



The Elston-Stewart Algorithm

Biostatistics 666



Overall Pedigree Likelihood

$$L = \sum_{G_1} \dots \sum_{G_n} \prod_i P(X_i | G_i) \prod_{founder} P(G_{founder}) \prod_{\{o, f, m\}} P(G_o | G_f, G_m)$$

- Computation rises exponentially with #people
- Computation rises exponentially with #markers
 - G – genotypes, X – Phenotypes
 - Iterations are over everyone (i), founders (f), or offspring, father, mother trios {o, f, m}



Simplification for Nuclear Families

$$L = \sum_{G_m} P(X_m | G_m) P(G_m) \sum_{G_f} P(X_f | G_f) P(G_f) \prod_o \sum_{G_o} P(X_o | G_o) P(G_o | G_m, G_f)$$

- Linear on number of offspring
 - G – genotypes, X – phenotypes
 - Indexes are m and f for mother and father and o for iterating over offspring