

# Pedigrees and kinship analysis in forensic genetics

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## Exercise set IV. Missing person identification and DVI

**Diviana** is available online here: <https://magnusdv.shinyapps.io/diviana/>.

If you want to run Diviana with real case data, we recommend to run it locally from RStudio. To set this up, execute the following in a fresh R session:

```
install.packages("remotes")
remotes::install_github(c("magnusdv/dvir", "magnusdv/diviana"), dependencies = T)
```

After installing the packages, you may launch Diviana:

```
diviana::launchApp()
```

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### Exercise IV-1 (Planecrash)

- Load the `planecrash` example data and click *Overview* to view a plot of the dataset. How many victims, missing individuals, and reference families are there?
- Go to **MARKERS** and inspect the information. Click on a marker and display its allele frequencies.
- Open the **ANALYSIS** tab and click *Solve*. Study the output tables and plot, and explain the solution.
- What is an ‘Undisputed’ match in Diviana? (Hint: Study the LR matrix.)
- Study the output log. Was joint analysis used in this case? Why not?
- Reduce the LR threshold to 1000, and re-analyse the data. Explain the changes.
- Apply a Standard mutation model to all markers and re-analyse the data. Explain the changes.
- Go to **RELATEDNESS** and check the estimated PM-PM relationships. One pair stands out. Who are they, and what is their most likely relationship?

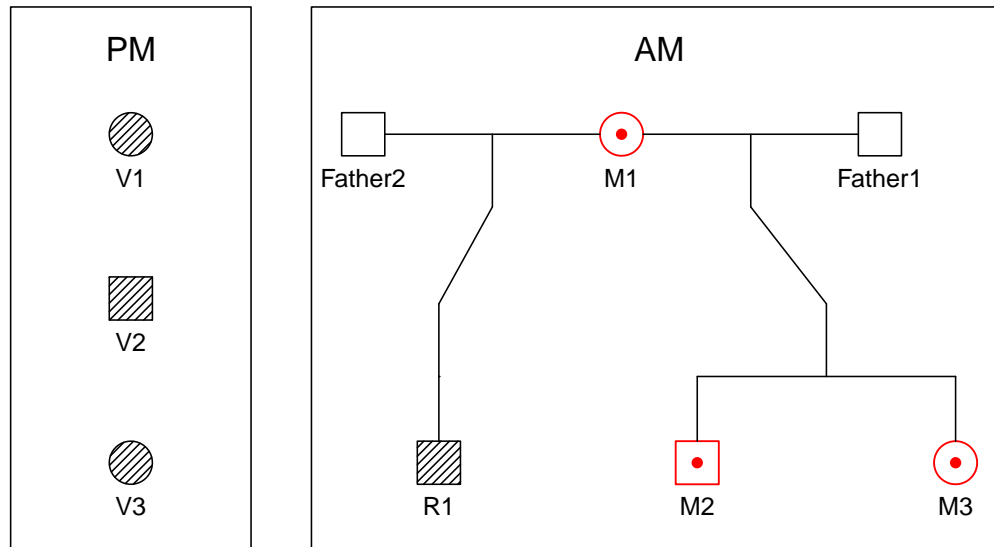
### Exercise IV-2 (Planecrash - cont.)

Reset all and load the `planecrash` dataset again. In each point below, do the described changes, save the pedigree and re-analyse the dataset. Explain the conclusions for the family in question.

- Modify family F1 so that the mother (individual 1) is missing instead of the daughter.
- In family F2, add a full sister to the missing person M2, named “M2-2”, who is also missing.
- Add a new family (F6) to the dataset. This should be a family with two missing sisters, named A and B. The family has no typed reference individuals.

**Exercise IV-3 (Car crash)**

We consider Exercise 4.9.8 in the book *Mass identification* by Kling et al (2021) which starts: “Following an accident where a car is crashed into sea, you are tasked with the mission to identify three persons, deceased in the accident”. The following plot summarises the case



- Download the file <https://familias.name/alcala2026/KETPex498.fam> to your computer, and load it into DIVIANA using the *Import* module in the *DATA* tab.
- Familias can only deal with one missing person in a reference family, explaining why there is only one missing person in the pedigree. Modify the pedigree so that the two half siblings of R1 are also missing. Rename the missing persons to M1, M2, and M3.
- Use the **RELATEDNESS** tab to estimate AM-PM and PM-PM relationships. Comment on the results.  
We next turn to the **ANALYSIS** tab. Click *Solve* and inspect the results.
- Comment on the **Exclusions** output.
- Comment on the **LR matrix**.
- Comment on the differences between LR and GLR.
- What is the impact of ignoring sex on the identification?
- Try some different frequency databases and different mutation models. Are there any indications that results are sensitivity to allele frequencies or choice of mutation model?