Name _____ 27 Feb 69

Genetics 301 Section 1 Final Exam-A 200 points
Qualification Permitted

Part I. (48 points, 3 each) True-False

____ 1. The P_1 phenotypes and genotypes are always "recovered" in the F_2.

____ 2. In order to determine how many mutants may be present in a stock, it should be crossed with normal and the F_2 or testcross progeny analyzed for frequency and number of phenotypes.

____ 3. Penetrance is the amount of increase in frequency of a dominant gene each generation.

____ 4. Leptotene, zygotene, pachytene, diplotene, and diakinesis are sequential stages in mitosis.

____ 5. Selection is a major way to change gene frequency.

____ 6. Concordance means point by point pairing of the chromosomes in synapsis.

____ 7. An important consequence of meiosis is the reduction from the diploid (2n) to the haploid state.

____ 8. The main exception to the equality of reciprocal crosses is sex linkage.

____ 9. Translocations and inversions can be detected by a change in the linkage relationship.

____ 10. Two linked genes with approximately 50% crossing over will appear to be independent.

____ 11. Crossing over is known to occur in the two-strand stage and not in the four-strand stage because as shown in Neurospora, all meiotic products from one cell yield only parental types or only crossover types.

____ 12. Our present notion about how chromosomes act to produce genetic characteristics includes the production of enzymatic proteins by DNA mediated by messenger and transfer RNA.

____ 13. RNA differs from DNA in having an extra OH group in the sugar component, and uracil replaces thymine as an organic base.

____ 14. A monosomic such as XXXY will result in Down's syndrome.

____ 15. A position effect results in different phenotypes for heterozygotes of linked dihybrid genetic material in different phases of linkage.

____ 16. A loop of the synaptic chromosomes may be seen cytologically if the cell is heterozygous for an inversion or a non-terminal deletion.

Part II. (28 points, 4 each) Completion

1. The American cotton, Gossypium hirsutum, has 26 pairs of chromosomes. Asiatic cotton, G. arborueum, has 13 pairs of chromosomes. Their hybrid has _____ chromosomes.

2. The masking effect of one gene pair over another is _____.

3. Two recessive mutants are alleles of each other if, when purebred stocks are crossed, they yield a _____ F_1.

4. A linear triplet sequence of organic bases which codes a single specific amino acid is called a _____.

5. The organic bases in the codon ATG would pair with _____ in the DNA molecule.

6. A tetraploid watermelon crossed with a diploid one would yield a hybrid which would be _____, _____, and _____.

7. A walnut comb rooster was mated to a single comb hen and 4 comb shape phenotypes were noted among the progeny: walnut, pea, rose, and single comb. The genotype of the rooster was _____.

Part III. (20 points, 4 each) Match the phenotyic or genotypic ratio with the described mode of inheritance and gene action.

A. 1:2:1	G. 9:7	M. 1:4:6:4:1
B. 3:1	H. 15:1	N. 3:6:3:1:2:1
C. 2:1	I. 13:3	O. 6:2:3:1
D. 1:1	J. 12:3:1	P. 2:1:4:2:2:1
E. 9:3:3:1	K. 9:3:4	Q. 1:2:1:2:4:2:1:2:1
F. 9:6:1	L. 1:4:4:7	R. 1:1:1:1
		S. 1:8:18:8:1

____ 1. F_2 of a monohybrid codominant.

____ 2. F_2 of a dihybrid quantitative inheritance problem.

____ 3. F_1 from a sex-linked dominant mutant in the heterogametic sex crossed with the normal in the homogametic sex.

____ 4. Testcross of an F_1 dihybrid dominant mutant plus an independent recessive mimic.

____ 5. F_2 involving two recessive mutants, one of which is epistatic to the other.

Part IV. (70 points, 10 each)

____ 1. Crested ducks never breed true. About 1/3 of the eggs that hatch are normal. Among 120 ducklings hatched from crested parents, how many would be expected to be crested?

2. In cocker spaniels the genotype bb ee is lemon color, B^+ _ ee is red, bb E_ is brown (liver) and B^+_ E_ is (extension) black. A black Cocker is mated to a lemon one and produces a lemon pup. If this black dog is mated to another of his own genotype, what frequencies and phenotypes would be expected among the progeny?

____ 3. What is the probability of obtaining the blood types in the indicated offspring from the mating below?

♂ O, MN, Rr, Hp^{2-1} x ♀ AB, MN, Rr, Hp^{2-1}

offspring: A, M, Rh+, Hp^{2-1}

4. Drone bees are haploid (develop from unfertilized eggs). Chartreuse eye color is a recessive mutant. A chartreuse eyed ♀ (queen) is mated to a normal ♂ (drone) (brown eyes). What eye colors are expected in the progeny?

♂ _____

♀ _____

____ 5. In turkeys white is recessive to the normal bronze. Seven poults hatch from heterozygous parents. What is the probability that two will be white and five bronze?

6. In the mouse the two mutants satin and beige are recessive. Testcross results of an F_1 involving both mutants gave 4 classes, one of which was 5% normal. Draw the phase of linkage for the two mutants in the F_1 and indicate the map distance.

7. In Neurospora there are four kinds of mutant genes a, b, c and d, any one of which results in a mold which requires nicotinic acid for growth. Those with mutant d will also grow if 3-hydroxy-anthranilic acid is added to the medium, and those with mutant b can grow on either 3-hydroxy-anthranilic acid or kynurenin as a substitute for nicotinic acid. Make a diagram showing the order in which these components fit into the chemical synthesis and indicate which step each gene controls.

Part V. (34 points, 17 each)

1. The phenotyic frequency of the dominant class is 7/16 in generation zero. The frequency of the A^+ gene is _____.

   Fill in the genotypic frequencies of generation zero. The aa homozygous recessive individuals are not allowed to reproduce.

   What will be the genotypic frequency of the next generation "one"? Fill in.

	7/16		
	p^2	$2pq$	q^2
	A^+A^+	A^+a	aa
generation zero			
generation one			

2. Two purebred spherical-fruited races of summer squash were crossed and produced an F_2 consisting of 100 disc, 76 spherical and 16 elongate-fruited progeny. Explain the mode of inheritance? Test your hypothesis by chi-square.

$p + q = 1$

$\frac{n!}{r!\ s!}\ p^r\ q^s$

$\frac{1}{(x + g)^2}$

$X^2 = \sum \frac{d^2}{e}$

X^2 value for 5% level of significance
for 1 df = 3.84
2 df = 5.99
3 df = 7.82
4 df = 9.5