1. Calculate population genotype frequencies

- Assume HWE (F_{ST}=0)
- Allele frequencies:
  - Allele 10 = 0.12
  - Allele 11 = 0.34
  - Allele 12 = 0.21
  - Allele 13 = 0.19
  - Allele 14 = 0.24
- Genotypes and population genotype frequencies
  - Mother (female) = 12/12, => $p_{12} * p_{12} = 0.21 * 0.21 = 0.0441$
  - Child (female) = 10/14 , => $2 * p_{10} * p_{14} = 2 * 0.12 * 0.24 = 0.0576$
  - Alleged Father (male) = 13 => $p_{13} = 0.19$

2. Calculate posteriors with different priors

- LR = 1,000 (from "DNA evidence")
- Test a range of prior odds (1/1000, 1/100, 1/10, 1/1, 10, 100,1000)
- Discuss the results and consequences

Prior odds	LR	Posterior odds
1/1000	1000	1
1/100	1000	10
1/10	1000	100
1	1000	1000
10	1000	10000
100	1000	100000
1000	1000	1000000

Posterior odds = Prior odds * LR

Why would prior odds differ?
Assume DVI situation with N individuals missing, an have DNA data from one body.

The prior odds of this being individual *i* can be approximated to 1/N.
The posterior will differ, with different values of N, even tough the LR is the same.

3. Calculate posterior probabilities

- LR=100
- Priors: $Pr(H_1) = 0.1$, $Pr(H_2) = 0.9$
- What is the posterior probability for H_1, $Pr(H_1|E)$?

$$W_i = \frac{\pi_i L_i}{\sum_{j=1}^{n} \pi_j L_j}$$

- $W_1=(0.1*100)/(0.1*100+0.9*1)\approx 0.917$
- $W_2=(0.9*1)/(0.1*100+0.9*1)\approx 0,083$

4. Test the impact of priors

- Consider two hypotheses (H_1 and H_2), and that the LR has been estimated to 398. What will the posterior probability be given that the prior probability for H_1 is 0.01? (or 0.5? or 0.9?)

Prior=0.01 => $W_1=(0.01*398)/(0.01*398+0.99*1)\approx 0.801$

Prior=0.5 => $W_1=(0.5*398)/(0.5*398+0.5*1)\approx 0.997$

Prior=0.9 => $W_1=(0.9*398)/(0.9*398+0.1*1)\approx 0.9997$

5. Three hypotheses, calculate the posteriors

- H_1: The tested man is the biological father of the child
- H_2: The tested man is the paternal uncle to the child
- H_3: The tested man is unrelated to the child
- Likelihood, $Pr(DNA|H_1) = 0.0123$
- Likelihood, $Pr(DNA|H_2) = 0.32$
- Likelihood, $Pr(DNA|H_3) = 0.0010$
- **LRs? (H1/H3), (H1/H2)**
- **Posterior probabilities? (assume equal priors)**

- LR (H_1 vs H_3)=0.0123/0.001=123 W_1=0.992, W_3=0.008
- LR (H_1 vs H_2)=0.0123/0.32 =0,03 W_1=0.037, W_2=0.963

- Taking all three hypotheses into account: W_1=0.037, W_2=0.960, W_3=0.003

In the case scenarios below, are autosomal or X-chromosomal markers generally more informative?

Case scenario	Autosomal	X-chromosomal	Similar
Full siblings vs maternal half siblings (female children)		X	
Full siblings vs maternal half siblings (male children)	X		
Full siblings vs paternal half siblings (female children)			X
Full siblings vs paternal half siblings (male children)		X	
Maternal half siblings vs unrelated (female children)			X
Maternal half siblings vs unrelated (male children)			X
Paternal half siblings vs unrelated (females children)		X	
Paternal half siblings vs unrelated (male children)	X		
Paternal uncle vs unrelated (female child)		X	
Paternal uncle vs unrelated (male child)	X		
Paternal aunt vs unrelated (female child)		X	
Paternal aunt vs unrelated (male child)		X	
Paternal grandmother vs unrelated (female child)		X	
Paternal grandmother vs unrelated (male child)	X		
Paternal grandfather vs unrelated (female child)	X		
Paternal grandfather vs unrelated (male child)	X		