

1. What are the maternal effects? (2 %) If you have a mutant with a visible phenotype, how do you decide whether the mutant phenotype is derived from Mendelian inheritance or maternal effect? (3 %) Give an example to describe the effect of the maternal genes on the phenotype of offspring. (5 %)
2. Ethylene-responsive element binding factors (ERFs) are members of a novel family of transcription factors that are specific to plants. AtERF1, AtERF2, and AtERF5 function as activators of GCC box-dependent transcription in Arabidopsis. However, AtERF3 and AtERF4 act as repressors. Please describe how these transcription activators and repressors regulate transcription initiation. (10 %)
3. Explain what SNPs and RFLPs are and how they can be detected. (10 %)
4. Define the terms monosomy and trisomy (4 %), and describe how they arise (3 %). Give examples of viable human monosomies and trisomies (3 %).
5. Describe how genomic, cDNA and EST libraries are obtained, and what the major differences among these three types of libraries are. (10 %)
6. The recombination frequencies between five linked loci are:
A-B: 9 cM; A-C: 17 cM; A-D: 10 cM; A-E: 20 cM; B-C: 24 cM
B-D: 18 cM; B-E: 12 cM; C-D: 8 cM; C-E: 36 cM; D-E: 28 cM
What's the linear order of these loci? (10 %)
7. In peas, long stem is dominant to short stem, and purple flower is dominant to white flower. The progeny from one cross consisted of 306 long stem, purple flower plants; 298 long stem, white flower plants; 95 short stem, purple flower plants; 101 short stem, white flower plants. Designate the alleles: T for long stem, t for short stem, P for purple flower, and p for white flower, what were the genotypes of the parents in this cross? Please include the reasoning in your answer. (10 %)
8. Please compare forward genetics with reverse genetics. (10 %)
9. The blood type distribution of Icelanders are A: 34%, B: 7.75%, AB: 2%, and O: 56.25%. If the population is at the Hardy-Weinberg equilibrium, what are the frequencies for I^A , I^B , and i alleles in the Icelanders population? (10 %)
10. Please define the following terms: (10 %)
 - A. epistasis
 - B. incomplete dominance
 - C. codominance
 - D. pleiotropy
 - E. polygenic trait