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UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER 2005

TITLE OF PAPER: GENETICS

COURSE CODE: B303

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:
1. ANSWER ANY <u>FOUR</u> QUESTIONS
2. EACH QUESTION CARRIES TWENTY FIVE (25) MARKS
3. ILLUSTRATE YOUR ANSWERS WITH LARGE AND CLEARLY LABELLED DIAGRAMS WHERE APPROPRIATE
4. ALL WORKING MUST BE CLEARLY SHOWN

SPECIAL REQUIREMENTS:

a) CALCULATORS (CANDIDATES MAY BRING THEM)
b) STATISTICAL TABLES (BACK PAGE)

THIS PAPER IS NOT TO BE OPENED UNTIL PERMISSION HAS

BEEN GRANTED BY THE INVIGILATORS

QUESTION 1

a) Name four aneuploid conditions known to you and explain how these might arise.   **[6 Marks]**
b) If a female (XX) undergoes non-disjunction and is fertilized by a normal male, explain what karyotypes might arise amongst her progeny. **[4 marks]**
c) Compare the consequences in humans and explain the symptoms associated with each karyotype where possible.   **[8 Marks]**
d) State two other conditions caused by abnormalities in chromosome number including an account of the karyotype and the symptoms associated with each **[7 Marks]**.

[TOTAL 25 MARKS]

QUESTION 2

a) Discuss fully, the evidence that supports that DNA is the hereditary material and not proteins as previously thought.   **[20 Marks]**
b) Briefly explain what the significance of these findings as well as an account of the contribution this has made to our understanding of inheritance.   **[5 Marks]**

[25 MARKS]

QUESTION 3

a. With the aid of specific examples, explain what is meant by a degenerate code.   **[4 Marks]**
b. Explain what is meant by the co-linearity of genes and proteins.

[4 Marks]

c. With the aid of large, clearly labeled diagrams, describe the process of translation.   **[17 Marks]**

[TOTAL 25 MARKS]

QUESTION 4

a) Three possible phenotypes in barley are "hooded", "long-awned" and "short-awned". An investigator crossed two pure-breeding socks, hooded X short-awned and obtained an F_1 which was phenotypically hooded. He then intercrossed the F_1 and obtained the following F_2:

Phenotype	Number of individuals
Hooded	435
Long-awned	160
Short-awned	205

    i.   Propose an explanation for the inheritance of this trait. **[3 Marks]**
    ii.   Test how well the results fit your hypothesis. **[4 Marks]**
    iii.   Using clearly stated symbols of your choice, state the genotypes of all individuals in this cross. **[7 Marks]**
    iv.   Predict the results of a cross between a long-awned and a short awned pureline. **[2 Marks]**

b) Two dwarf corn plants *dwarf* 1 and *dwarf* 2, each had a different origin but were phenotypically identical. A cross between *dwarf* 1 and *dwarf* 2 gave an F_1 in which all individuals were tall. When these were intercrossed they gave an F_2 in which 270 individuals were tall and 210 were dwarfs.

    i.   Propose an explanation for these results. **[2 Marks]**
    ii.   Using clearly stated symbols of your choice, state the genotypes of all individuals in this cross. **[7 Marks]**

QUESTION 5

a) State the Hardy-Weinberg law. **[2 Marks]**
b) Using a single gene A with two alleles A and a, prove the Hardy-Weinberg law. **[5 Marks]**

c) State what factors may cause departure from equilibrium. **[5 Marks]**

d) In a population living on a small island, ABO blood groups are found to be as follows:

A	AB	B	O
120	330	250	100

i. Calculate the frequencies of I^A, I^B and O in this population. **[8 Marks]**
ii. Use Bernstein's coefficients to correct the allelic frequencies. **[5 Marks]**

[TOTAL 25 MARKS]

QUESTION 6

a) In *Drosophila*, eye colour is controlled by an X-linked gene R in which the dominant allele results in red eyes whilst the recessive allele results in white eyes. A Red eyed male is crossed to a white eyed female.

   i. Explain what phenotypes, and in what proportions, may be expected amongst the progeny. **[4 Marks]**
   ii. If the reciprocal cross is carried out, what phenotypes, and in what proportions may arise among the progeny. **[4 Marks]**

b) A woman with normal vision but whose father suffered from colour-blindness marries a colour-blind man and together they have 4 children in this order- boy, twin girls (monozygotic) and a boy.

