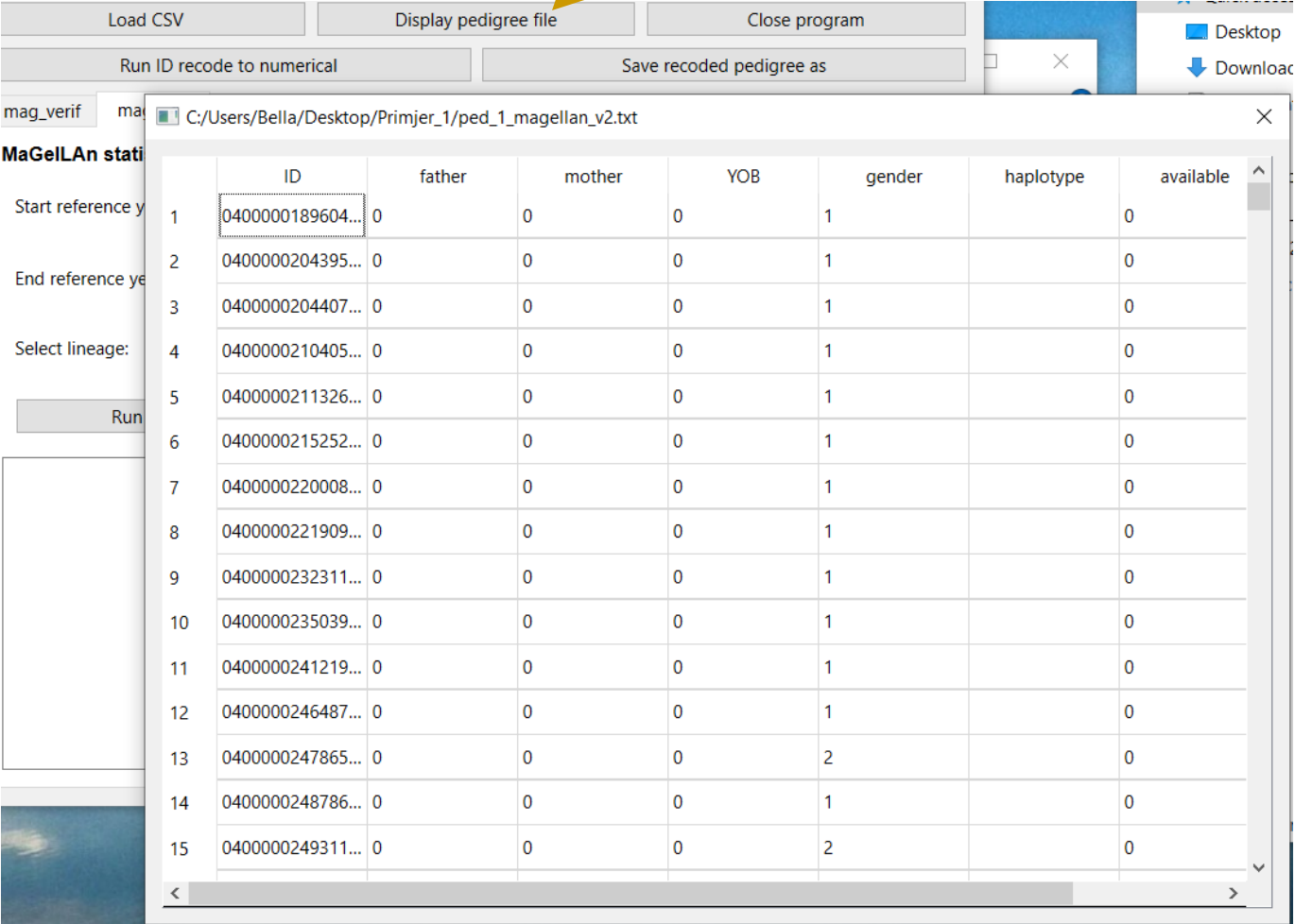
Haplotype imputation: Impute haplotype Reliability: ☒ high ☐ low Save imputed CSV as

No. of individuals in pedigree	1647
No. of distinct haplotypes	0
No. of individuals with sequenced haplotype	0
No. of pairwise mismatches	0
Maximal no. of conflicts / individual	0 / NA
No. of informative individuals	0
No. of individuals participating in conflicts	0
No. of conflicting or misplaced individuals	0
Pruned no. of conflicting individuals	0

There are no conflicts in the pedigree.

