

AML 253: Introduction to Mathematical Tools and Modeling for the Life & Social Sciences

16.10.2023

Mock Exam, Fall 2023 Intro to Math Tools & Modeling

(Duration: 60 minutes)

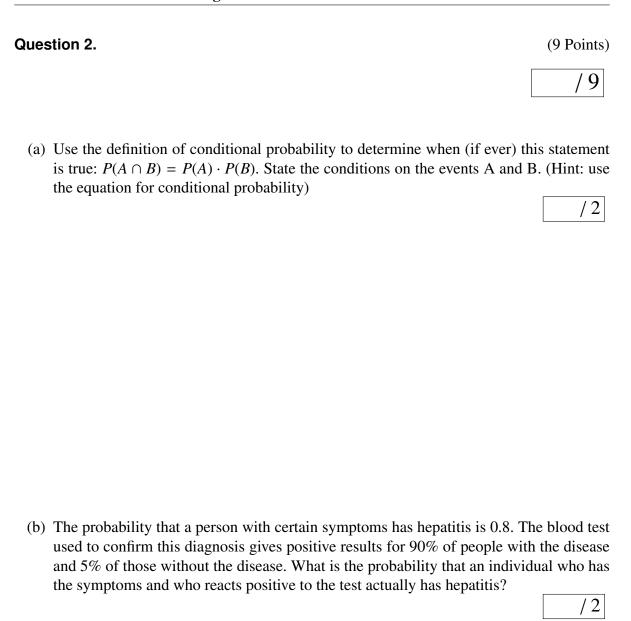
Last Name:	_ First Name:
I confirm that I have read the following rexam (pages 1-8).	notes and that I have checked the completeness of this
	Signature of the above-named exam attendee
Notes:	
1. No additional materials are allowed	ed.
2. Unreadable answers or answers w luation.	ritten with a pencil can be disqualified from the eva-
3. Please ensure that your responses	directly address the questions posed.

Only for the examiner:

4. You have 60 minutes to complete the exam.

1	2	3	-	-	-	-	-	-	total
(5)	(9)	(9)							(23)

Question 1.	(5	5 Points)
		/ 5
Select True or False accordingly and justify your answer.		
a) The Hardy-Weinberg population genetic model's assumptions are only two: the population is very large and the mating is random.	True	False □
b) The Hardy-Weinberg model is described by: $P(AA) = q$, $P(aa) = p$ and $P(Aa) = pq$.		
c) If the allele b occurs with a frequency of 0.8 in a population. The frequency of genotype Bb is 0.3.		
d) The Hardy-Weinberg Equilibrium is a probability of survival of one specific allele.		
e) If <i>A</i> and <i>B</i> are two independent events with probabilities $P(A)$ and $P(B)$, respectively. Then $P(A \cap B) = P(A) \cdot P(B)$.		



(c) Suppose that you have a batch of red- and white-flowering pea plants where all three genotypes, CC, Cc, and cc, are equally represented. The allele C for red flowers is dominant. You pick one plant at random and cross it with a white-flowering pea plant. What is the probability that the offspring will have red flowers?

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- (d) If two fair dice are rolled, find the probabilities of the following results.
 - (a) A sum of 10, given that the sum is greater than 5.
 - (b) A "double" (two identical numbers), given that the sum is 12.
 - (c) A double, given that the sum is 11.

/ 3

Question 3.	(9 Points)
	/9
Let p, q, and r denote the frequencies of alleles A, B, and O, respectively, in a given for the standard blood groups. Assume random mating.	n population
(a) What are the frequencies of each phenotype?	/2
(b) A study of blood types in Ecuador found the following frequencies of the	phenotypes:
O=75.6%, A=11.5%, B=9.5%, AB=3.4%. Find the frequencies of each all	/ 3

(c) What about if we know that the frequencies for RH factor are given as follow Rh+=34.1%, Rh-=65.9%. What are the frequencies of each phenotype?

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(d) Find the probability for each blood type with Rh+ and with Rh-.

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