

DNA data is given below and in the online files.

Marker	Rand	Gawyn	Elayne	Galad	Shawl
CSF1PO	13,12	10,12	10,12	10,13	10,10
D13S317	11,10	12,12	11,12	11,9	11,13
D16S539	8,12	12,11	12,11	12,8	12,9
D18S51	16,15	13,16	13,16	17,16	15,15
D19S433	13,16.2	14,15	16.2,15	16.2,18	12,14
D21S11	30,31.2	31.2,30	31.2,30	31.2,30	30,30
D2S1338	23,18	18,19	27,19	18,23	18,20
D3S1358	15,14	16,18	16,15	16,14	16,14
D5S818	12,13	11,11	11,11	11,12	12,12
D7S820	11,11	11,11	11,9	11,11	8,12
D8S1179	12,11	13,11	13,13	13,12	13,14
FGA	23,24	22.2,20	22.2,24	22.2,23	22.2,20
TH01	6,9.3	9.3,6	9.3,6	8,6	6,7
TPOX	8,10	11,8	8,8	11,11	11,8
D10S1248	16,13	14,13	16,13	16,16	13,17
D12S391	18,17	26,17	26,17	24,18	26,21
D1S1656	16,12	18,14	18,14	18,16	18,13
D22S1045	11,15	16,16	16,11	17,17	15,16
D2S441	14,11	10,10	10,10	10,14	14,14
SE33	28.2,19	26.2,14	26.2,14	26.2,26.2	26.2,30.2
AMEL	X,Y	X,Y	X,X	X,Y	X,X

Allele frequencies are given as a file, no population substructure is assumed (i.e. $\theta=0$). We can disregard mutations (i.e. mutation rate=0). Silent alleles and other complicating factors can also be disregarded.

- c) Use the pedigree depicted above to compute a joint LR comparing the hypothesis that the shawl indeed belongs to Morraine versus the hypothesis that it belongs to someone unrelated to Elayne, Galad and Gawyn.