Practical

■ 20. Display pedigree file



The screenshot shows the MaGeLLAn software interface. At the top, there are buttons: 'Load CSV', 'Display pedigree file' (highlighted with a yellow arrow), and 'Close program'. Below these are 'Run ID recode to numerical' and 'Save recoded pedigree as'. On the left, there are input fields for 'mag_verif', 'mag', 'Start reference year', 'End reference year', and 'Select lineage:', along with a 'Run' button. The main window displays a pedigree table with the following columns: ID, father, mother, YOB, gender, haplotype, and available. The table contains 15 rows of data.

	ID	father	mother	YOB	gender	haplotype	available
1	0400000189604...	0	0	0	1		0
2	0400000204395...	0	0	0	1		0
3	0400000204407...	0	0	0	1		0
4	0400000210405...	0	0	0	1		0
5	0400000211326...	0	0	0	1		0
6	0400000215252...	0	0	0	1		0
7	0400000220008...	0	0	0	1		0
8	0400000221909...	0	0	0	1		0
9	0400000232311...	0	0	0	1		0
10	0400000235039...	0	0	0	1		0
11	0400000241219...	0	0	0	1		0
12	0400000246487...	0	0	0	1		0
13	0400000247865...	0	0	0	2		0
14	0400000248786...	0	0	0	1		0
15	0400000249311...	0	0	0	2		0

Practical

■ 21. Run ID to recode to numerical and Save recoded pedigree

```
TextPad - [C:\Users\Bella\Desktop\Primjer_1\recoded_ped_1_magellan.csv]
File Edit Search View Tools Macros Configure Window Help
ID,father,mother,YOB,gender,haploptype,available,oldID
1001,0,0,0,1,,0,040000018960476
1002,0,0,0,1,,0,040000020439576
1003,0,0,0,1,,0,040000020440776
1004,0,0,0,1,,0,040000021040576
1005,0,0,0,1,,0,040000021132676
1006,0,0,0,1,,0,040000021525276
1007,0,0,0,1,,0,040000022000876
1008,0,0,0,1,,0,040000022190976
1009,0,0,0,1,,0,040000023231176
1010,0,0,0,1,,0,040000023503976
1011,0,0,0,1,,0,040000024121976
1012,0,0,0,1,,0,040000024648776
1013,0,0,0,2,,0,040000024786576
1014,0,0,0,1,,0,040000024878676
1015,0,0,0,2,,0,040000024931176
1016,0,0,0,2,,0,040000025251976
1017,0,0,0,1,,0,040000025320376
1018,0,0,0,2,,0,040000025484276
1019,0,0,0,1,,0,040000026025776
1020,0,0,0,1,,0,040000026162476
1021,0,0,0,1,,0,040000026194376
1022,0,0,0,2,,0,040000026480976
1023,0,0,0,1,,0,040000026930476
1024,0,0,0,2,,0,040000027285576
1025,0,0,0,2,,0,040000027626776
1026,0,0,0,1,,0,040000027660976
1027,0,0,0,2,,0,040000027872676
1028,0,0,0,2,,0,040000028428976
1029,0,0,0,1,,0,040000028500776
1030,0,0,0,1,,0,040000028675976
1031,0,0,0,2,,0,040000028708876
```

Practical

■ 22. Mag_stat module for the reference year 2000 - 2006

Load CSV

Display pedigree file

Close program

Run ID recode to numerical

Save recoded pedigree as

mag_verif

mag_stat

mag_calc

mag_sampl

mag_viz

mag_snp

MaGeLLan statistics module

Start reference year: 2000

Set

End reference year: 2006

Set

Select lineage:

