

York University
AK/ITEC 4310 3.0
Applied Artificial Intelligence

Midterm Sample

Examiner: S. Chen
Duration: One hour

This exam is closed textbook(s) and closed notes. Use of any electronic device (e.g. for computing and/or communicating) is NOT permitted.

Do not unstaple this test book – any detached sheets will be discarded. Answer all questions in the space provided. No additional sheets are permitted.

Work independently. The value of each part of each question is indicated. The total value of all questions is 50.

Write your name and student number in the space below.

Surname: _____

Given Names: _____

Student Number: _____

Q1. _____

Q2. _____

Q3. _____

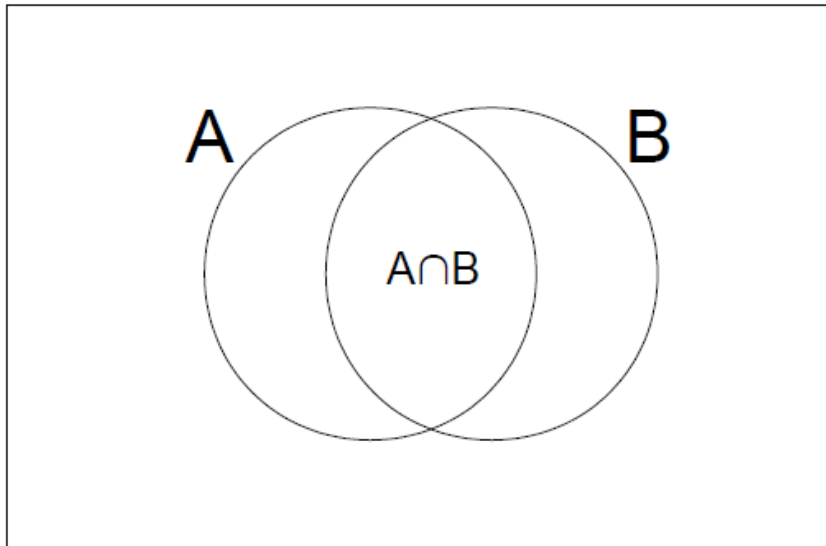
Q4. _____

Q5. _____

Question 1 (10 marks) Basic Probability:

You have two sacks with red and black balls. The first sack has 3 red balls and 2 black balls. The second sack has 4 red balls and 1 black balls.

You draw one ball from each sack (assume each ball has an equal chance of being drawn from its sack). What is the probability that both balls have the same colour?



- $P(A|B) = P(A \cap B) / P(B)$
 $= P(B|A)P(A) / P(B)$
 $= P(B|A)P(A) / P(A \cap B) + P(A' \cap B)$
 $= P(B|A)P(A) / P(B|A)P(A) + P(B|A')P(A')$

Question 2 (10 marks) Simple Bayesian Probability:

Sum of two dice	Can be done by:	Probability
2	(1, 1)	1/36
3	(1, 2) (2, 1)	2/36
4	(1, 3) (2, 2) (3, 1)	3/36
5	(1, 4) (2, 3) (3, 2) (4, 1)	4/36
6	(1, 5) (2, 4) (3, 3) (4, 2) (5, 1)	5/36
7	(1, 6) (2, 5) (3, 4) (4, 3) (5, 2) (6, 1)	6/36
8	(2, 6) (3, 5) (4, 4) (5, 3) (6, 2)	5/36
9	(3, 6) (4, 5) (5, 4) (6, 3)	4/36
10	(4, 6) (5, 5) (6, 4)	3/36
11	(5, 6) (6, 5)	2/36
12	(6, 6)	1/36

You have rolled two six-sided dice, and the sum of the two values is 9. What is the (conditional) probability that the second die value is a 5?

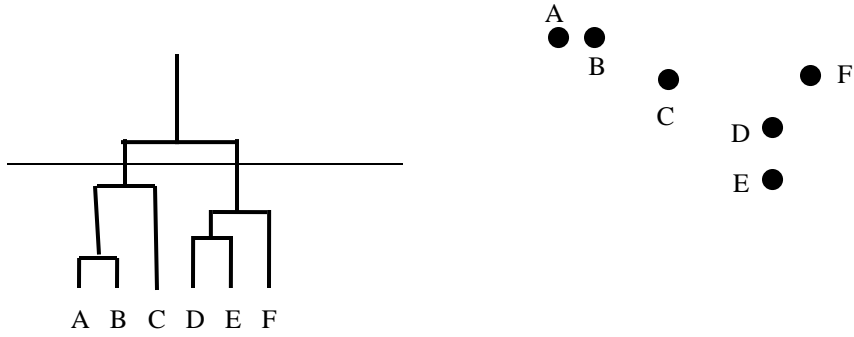
Question 3 (10 marks) Advanced Bayesian Probability:

A patient goes to see a doctor. The doctor performs a test. If the disease exists in the patient, the test has a 100% chance of returning a positive result. If the disease does not exist in the patient, the test has a 2% chance of returning a (false) positive result. If the disease exists in $3/1000 = 0.003$ people of the general population, what is the probability of a positive test indicating that the patient has the disease? (Note: round $997/1000$ to 1.)

The patient now says that they have a family history of the disease, so his chance of inheriting the disease is actually 1 in 4. Now, what is the probability of a positive test indicating that the patient has the disease?

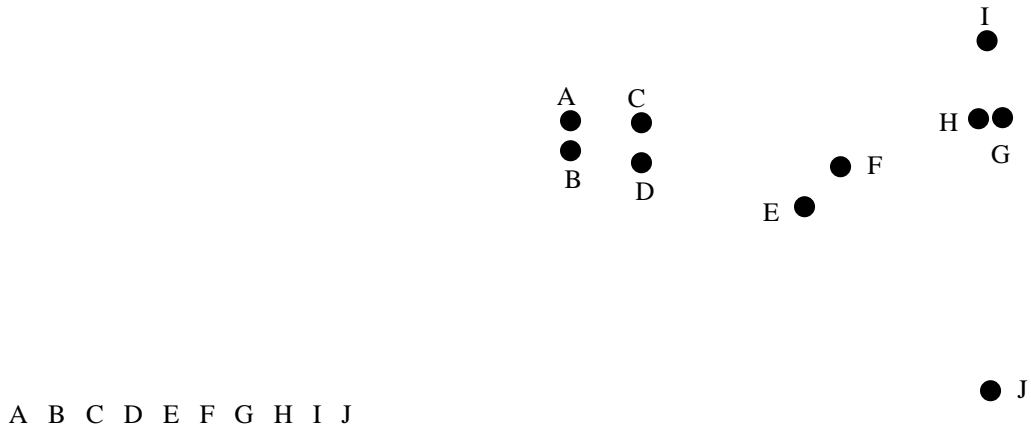
Note: a fractional answer is sufficient – e.g. $0.005/0.028$

Question 4 (10 marks) Hierarchical Clustering 1:



Draw the selected clusters representing the given “cut line”.

Question 5 (10 marks) Hierarchical Clustering 2:



Draw the dendrogram for the ten points shown.