   i. Construct a pedigree to show this information. **[4 Marks]**
   ii. What is the probability that this couple has a color blind child? **[2 Marks]**
   iii. What is the probality that the twins are colour blind **and** the first boy is normal? **[2 Marks]**

c) Distinguish between the following pairs of terms:

   i. Sex-linked and sex limited traits
   ii. A terminal and an interstitial deletion
   iii. A paracentric and a pericentric inversion
   iv. A reverse and a tandem duplication **[3 Marks]**

[TOTAL 25 MARKS]

df\area	.995	.990	.975	.950	.900	.750	.500	.250	.100	.050	.025	.010	.005
1	0.00004	0.00016	0.00098	0.00393	0.01579	0.10153	0.45494	1.32330	2.70554	3.84146	5.02389	6.63490	7.87944
2	0.01003	0.02010	0.05064	0.10259	0.21072	0.57536	1.38629	2.77259	4.60517	5.99146	7.37776	9.21034	10.59663
3	0.07172	0.11483	0.21580	0.35185	0.58437	1.21253	2.36597	4.10834	6.25139	7.81473	9.34840	11.34487	12.83816
4	0.20699	0.29711	0.48442	0.71072	1.06362	1.92256	3.35669	5.38527	7.77944	9.48773	11.14329	13.27670	14.86026
5	0.41174	0.55430	0.83121	1.14548	1.61031	2.67460	4.35146	6.62568	9.23636	11.07050	12.83250	15.08627	16.74960
6	0.67573	0.87209	1.23734	1.63538	2.20413	3.45460	5.34812	7.84080	10.64464	12.59159	14.44938	16.81189	18.54758
7	0.98926	1.23904	1.68987	2.16735	2.83311	4.25485	6.34581	9.03715	12.01704	14.06714	16.01276	18.47531	20.27774
8	1.34441	1.64650	2.17973	2.73264	3.48954	5.07064	7.34412	10.21885	13.36157	15.50731	17.53455	20.09024	21.95495
9	1.73493	2.08790	2.70039	3.32511	4.16816	5.89883	8.34283	11.38875	14.68366	16.91898	19.02277	21.66599	23.58935
10	2.15586	2.55821	3.24697	3.94030	4.86518	6.73720	9.34182	12.54886	15.98718	18.30704	20.48318	23.20925	25.18818
11	2.60322	3.05348	3.81575	4.57481	5.57778	7.58414	10.34100	13.70069	17.27501	19.67514	21.92005	24.72497	26.75685
12	3.07382	3.57057	4.40379	5.22603	6.30380	8.43842	11.34032	14.84540	18.54935	21.02607	23.33666	26.21697	28.29952
13	3.56503	4.10692	5.00875	5.89186	7.04150	9.29907	12.33976	15.98391	19.81193	22.36203	24.73560	27.68825	29.81947
14	4.07467	4.66043	5.62873	6.57063	7.78953	10.16531	13.33927	17.11693	21.06414	23.68479	26.11895	29.14124	31.31935
15	4.60092	5.22935	6.26214	7.26094	8.54676	11.03654	14.33886	18.24509	22.30713	24.99579	27.48839	30.57791	32.80132
16	5.14221	5.81221	6.90766	7.96165	9.31224	11.91222	15.33850	19.36886	23.54183	26.29623	28.84535	31.99993	34.26719
17	5.69722	6.40776	7.56419	8.67176	10.08519	12.79193	16.33818	20.48868	24.76904	27.58711	30.19101	33.40866	35.71847
18	6.26480	7.01491	8.23075	9.39046	10.86494	13.67529	17.33790	21.60489	25.98942	28.86930	31.52638	34.80531	37.15645
19	6.84397	7.63273	8.90652	10.11701	11.65091	14.56200	18.33765	22.71781	27.20357	30.14353	32.85233	36.19087	38.58226
20	7.43384	8.26040	9.59078	10.85081	12.44261	15.45177	19.33743	23.82769	28.41198	31.41043	34.16961	37.56623	39.99685