

Genetics 320 Problem Set Four

Solutions

1. (2 points): 1000 linear tetrads from A/a are scored, and the following numbers are observed:

linear tetrad	number seen
aaAA	390
aAaA	90
AAaa	410
AaaA	110

(a) What is the frequency of first division segregation? Of second division segregation?

$$Freq(1st) = (390+410)/1000 = 0.8, Freq(2nd) = (90+110)/1000 = 0.2$$

(b) What is the recombination frequency between the A locus and the centromere?

$$locus-centromere\ recombination\ frequency = (1/2) * Freq(2nd\ Div\ seg) = (1/2) * 0.2 = 0.1$$

2. (3 points): Consider *unordered* tetrads from the cross Ab/aB, where the tetrads were

tetrad members	number seen	
Ab, aB, ab, AB	138	<i>tetatype</i>
ab, ab, AB, AB	12	<i>nonparental</i>
Ab, Ab, aB, aB	150	<i>parental</i>

(a) Identify the parental, nonparental, and tetratypes.

(b) What is the recombination fraction between the A and B loci?

$$\frac{(1/2)T + NPD}{T + NPD + P} = \frac{(1/2)138 + 12}{138 + 12 + 150} = 0.27$$

3. (5 points): In a cross of $cr^+ al \times cr al^+$, 100 ordered tetrads were scored. These fell into the following five types (Labeled A - F), with the numbers observed given below the label.

Tetrad A	Tetrad B	Tetrad C	Tetrad D	Tetrad E	Tetrad F
38	2	40	13	4	3
$cr^+ \quad +$	$cr \quad al$	$cr \quad al$	$cr^+ \quad +$	$cr \quad al$	$cr \quad al$
$cr^+ \quad +$	$cr \quad al$	$cr^+ \quad +$	$+ \quad al$	$+ \quad +$	$+ \quad al$
$+ \quad al$	$+ \quad +$	$+ \quad al$	$cr^+ \quad +$	$cr^+ \quad +$	$cr^+ \quad +$
$+ \quad al$	$+ \quad +$	$+ \quad +$	$+ \quad al$	$+ \quad al$	$+ \quad +$

(a) What tetrad types are parental? Nonparental? Tetratypes?

$$Parental = A, D; Nonparental = B; Tetratypes = C, E, F$$

(b) For locus *cr*, which tetrad types show second division segregation? D, E, F

(c) For locus *al*, which tetrad types show second division segregation? C, D, E

(d) What is the genetic map (position and recombination frequencies of the loci with respect to each other and the centromere)?

$Freq(T) = (40+4+3)/100 = 0.47$, $Freq(NPD) = 2/100 = 0.02$. Hence, $cr - al$ distance is = $(1/2)0.47 + 0.02 = 0.255$

$Freq(2DS \text{ for } cr) = (13+4+3)/100 = 0.2$; hence cr -centromere = $(1/2)0.2 = 0.1$

$Freq(2DS \text{ for } al) = (40+13+4)/100 = 0.57$; hence al -centromere = $(1/2)0.57 = 0.285$

Gene order = (Centromere) — cr — al

(e) Draw what crossover(s) at the 4-strand stage give rise to tetrad type F.

