1. Fill in the missing variable for the following equations.
   a. Calculating genotypic frequency

$$f(\_\ \_) = \frac{\square}{\square}$$

frequency(AA)= #AA individuals/ N (total # of individuals)

   b. Calculating allelic frequency

$$f(\ \_\ ) = \frac{\square}{\square}$$

frequency (allele)= # of copies of the allele/ # of copies of all alleles at the locus in a population

f(A)= p

f(a)= q

- The addition of the two allelic frequencies always add up to 1!!
- $P^{2=}$ homozygous dominant allele pair frequency
- Q^2= homozygous recessive allele pair frequency
- 2pq= heterozygous allele frequency.

2. What assumptions must be met for a population to be in Hardy-Weinberg equilibrium?
   - Population is large
   - Randomly mating
   - Not affected by mutation, migration, or natural selection.
   - USED to predict that the allelic frequencies of a population do not change and that the genotypes are stable.

3. The human MN blood-type antigens are determined by two alleles L^M and L^N. The MN blood types and corresponding genotypes of 398 individuals were collected.

Phenotype	Genotype	Number
MM	L^ML^M	100
MN	L^ML^N	150
NN	L^NL^N	50

Calculate the genotypic and allelic frequencies at the MN locus for the population.

$f(L^ML^M)$= 100/200=0.5

$f(L^ML^N)$ =150/200=0.75

$f(L^NL^N)$= 50/200=0.25

p=$f(L^M)$= 350/400=0.875

q=$f(L^N)$= 205/400=0.625

4. Fill in the calculations for the following genotypes for a jumping locus for the frog.

Genotype	Offspring # N=100	Genotypic frequency	Fitness	Selection coefficient (1-fitness)	Allelic frequency	$P^2/q^2/2pq$
JJ	10	0.1	0.2	0.8	F(J)= 20+30/200=0.4= p	P^2=0.16
Jj	60	0.6	1	0	F(j)=60+30+30/200= 0.6=q ** adds up to 1!*	Q^2=0.36
jj	30	0.3	0.5	0.5		

2pq=0.48

***Selection coefficient is the relative intensity of selection against a genotype. Want high fitness and low selection

5. Explain the following nonrandom mating effects on the genotypic frequencies of a population
    a. Positive assortative mating: tendency of like individuals to mate. Increases homozygous alleles.
    b. Negative assortative mating: tendency of unlike individuals to mate
    c. Outbreeding: mating between unrelated individuals
    d. Inbreeding: mating of related individuals, typically creates positive assortative mating.
        i. Inbreeding coefficient measures the probability that two alleles are identicale by descent. Ranges from 0 to 1. The value of 0 indicate allele is random. The value of 1 indicates that all alleles are identical by descent. Can do this by analysis of pedigree.
6. What are the effects of the follow on genetic variation within populations?
    a. Mutation: gives rise to genetic variation. At equilibrium, the allelic frequencies do not change even though mutation in both directions continues. At equilibrium the genotypic frequencies will also remain the same. But when not at equilibrium it changes the allelic frequencies disrupting the genotypic frequencies.
    b. Migration: 1. Prevents populations from becoming genetically different from one another 2. Increases genetic variation within populations. The amount of change in allelic frequency due to migration between populations depends on the difference in allelic frequency and the extent of the migration.
    c. Genetic drift: change in allelic frequency. Can view it 1. As it influcences the change in allelic frequency of a single population or the 2. Affects differences that accumulate among series of population. As a result of genetic drift, allelic frequencies in the different populations diverged and often became fixed for one allele or the other.
        i. Caused by founder effect- establishment of a population by a small number or the founders. So small genetic variation.
        ii. And genetic bottle neck- a population undergoes a drastic reduction in population size. So reduction in genetic variation.
    d. Natural selection: effect of natural selection on the gene pool of the population depends on the fitness values of the genotypes in the population.