

注意事項：不必抄題，請在答案紙上標明題號順序作答。

1. From two crosses of the general type $AABB \times aabb$ the F1 individuals of type $AaBb$ were testcrossed to $aabb$. The results are shown below.

Testcross of F1 from cross	Testcross progeny			
	$AaBb$	$aabb$	$Aabb$	$aaBb$
1	360	380	230	230
2	310	315	287	288

For each set of progeny, use the χ^2 test to decide if there is evidence of linkage.

(即參考下列之Chi-Square表，針對上述之兩種交配 (Testcross 1, 2) 結果，進行“適合度”(good of fit) 測試，請詳列出計算式，並判定結果。)(20%)

df	Probabilities (p)					
	0.90	0.50	0.20	0.05	0.01	0.001
1	0.02	0.46	1.64	3.84	6.64	10.83
2	0.21	1.39	3.22	5.99	9.21	13.82
3	0.58	2.37	4.64	7.82	11.35	16.27
4	1.06	3.36	5.99	9.49	13.28	18.47
5	1.61	4.35	7.29	11.07	15.09	20.52
6	2.20	5.35	8.56	12.59	16.81	22.46
7	2.83	6.35	9.80	14.07	18.48	24.32
8	3.49	7.34	11.03	15.51	20.09	26.13
9	4.17	8.34	12.24	16.92	21.67	27.88
10	4.87	9.34	13.44	18.31	23.21	29.59
15	8.55	14.34	19.31	25.00	30.58	37.30
25	16.47	24.34	30.68	37.65	44.31	52.62

2. There is an example of complementation test of wing length in fruit flies; six recessive mutations causing short wings crossed in the following possible ways.

Mutant

Numbers	1	2	3	4	5	6
1	Short	Long	Short	Short	Long	Short
2		Short	Long	Long	Short	Long
3			Short	Short	Long	Short
4				Short	Long	Short
5					Short	Long
6						Short

- (1) How many genes would these mutations have defined?
- (2) Which mutations would have been in the same genes(s)? (10%)

3. (1) Consider a family where both parents have normal pigmentation, but they have an albino child. If they have six more children, what is the probability that four will be normal and two will have albinism? (3%)

(2) The restriction enzyme *Eco* RI cuts DNA at the sequence GAATTC, and the enzyme *Msp* I cuts DNA at the sequence CCGG. On the average, how frequently will each enzyme cut double-stranded DNA? (In other words, what is the average spacing between restriction sites?) (6%)

4. (1) While mutations have been observed in many different genes, they have not been isolated in histones. Why should this be expected? If one wanted to produce antibodies to histones, would it be any easy task? Explain your answer. (6%)

(2) A particular gene is necessary, but not sufficient, for a certain developmental fate. What is the expected phenotype of a loss-of-function mutation in the gene? Is the allele expected to be dominant or recessive? (6%)

5. Suppose you have a plate on which several transformed *E. coli* colonies are growing. You wish to identify any colony that carries the rice gene that codes for α -amylase. Please list a step-by-step procedure that would enable you to locate such a colony. (12%)

6. (1) What is RFLP analysis? (5%)

(2) Why is RFLP analysis useful in determining evolutionary relationship? (5%)

7. Indicate the polarity of each of the following as either 5' or 3'. (6%)

(1) Translation of mRNA begins at this end.

(2) The base at this end of the anticodon is in the wobble position.

(3) The amino acid with the carboxyl end was designated by a codon toward this end of the transcript.

8. Describe the following terms. (21%)

(1) *Alu* family

(2) Pseudodominance

(3) Nucleolar organizer region

(4) Merozygote

(5) *C* value

(6) Enhancer

(7) Centimorgan