☒ Maternal

☐ Paternal

Run mag_stat

View report

Clear report

founder dam: 040000028898976	number of individuals in dam line = 35	haplotype = N/A
founder dam: 040000020449776	number of individuals in dam line = 31	haplotype = N/A
founder dam: 040000031883776	number of individuals in dam line = 23	haplotype = N/A
founder dam: 040000027447176	number of individuals in dam line = 21	haplotype = N/A
founder dam: 040000032734876	number of individuals in dam line = 20	haplotype = N/A
founder dam: 040000030155376	number of individuals in dam line = 19	haplotype = N/A
founder dam: 040000026621976	number of individuals in dam line = 18	haplotype = N/A
founder dam: 040000032682676	number of individuals in dam line = 18	haplotype = N/A
founder dam: 040000031036176	number of individuals in dam line = 17	haplotype = N/A
founder dam: 040000044757276	number of individuals in dam line = 17	haplotype = N/A
founder dam: 040000031158876	number of individuals in dam line = 15	haplotype = N/A
founder dam: 040000022620976	number of individuals in dam line = 14	haplotype = N/A
founder dam: 040000033510976	number of individuals in dam line = 14	haplotype = N/A
founder dam: 040000033947876	number of individuals in dam line = 14	haplotype = N/A
founder dam: 040000024741176	number of individuals in dam line = 13	haplotype = N/A
founder dam: 040000033608776	number of individuals in dam line = 13	haplotype = N/A

mag_snp.py 08,
mag_snp.py 08,
mag_stat.py 08,
mag_verif.py 08,
mag_viz.py 08,
magellan.py 08,
OpenSans-Regular.ttf 08,
OutputStat_DamLineMembership_1.txt 09,
OutputStat_DamLineMembership_2.txt 09,
OutputStat_DamLineMembershipAllInRef... 09,
OutputStat_DamLineMembershipFemale... 09,
OutputStat_DamLinesWithFemalesInRefP... 09,
OutputStat_DamLinesWithOnlyMalesInRe... 09,
OutputVerif_ConflictingIndividuals.txt 09,
OutputVerif_DetailedConflictingIndividua... 09,
OutputVerif_MisplacedBranches.txt 09,
OutputVerif_Summary.txt 09,
README.md 08,
recoded_ids.json 09,
requirements.txt 08,
setup.cfg 08,
setup.py 08,

Practical

■ 23. Mag_calc module for the reference year 2000 - 2006

Load CSV

Display pedigree file

Close program

Run ID recode to numerical

Save recoded pedigree as

mag_verif

mag_stat

mag_calc

mag_sampl

mag_viz

mag_snp

MaGelAn calculation module

Start reference year: 2000

Set

End reference year: 2006

Set

Select lineage:

☒ Maternal

☐ Paternal

Run mag_calc

View report

Clear report

Records in the studbook = 1647
No. of individuals in the reference population (2000 - 2006) = 85
No. of female individuals in the reference population = 15
No. of founder dams = 270
No. of founder dam lines in reference population = 13
No. of founder dam lines including lines with only males in reference population = 40
No. of founder dam lines in reference population with samples = 0
No. of founder dam lines in reference population with only one sample = 0
Total number of samples (haplotyped individuals) = 0
No. of samples in reference population = 0: dams = 0, sires = 0

Dam lines:

Probability of identity in founder dams = 0.003703703703703704
Probability of identity of a dam line in reference population = 0.08444444444444445
Increase in identity = 0.08104089219330854
Effective dam line size = 12.339449541284406

Haplotype lines:

Practical

■ 24. Mag_viz

Load CSV

Display pedigree file

Close program

Run ID recode to numerical

Save recoded pedigree as

mag_verif

mag_stat

mag_calc

mag_sampl

mag_viz

mag_snp

MaGeLLAn visualization module

Enter unit ID: 040000196162847

Set

Start reference year: 1980

Set

End reference year: 2002

Set

Generations before: Enter generations before

Set

End reference year: Enter generations after

Set

Select lineage:

☒ Maternal

☐ Paternal

Select image size:

☐ large

☒ medium

☐ small

Run mag_viz

Save lineage as

